

ICSSE2020

International Conference on System Science and Engineering 2020

Final Program & Abstract



AUGUST 31, 2020 --- SEPTEMBER 03, 2020



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Foreword

Welcome to ICSSE 2020, an annual international conference focused on System Science and Engineering. This conference is organized by the Taiwan Association of Systems Science and Engineering (TASSE) and got sponsored from Ministry of Science and Technology, Taiwan, R.O.C. and *National Taiwan University of Science and Technology*. The ICSSE 2020 is soliciting novel research results on Systems Science, Engineering and related topics. Due to the pandemic of COVID19, this conference will take place both virtually and physically during August 31- September 3, 2020. The physical conference is held in the National Taiwan University of Science and Technology. Hundreds of paper will be presented with worldwide participants from the Systems Science, Engineering, Intelligent Systems, deep learning and Industry 4.0 Systems. We would like to express our sincere appreciation to all participants especially in this pandemic era for their strong support. We hope this event can provide a great opportunity for scientists, engineers, and practitioners from all over the world to present the latest system design concepts, research results, developments and applications, as well as to facilitate interactions between scholars and practitioners. On behalf of the Organizing and Program Committees, we thank you all for coming and virtually attending on ICSSE 2020.



General Chair
Bing-Fei Wu,
President of TASSE



General Chair
Jyh-Horng Chou,
Chair Prof. in NKUST



General Chair
Shun-Feng Su
Chair Prof. in NTUST

Plenary Speech

Plenary Speech (I)

Bridging Numeric and Symbolic System Modeling **with** **the Principles of Granular Computing**



Witold Pedrycz
IEEE Fellow, 1998

Professor and Canada Research Chair (CRC) in Computational Intelligence,
Department of Electrical and Computer Engineering, University of Alberta, Edmonton, Canada.

Abstract: In modeling complex systems, one strives to take full advantage of available numeric data and qualitative (symbolic) evidence. We anticipate that the resulting constructs (models) should meet a number of requirements. In particular, we require that they exhibit high accuracy, are interpretable and explainable as well as come with some level of stability. The tendency of satisfying (at least to some degree) all requirements outlined above is well visible in some general pursuits encountered under the banner of Artificial Intelligence (AI) and its recent developments of explainable AI (XAI).

We advocate that in addressing these timely challenges, information granules and Granular Computing play a significant role by facilitating a smooth and continuous linkage between these two views and striking a sound balance between qualitative and quantitative facets of modeling. First, it is demonstrated that information granularity is of paramount relevance in building associations between real-world data and symbols commonly encountered in AI processing. Second, we stress that a suitable level of abstraction (specificity or information granularity) becomes essential to support user-oriented framework of designing and functioning ensuing models. In both cases, central to all pursuits is a process of formation of information granules followed by their prudent characterization. We discuss a comprehensive approach to the development of information granules completed by the principle of justifiable granularity. Here various construction scenarios are discussed including those engaging conditioning and collaborative mechanisms incorporated in the design of information granules. The mechanisms of assessing the quality of granules are presented. A symbolic manifestation of information granules is put forward and analyzed from the perspective of semantically sound descriptors of data and relationships among data delivering a required level of linguistic stability. We elaborate on the generative and discriminative aspects of information granules supporting their further usage in the formation of granular models. In the sequel, these features are exploited in the construction of models of the required interpretability and explainability faculties as well as being endowed with summarization capabilities. We also show how such models can be formed at various levels of abstraction by engaging information granules of higher type and higher order.

Plenary Speech (II)

The Origin and Goal of Cyber-Physical-Social Systems: From Systems Learning to Systems Intelligence



Fei-Yue Wang

IEEE Fellow, 2003

State Specially Appointed Expert,

Director of the State Key Laboratory for Management and Control of Complex Systems, Chinese Academy of Sciences.

Abstract: For complex systems, the ACP approach is used to describe behaviors based on artificial systems, to analyze based on Computational experiments, and to control based on Parallel execution. The actual benefits are gained through virtual resources that are built by artificial systems. In a similar way, the software-defined-network approach offer the availability to programming networks by separating network data plane and control plane, which makes it possible to re-construct network resources or even architectures. From engineering perspective, the artificial systems are Digital Twins or Software Defined Systems (SDS). SDS will be the key technique for the next generation of Systems Engineering (SE 5.0). Integrated with intelligent technology, the DoDAF and TOGAF architecture frameworks developed from C4ISR/AF, will conveniently include the human and social factors to modeling and behavior analyzing of system processes, and flexibly cope with various Cyber-Physical-Social Systems (CPSS) problems, and easily apply parallel system technology. In other words, Systems Engineering 5.0 is a new era, when the parallel system and SDS approaches will be integrated with CPSS to synthetically deal with the complex systems, that is: SE 5.0 = ACP + CPSS + SDS

Program at a Glance

The International Conference on System Science and Engineering 2020 (ICSSE 2020), August 31 - September 3, 2020

ICSSE 2020 Conference Program

September 1, 2020 (Tuesday)

| | |
|---------------------|--|
| 09:00 17:30 | Registration 【9/1 AM: IB-202, 9/1 PM: IB-505】 |
| 09:30 10:00 | Opening Ceremony 【IB-202】 Oral & Virtual conference, Virtual conference software: ZooM |
| 10:00 10:50 | Plenary Speech (I) Bridging Numeric and Symbolic System Modeling with the Principles of Granular Computing Speaker: Prof. Witold Pedrycz Chair: Prof. Kao-Shing Hwang 【IB-202】 Oral & Virtual conference, Virtual conference software: ZooM |
| 11:00 11:50 | Plenary Speech (II) The Origin and Goal of Cyber-Physical-Social Systems: From Systems Learning to Systems Intelligence Speaker: Prof. Fei-Yue Wang Chair: Prof. Yo-Ping Huang 【IB-202】 Oral & Virtual conference, Virtual conference software: ZooM |
| 12:10 13:00 | Lunch 【IB, 5F】 |

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|---------------------|---|---------------------|---|---------------------|---|---|---|
| 13:00 15:40 | SESSION (I) Oral & Virtual conference ICSSE 2020 Best Student Paper Award Competition Chairman: Prof. Tzoo-Hseng S. Li Co-Chairmen: Prof. Jih-Gau Juang and Prof. Pei-Jun Lee (TA-1) 【IB-505】 #1067, #1085, #1106, #1140, #1163, #1165 Virtual conference software: Zoom | | SESSION (II) Virtual conference SI of IJFS (I) Chairman: Jin-Tsong Jeng (TA-2) 【IB-506】 #1119, #1080, #1011, #1021, #1149, #1167, #1094 Virtual conference software: Zoom | | 13:00 14:15 | SESSION (III) Oral SS10 Intelligent Learning in Control Systems Chairman: Prof. Kao-Shing Hwang (TA-3) 【IB-507】 #1054, #1127, #1133, #1134, #1141, #1113 | |
| | | | | | 14:20 15:50 | SESSION (III) Oral Deep Learning and Applications 1 Chairman: Prof. Jih-Gau Juang (TA-4) 【IB-507】 #1057, #1058, #1126, #1161, #1174, #1112 | |
| 15:40 16:00 | Coffee Break 【IB, 5F】 | | | | | | |
| 16:00 17:30 | SESSION (I) Oral WS04 Smart Manufacturing/Industry 4.0 Systems Chairman: Prof. Ching-Chih Tsai (TA-5) 【IB-505】 #1073, #1079, #1091, #1012, #1009, #1157 | 15:00 17:40 | SESSION (II) Oral & Virtual conference ICSSE 2020 Best Paper Awards Competition Chairman: Prof. Wen-June Wang Co-Chairmen: Prof. Chin-Wang Tao and Prof. Kuang-Yow Lian (TA-6) 【IB-508】 #1053, #1064, #1070, #1098, #1124, #1172 Virtual conference software: Zoom | 15:50 16:40 | SESSION (III) Oral SI of IJFS (II) Chairman: Jin-Tsong Jeng (TA-7) 【IB-507】 #1007, #1168 | 16:00 17:30 | Poster Session (I) #1023, #1097, #1088, #1138, #1128, #1092 SS04 Fuzzy Systems and Its Applications (Chairman: Prof. Chun-Fei Hsu): #1049, #1051 SS08 System Development, Control, and Optimization (Chairmen: Prof. Jinn-Tsong Tsai, Prof. Fu-I Chou and Prof. Po-Yuan Yang): #1032, #1035, #1037, #1046, #1047, #1052, #1131 SS01 Intelligent Systems in Autonomous Vehicles (Chairman: Prof. Tsu-Tian Lee): #1024, #1031, #1045, #1090 SS02 Intelligent Systems and Modeling (Chairman: Prof. Jin-Tsong Jeng): #1093 |
| | | | | | 16:50 17:30 | | SESSION (III) Oral SS09 Healthcare Systems Chairman: Prof. Yo-Ping Huang (TA-8) 【IB-507】 #1025, #1062, #1089, #1036 |
| 18:30 ~ 20:30 | Banquet 【台北凱撒大飯店 4樓上海廳 (忠孝西路一段 38 號 4 樓)】 | | | | | | |

September 2, 2020 (Wednesday)

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|---------------------|---|--|--|--|--|--|
| 09:00 17:30 | Registration 【IB-505】 | | | | | |
| 08:50 10:20 | SESSION (I) Virtual conference SS11 PHM for Complex Systems 1 Chairmen: Prof. Xiao-jian Yi, Prof. Hui-Na Mu and Prof. Ya-juan Liu (WM-1) 【IB-505】 #1022, #1033, #1034, #1042, #1072 Virtual conference software: Zoom | | SESSION (II) Virtual conference Deep Learning and Applications 2 Chairman: Prof. Chen Chien Hsu (WM-2) 【IB-506】 #1026, #1048, #1050, #1123 Virtual conference software: Zoom | | | |
| | Coffee Break 【IB, 5F】 | | | | | |
| 10:40 12:10 | SESSION (I) Virtual conference SS11 PHM for Complex Systems 2 Chairmen: Prof. Xiao-jian Yi, Prof. Hui-Na Mu and Prof. Ya-juan Liu (WM-3) 【IB-505】 #1150, #1153, #1154, #1018 Virtual conference software: Zoom | | SESSION (II) Virtual conference WS03 Reliability Design and Resilient Control of Intelligent Mechatronic Systems Chairmen: Prof. Zhengtian Wu and Prof. Xiaona Song (WM-4) 【IB-506】 #1158, #1101, #1137, #1028 Virtual conference software: Zoom | | SESSION (III) Virtual conference SS12 Robotic Vision & Its Application Chairman: Prof. Mei-Yung Chen (WM-5) 【IB-507】 #1095, #1121, #1027 Virtual conference software: Zoom | |
| | Lunch 【IB, 5F】 | | | | | |
| 12:10 13:00 | | | | | | |

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|---------------------|---|---|---|
| 13:00 14:30 | <p style="text-align: center;">SESSION (I) Virtual conference</p> <p>SS07 Intelligent and Learning Control of Nonlinear Systems: Theory and Applications Chairmen: Prof. Yongming Li and Prof. Tieshan Li (WA-1) 【IB-505】</p> <p>#1043, #1082, #1086, #1177 Virtual conference software: VooV</p> | <p style="text-align: center;">SESSION (II) Virtual conference</p> <p>WS01 Workshop on Offshore Robotics 1 Chairman: Prof. Hongde Qin (WA-2) 【IB-506】</p> <p>#1081, #1111, #1118, #1120, #1125 Virtual conference software: ZooM</p> | <p style="text-align: center;">SESSION (III) Virtual conference</p> <p>SS13 Intelligent Systems in Biometrics and Physiological Measurements Chairman: Prof. Jing-Ming Guo (WA-3) 【IB-507】</p> <p>#1077, #1164, #1135, #1063 Virtual conference software: ZooM</p> |
| 14:40 15:40 | <p style="text-align: center;">SESSION (I) Virtual conference</p> <p>SS14 Consensus for Large-scale Group Decision Making Chairmen: Prof. Jian Wu, Prof. Yucheng Dong, Prof. Zaiwu Gong, Prof. Yejun Xu, Prof. Zhen Zhang #1084, #1099 Virtual conference software: ZooM</p> <p>SS15 Theory, Method and Application of Conflict Decision Chairmen: Prof. Haiyan Xu and Prof. Ginger Y. Ke #1166, #1173 Virtual conference software: VooV (WA-4) 【IB-505】</p> | <p style="text-align: center;">SESSION (II) Virtual conference</p> <p>WS01 Workshop on Offshore Robotics 2 Chairman: Prof. Hongde Qin (WA-5) 【IB-506】 #1129, #1144, #1156 Virtual conference software: ZooM</p> | <p style="text-align: center;">SESSION (III) Virtual conference</p> <p>Awards Ceremony Session (WA-6) 【IB-507】 Virtual conference software: ZooM</p> |
| 15:40 16:00 | Coffee Break 【IB, 5F】 | | |

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|---------------------|---|--|--|
| 16:00 17:30 | <p style="text-align: center;">SESSION (I) Virtual conference</p> <p>SS05 Performance Analysis and Synthesis of Complex Systems Chairmen: Prof. Jianwei Xia, Prof. Xudong Zhao, and Prof. Hao Shen (WA-7) 【IB-505】</p> <p>#1006, #1016, #1030, #1061, #1066, #1068 Virtual conference software: VooV</p> | <p style="text-align: center;">SESSION (II) Virtual conference</p> <p>SS06 Intelligent Control and Applications Chairmen: Prof. Wen-Shyong Yu and Prof. Ching-Hung Lee (WA-8) 【IB-506】</p> <p>#1110, #1122, #1044, #1056, #1105, #1152 Virtual conference software: Teams</p> | <p style="text-align: center;">Poster Session (II)</p> <p>#1010, #1139, #1142, #1143, #1145, #1146, #1147, #1176, #1109 #1040</p> <p>16:00 17:30</p> <p>SS04: #1059, #1060, #1104, #1107, #1115, #1171</p> <p>#1136, #1151, #1100</p> <p>#1013, #1019, #1038, #1074, #1075, #1076 #1160, #1108,</p> |
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September 3, 2020 (Thursday)

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|---------------------|--|
| 10:00 11:30 | <p style="text-align: center;">Poster Session (III)</p> <p>SS02, SS03 Intelligent Systems (Chairman: Prof. Chen-Chia Chuang): #1071, #1083, #1096, #1159, #1132</p> |
|---------------------|--|

Detailed Program Listing

ICSSE 2020 Best Student Paper Award Competition

9/1 (TA-1) 【IB-505】 13:00-15:40

Chairman: Prof. Tzoo-Hseng S. Li

Co-Chairmen: Prof. Jih-Gau Juang and Prof. Pei-Jun Lee

Oral & Virtual conference: Virtual conference software: Zoom

| | | |
|-------|--|----------|
| #1067 | Observer-based Sampled-Data Adaptive Fuzzy Output Feedback Control for MIMO Pure-Feedback Nonlinear Systems |023 |
| | Kunting Yu and Yongming Li | |
| #1085 | A Descriptor System approach for Polynomial Fuzzy-Model-Based Control Design |023 |
| | Fan-Nong Yu, Ying-Jen Chen, Kazuo Tanaka, Motoyasu Tanaka and Shun-Hung Tsai | |
| #1106 | Contour Based Region of Interest Selection for Remote Photoplethysmography Signals |024 |
| | Chao-Yue Zeng, Po-Wei Huang and Bing-Fei Wu | |
| #1140 | Fixed-time Trajectory Tracking Control of an Unmanned Surface Vehicle |024 |
| | Renhui Wang, Haoyuan Xue, Zhongkun Li, He Li, Ning Wang and Hong Zhao | |
| #1163 | Fast and Robust Underwater Obstacle Detection in Acoustic Vision |025 |
| | Hengrui Liu, Deshan Chen, Di Zhang and Peng Zhou | |
| #1165 | Face Expression and Tone of Voice for Deception System |025 |
| | Li-Wei Hsiao, Jing-Ming Guo, Gi-Luen Huang, Yi-Fang Hsieh, Chih-Hsien Hsia and Herleeyandi Markoni | |

SI of IJFS (I)

9/1 (TA-2) 【IB-506】 13:00-15:40

Chairman: Prof. Jin-Tsong Jeng

Virtual conference: Virtual conference software: Zoom

| | | |
|-------|---|----------|
| #1119 | The Normal T-spherical Fuzzy Taxonomy Method for Multiple Attribute Decision-making Problems |026 |
| | Peide Liu and Dongyang Wang | |
| #1080 | Observer-Based Adaptive Fuzzy Prescribed Performance Control for Intelligent Ship Autopilot |027 |
| | liyan zhu, Tieshan Li and Yue Wu | |

| | | |
|-------|--|-----|
| #1011 | Morphological Reconstruction based Improved Fuzzy C-means Clustering Algorithm with Guided Filter for Image Segmentation | 027 |
| | Guangmei Xu, Jin Zhou, Jiwen Dong, Hui Jiang, Dong Wang, Lin Wang, Shiyuan Han and Yuehui Chen | |
| #1021 | A General Transfer Learning based Gaussian Mixture Model for Clustering | 028 |
| | Rongrong Wang, Jin Zhou, Hui Jiang, Shiyuan Han, Lin Wang, Dong Wang and Yuehui Chen | |
| #1149 | Fuzzy Control under Time-varying Universe and Phase Optimization in Traffic Lights | 028 |
| | Cang Zhou, Hong Mo, Xiuru Chen and Huan Wen | |
| #1167 | A PROMTHEE II Approach Based on Probabilistic Hesitant Fuzzy Linguistic Information with Applications to Multi-Criteria Group Decision Making | 029 |
| | Lu Chen, Haiyan Xu and Ginger Y. Ke | |
| #1094 | Continuous Attractors of Fuzzy Coupled Recurrent Neural Networks | 029 |
| | Zhixin Pang, Jiali Yu, Jinsong Leng, Chunxiao Wang and Bisen Liu | |

SS10 Intelligent Learning in Control Systems

9/1 (TA-3) 【IB-507】 13:00-14:15

Chairman: Prof. Kao-Shing Hwang

Oral conference

| | | |
|-------|--|-----|
| #1054 | Object Proximity Sensing based on 3D Point Cloud Segmentation | 030 |
| | Kao-Shing Hwang, Jin-Ling Lin and Wei-Cheng Jiang | |
| #1127 | TPSO-based Tracking Control of a Mobile Robot Using T-S Fuzzy Systems | 031 |
| | Gwo-Ruey Yu and Wei-Yi Wang | |
| #1133 | A Banknotes Recognition System Based on Yolact | 031 |
| | Kuan-Ting Chen, Wen-June Wang, Hsiang-Chieh Chen and Yi-Chieh Cai | |
| #1134 | An Intelligent 6-DOF Robotic Arm for Tracking and Facing Human's Forehead with a Fixed Distance | 032 |
| | Bo-Yi Li, Wen-June Wang, Hsiang-Chieh Chen and Wei-Kai Wang | |
| #1141 | Artificial Intelligence Visual Surveillance for Autonomous Farm Management | 032 |
| | Leel Vinod and Jin-Tsong Jeng | |
| #1113 | Polyphase Watt-Hour Measurement Methods Based on Back Propagation Neural Network | 033 |
| | Chun-Liang Lu and Yong-Lin Kuo | |

Deep Learning and Applications 1

9/1 (TA-4) 【IB-507】 14:20-15:50

Chairman: Prof. Jih-Gau Juang

Oral conference

| | | |
|-------|--|----------|
| #1057 | Deep Learning and Object Identification for Hexacopter Application |034 |
| | Sheng-I Chang and Jih-Gau Juang | |
| #1058 | Real-time Path Planning and Fuzzy Based Obstacle Avoidance for UAV Application |034 |
| | Tsung-Hsien Huang and Jih-Gau Juang | |
| #1126 | Navigation Application of Q-learning Neural Network |034 |
| | Ying-Hao Chen, Wei-Cun Chen and Chian-Song Chiu | |
| #1161 | A Signal Fusion-based ANN Algorithm for Fault Diagnosis of Rotating Machinery |035 |
| | Yennun Huang, Shang-Chih Lin, Chia-Wei Jen and Shun-Feng Su | |
| #1174 | Loading Optimization of Chiller Systems Using Deep Learning Method |036 |
| | Kuang-Yow Lian, Yong-Jie Hong, Zhe-Wel Zhang, Yu-Wei Su and Kebba Jaiteh | |
| #1112 | Study of Metal 3D Printing-Assisted Pelvic Fracture Surgery |036 |
| | Jia-En Chen, Tsu-Te Yeh, Sendren Sheng-Dong Xu, Yuan-Ta Li, Ching-Cheng Hsiao, Chin-Chieh Yi and Rui-Hong Wu | |

WS04 Smart Manufacturing/Industry 4.0 Systems

9/1 (TA-5) 【IB-505】 16:00-17:30

Chairman: Prof. Ching-Chih Tsai

Oral conference

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|-------|---|------------|
| #1073 | Intelligent PID Injection Speed and Pressure Control Using ORBLS for Compound Plunger in Semiconductor Die Packaging |037 |
| | Yu-Ruy Cheng, Ching-Chih Tsai, Chun-Chieh Chan and Guo-Shun Hung | |
| #1079 | Map-Free Path Planning of a Fuzzy-Controlled Mobile Robot in Unknown Environments |038 |
| | Chia-Feng Juang, Ching-Yu Chou and Yuan-Sue Yang | |
| #1091 | Virtual Machining System Development for Electrical Discharge Machining | 038 |
| | Guo-Jung Chen, Ching-Hung Lee and We-Yu Lai | |
| #1012 | Adaptive Neural Backstepping Control for Uncertain Robotic Manipulator | 039 |
| | Mei-Yung Chen and Peng Jing-Quan | |
| #1009 | Simulation Implementation of MPPT Design under Partial Shading Effect of PV Panels | 039 |
| | Sy Ngo and Chian-Song Chiu | |
| #1157 | Visual Tracking Cleaner — A Robot Implements on the Whiteboard |040 |
| | Hsiao-Ni Chi, Pei-Jun Lee and Chia-Ling Lo | |

ICSSE 2020 Best Paper Awards Competition

9/1 (TA-6) 【IB-508】 15:00-17:40

Chairman: Prof. Wen-June Wang

Co-Chairmen: Prof. Chin-Wang Tao and Prof. Kuang-Yow Lian

Oral & Virtual conference: Virtual conference software: Zoom

| | | |
|-------|---|------|
| #1053 | Face Transformation and Local Feature Adjustment Algorithm Based on Facial Feature Points | .041 |
| | | |
| | Wen-Hau Jian and Mei-Yung Chen | |
| #1064 | Facial Recognition System Design Using Deep Learning Network for Authorized Access to Autonomous Vehicles | .041 |
| | | |
| | Hsin Han Chiang, Zong-Yue Deng, Wei-Yen Wang, Shih-Ting Hung and Tsu-Tian Lee | |
| #1070 | Adaptive PID-Like Control Using Fuzzy Broad Learning System for Nonlinear Dynamic Systems | .042 |
| | | |
| | Hung-Sheng Chen, Ching-Chih Tsai and Feng-Chun Tai | |
| #1098 | Estimation of Domain of Attraction for Positive Polynomial Fuzzy Systems with Input Saturation using Membership-Function-Dependent Analysis and Imperfect Premise Matching Concept | .042 |
| | | |
| | Meng Han, H.K. Lam, Fucai Liu, Yuandi Li and Yinggan Tang | |
| #1124 | An Experimental Comparison Study of Artificial Supercavitation Generated by Air Injection Behind Disk-shaped Cavitators and Elliptical Disk-shaped Cavitators | .043 |
| | | |
| | Guangyao Chen, Shaoqiong Yang, Tongshuai Sun and Peng Lv | |
| #1172 | Intelligent Non-Invasive Vital Signs Estimation from Image Analysis | .044 |
| | | |
| | Tran Quoc Viet, Shun-Feng Su, Minh-Quang Tran and Truong Vi | |

SI of IJFS (II)

9/1 (TA-7) 【IB-507】 15:50-16:40

Chairman: Prof. Jin-Tsong Jeng

Oral conference

| | | |
|-------|---|------|
| #1007 | A Wavelet K-Means Clustering and Fuzzy Based Method for Parkinson's Disease MRI Segmentation | .045 |
| | | |
| | Kanika Bhalla, Yo-Ping Huang, Hung-Chi Chu and Si-Huei Lee | |
| #1168 | The Fuzzy Control Approach for a Quadruped Robot Guide Dog | .046 |
| | | |
| | Kuo-Yi Chen and Chin-Yuan Tsui | |

SS09 Healthcare Systems**9/1 (TA-8) 【IB-507】 16:50-17:30****Chairman: Prof. Yo-Ping Huang****Oral conference**

| | | |
|-------|---|------|
| #1025 | Deep Reinforcement Learning Design for Collision Avoidance of Dual-Arm Robot | .047 |
| | Ching-Chang Wong, Hsuan-Ming Feng, Shao-Yu Chien and Hisasuki Aoyama | |
| #1062 | CNN-based Sound Classification Mechanism | .047 |
| | Hung-Chi Chu and Young-Lin Zhang | |
| #1089 | Visibility Stabilization Method for Vehicle Detection Under Extreme Weather Conditions | .048 |
| | Xiu-Zhi Chen, Chieh-Min Chang, Chao-Wei Yu and Yen-Lin Chen | |
| #1036 | Image-based Solar Irradiance Forecasting Using Recurrent Neural Networks | .048 |
| | Tsai-Ping Chu, Jian-Hua Zhou and Yih-Guang Leu | |

Poster Session (I)**9/1: 16:00-17:30**

| | | |
|-------|---|------|
| #1023 | Surface Defect Recognition for Calcium Silicate Boards Based on a Deep Learning Method | .050 |
| | Hao-Wei Chen, Chi-Yi Tsai, Yu-Hsiang Chen and Yu-Chen Hu | |
| #1093 | The Study of Control-Consistency Space and Control Lyapunov Function for Nonlinear Descriptor Systems | .050 |
| | Jenq-Lang Wu, Jia-Yao Jhang and Chee-Fai Yung | |
| #1097 | End-to-end Identification of Pharmaceutical Blister Packages Based on One-side Handheld Images | .051 |
| | Sheng-Luen Chung, Chang-Lin Cho and Shun-Feng Su | |
| #1088 | A Novel Image Protection Algorithm with Double Hyperchaos Ciphering | .052 |
| | Shih-Yu Li, kai-chung Shih, Chin-Sheng Chen and Lap-Mou Tam | |
| #1138 | Deep-Learning based Automatic Segmentation of Coronary Arteries in Computed Tomography Angiography Images | .052 |
| | Li-Syuan Pan, Wing P. Chan, Chia-Wei Li, Shee-Yen Tay and Shun-Feng Su | |
| #1128 | A CNN-Based Human Head Detection Algorithm Implemented on Edge AI Chip | .053 |
| | Fang-Jing Shen, Jian-Hao Chen, Wei-Yen Wang, Dien-Lin Tsai, Lien-Chieh Shen, Ching-Tung Tseng | |
| #1092 | Vibration Signals Analysis for Bearing Fault Diagnosis Using Convolutional Neural Network and XAI Approach | .053 |
| | Han-Yun Chen and Ching-Hung Lee | |

SS04:

| | | |
|-------|--|------|
| #1049 | Motion and Balance Control for a Collinear-Mecanum-Wheeled Self-Balancing Robot | .054 |
| | Tzu-Chun Lin, Wei-Fu Kao, Zi-Ling Lin and Chun-Fei Hsu | |

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|-------|--|------|
| #1051 | Intelligent Control of a Unicycle Balancing Robot | .054 |
| | T Chun-Fei Hsu, Bo-Rui Chen, Ren-Jie Ou and Tsu-Tian Lee | |

SS08:

| | | |
|-------|---|------|
| #1032 | Parameters Optimization for Group Search Algorithm | .055 |
| | Kai-Yu Yang, Po Yuan Yang, Fu-I Chou and Jyh-Horng Chou | |

| | | |
|-------|---|------|
| #1035 | Improved Fractional-Order Particle Swarm Optimizer based on Sliding-Level Strategy | .056 |
| | Yu-cheng Liao, Po Yuan Yang, Fu-I Chou and Jyh-Horng Chou | |

| | | |
|-------|---|------|
| #1037 | Solution of Unconstrained Optimization Problems by Using Hybrid Vector Multi-Objective Genetic Algorithm | .057 |
| | Chiu-Hung Chen, Po Yuan Yang, Chun-Jen Kuo and Jyh-Horng Chou | |

| | | |
|-------|--|------|
| #1046 | Parameter Optimization for Reinforcement Learning by Using Uniform Design | .058 |
| | Chia-Wei Chuang, Po Yuan Yang, Fu-I Chou, Jinn-Tsong Tsai and Jyh-Horng Chou | |

| | | |
|-------|---|------|
| #1047 | An Active Data Augmentation Method to Improve Deep Learning Model for Surface Defect Detection with Scarce Samples | .059 |
| | Tzu-Chieh Hung, Chin-Sheng Chen and Hao-Xiang Yang | |

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|-------|---|------|
| #1052 | Performance Optimization Research on Ultrasonic Vibration Assisted Turning | .059 |
| | Wei Tai Huang, Zhi-Yao Tu and Jyh-Horng Chou | |

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|-------|---|------|
| #1131 | Trajectory Recognition of Spinning Ball for Ping-Pong Robots | .060 |
| | Chun-Ting Liu, Chung-Hsun Sun and Hsiang-Chieh Chen | |

SS01:

| | | |
|-------|---|------|
| #1024 | Mobilenet-SSDv2: An Improved Object Detection Model for Embedded Systems | .060 |
| | Yu-Chen Chiu, Chi-Yi Tsai, Ming-Da Ruan, Guan-Yu Shen and Tsu-Tian Lee | |

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|-------|---|------|
| #1031 | Omni-directional Drive Autonomous Mobile Robot | .061 |
| | Ching-Chang Wong and Chih-Cheng Liu | |

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|-------|--|------|
| #1045 | Road User Intention Classify by K-means Algorithm | .061 |
| | Kuan Yi Lin, Tsung Lin Hsieh, Chien I Yu and Peter Liu | |

| | | |
|-------|---|------|
| #1090 | Surrounding View Advanced Driver Assistance Systems base on Lightweight Technology | .062 |
| | Ko Feng Lee, Yen-Lin Chen, Kai-Yi Chin, Chao-Wei Yu and Chia-Yu Hsiao | |

SS11 PHM for Complex Systems 1

9/2 (WM-1) 【IB-505】 08:50-10:20

Chairmen: Prof. Xiao-jian Yi, Prof. Hui-Na Mu and Prof. Ya-juan Liu

Virtual conference: Virtual conference software: Zoom

| | | |
|-------|---|------|
| #1022 | Reliability Model of Single Internal and External Meshing Planetary Gear Transmission Mechanism Considering Load Correlation | .063 |
| | | |
| | Shulin Liu, Zili Wang, xiaojian Yi and Peng Hou | |
| #1033 | Application of Multi-sensor Information Fusion Technology in Fault Diagnosis of Transport Vehicle Engine | .064 |
| | | |
| | Zhao Yao, Shen Yu, Zhannan Guo, Jianxin He, xiaojian Yi and Yingshun Li | |
| #1034 | Research on Fault Diagnosis of Armored Delivery Vehicle Based on Oil Monitoring Information | .065 |
| | | |
| | Yingshun Li, Ji yao Lu, Zhannan Guo, Aina Wang, Jianxin He and xiaojian Yi | |
| #1042 | A Survey Of Equipment Fault Diagnosis and Condition Evaluation Methods Based On Data Driven | .066 |
| | | |
| | Yingshun Li, Aina Wang and xiaojian Yi | |
| #1072 | A Maintenance Analysis Method Associated Functional Structure for Complex Equipment | .066 |
| | | |
| | Na Jiao, Wenjun Guo, Meng Zhang and xiaojian Yi | |

SS11 PHM for Complex Systems 2

9/2 (WM-3) 【IB-505】 10:40-12:10

Chairmen: Prof. Xiao-jian Yi, Prof. Hui-Na Mu and Prof. Ya-juan Liu

Virtual conference: Virtual conference software: Zoom

| | | |
|-------|--|------|
| #1150 | Simulation Analysis on Safety Prediction of Front Impact of Special Vehicles | .067 |
| | | |
| | Zhongliang Wei, Xingguo Zhao, Minhui Chen, Liang Ling, Fang Xie, Li Li and Sijuan Zheng | |
| #1153 | Study on Mental Load Test and Evaluation of Special Vehicle Crew | .068 |
| | | |
| | Fang Xie, Sijuan Zheng, Liang Ling, Zhongliang Wei and Wei Hu | |
| #1154 | Study on Electric and Electric Hybrid Energy Matching of Off-Road Vehicle Based on Ragone Curve | .068 |
| | | |
| | Jianguo Lv, Xuelian Xiao, Yuankun Dong, Chunlin Liu, Chaofan Wang and Zhiyuan Guo | |
| #1018 | Aggregation and Comparison of Probabilistic Linguistic Term Sets with Interval Probabilities | .069 |
| | | |
| | Huchang Liao and Xingli Wu | |

Deep Learning and Applications 2

9/2 (WM-2) 【IB-506】 08:50-10:20

Chairman: Prof. Chen Chien Hsu

Virtual conference: Virtual conference software: Zoom

| | | |
|-------|--|------|
| #1026 | A Tiny Neural Network Model for Estimating Next 24 Hour Temperature Transition | .070 |
| | Huidong Tang, Yuichiro Mori and Masahiko Toyonga | |
| #1048 | Deep Learning Based Real-Time Multiple-Person Action Recognition System | .070 |
| | Jen-Kai Tsai, Chen-Chien Hsu and Wei-Yen Wang | |
| #1050 | Object Pose Estimation System for Pick and Place Automation | .071 |
| | Hsin-Hung Chen, Chen-Chien Hsu and Wei-Yen Wang | |
| #1123 | Should Kernels Be Trained in CNN? - a Paradigm of AG-Net | .071 |
| | Jingchen Li, Haobin Shi and Kao-Shing Hwang | |

WS03 Reliability Design and Resilient Control of Intelligent Mechatronic Systems

9/2 (WM-4) 【IB-506】 10:40-12:10

Chairmen: Prof. Zhengtian Wu and Prof. Xiaona Song

Virtual conference: Virtual conference software: Zoom

| | | |
|-------|--|------|
| #1158 | Sliding Mode Control of Temperature and Humidity in Air Conditioners | .072 |
| | Zhengtian Wu, Lijian Yang and Baoping Yang | |
| #1101 | A New Fuzzy DEA Model for Green Supplier Evaluation Considering Undesirable Outputs | .072 |
| | HuiDong Wang, Mingguang Dong and Lei Wang | |
| #1137 | Data-driven Robust PID Control of Unknown USVs | .073 |
| | Dong Nan, Yongpeng Weng and Ning Wang | |
| #1028 | L_1/H_∞ Filter Design for Affine Fuzzy Systems with Imperfect Premise Matching | .073 |
| | Huimin Wang, Xinyue Shen and Xiao-Jian Li | |

SS12 Robotic Vision & It's Application

9/2 (WM-5) 【IB-507】 10:40-12:10

Chairman: Prof. Mei-Yung Chen

Virtual conference: Virtual conference software: Zoom

| | | |
|-------|--|------|
| #1095 | Virtual Reality Exposure Therapy for Driving Phobia Disorder: A System Design and Development | .074 |
| | Ru-Ting Kuo, Amy J.C. Trappey, Charles Trappey, Chia-Ming Chang, Chih-Hsuan Nieh and Pin-Chun Lin | |
| #1121 | Analysis and Prediction of Chaotic Time Series Based on Deep Learning Neural Networks | .075 |
| | Cheng-Hsiung Yang and Hui-Yu Shen | |
| #1027 | Improvement of Deep Learning Based Human Action Recognition with Motion Prediction System | .075 |
| | Yu Cho, Xin-Hong Ho and Cheng-Ming Huang | |

SS07 Intelligent and Learning Control of Nonlinear Systems: Theory and Applications

9/2 (WA-1) 【IB-505】 13:00-14:30

Chairmen: Prof. Yongming Li and Prof. Tieshan Li

Virtual conference: Virtual conference software: VooV

| | | |
|-------|---|------|
| #1043 | Adaptive Fuzzy Finite-Time Bipartite Containment Control for Stochastic Multi-Agent Systems | .076 |
| | Ying Wu, Hong Xue, Ying Tian and Hongjing Liang | |
| #1082 | Adaptive Fixed-Time Prescribed Performance Control for a Class of Nonlinear Systems with Quantized Input Signals | .077 |
| | Ming Chen, Man Yu, Long yan Zhang and Qing huan Wang | |
| #1086 | Fault Tree Analysis of Electronic-controlled Air Suspension | .077 |
| | Yi-Xian Fang and Rui Bai | |
| #1177 | Research on Classification and Detection System of Common Household Tools for Home Service Robot | .078 |
| | Weizhao Chen, Wenbai Chen, Chao He, Nan Liu, Peiliang Wu and Haobin Shi | |

WS01 Workshop on Offshore Robotics 1

9/2 (WA-2) 【IB-506】 13:00-14:30

Chairman: Prof. Hongde Qin

Virtual conference: Virtual conference software: Zoom

| | | |
|-------|--|------|
| #1081 | Research on Structural Health Monitoring of Pressure Cabin Based on Stress Intensity Factor | .079 |
| | | |
| | Changli Yua, Runfa Gea, Myung Hyun Kimb, Xiaobo Gong and Zhen Xin Yang | |
| #1111 | Research on Underwater Image Recognition Based on Deep Learning | .080 |
| | | |
| | Chong Wang, Yu Jiang, Ge Liu and Fenglin Wei | |
| #1118 | A Real Time Multi-thread Underwater Images Enhancement System | .081 |
| | | |
| | Xiaofeng Liu, Risheng Liu, Ming Zhu, Wei Zhong, Xin Fan, Zhongxuan Luo and Wanhui Zhang | |
| #1120 | Planning for Fish Net Inspection with an Autonomous OSV | .082 |
| | | |
| | Tony Xiaotong Lin, Qiuyang Tao and Fumin Zhang | |
| #1125 | Design and Simulation of Open Frame Underwater Towing Vehicle | .082 |
| | | |
| | Guangzhao Zhou, Xianbo Xiang and Chuan Liu | |

WS01 Workshop on Offshore Robotics 2

9/2 (WA-5) 【IB-506】 14:40-15:40

Chairman: Prof. Hongde Qin

Virtual conference: Virtual conference software: Zoom

| | | |
|-------|---|------|
| #1129 | Recognition and 3D Pose Estimation for Underwater Objects Using Deep Convolutional Neural Network and Point Cloud Registration | .083 |
| | | |
| | Xin-Xin Wang, Jian Gao and Lei Feng | |
| #1144 | Adaptive Localisation for USVs Using IMU-IMM | .084 |
| | | |
| | Bryan Gunawan, Yuanchang Liu and Xudong Li | |
| #1156 | Online Reinforcement Learning-Based Adaptive Tracking Control of an Unknown Unmanned Surface Vehicle with Input | .084 |
| | | |
| | Ning Wang and Yongpeng Weng | |

SS13 Intelligent Systems in Biometrics and Physiological Measurements

9/2 (WA-3) 【IB-507】 13:00-14:30

Chairman: Prof. Jing-Ming Guo

Virtual conference: Virtual conference software: Zoom

| | | |
|-------|---|------|
| #1077 | Spectrogram Analysis with Convolutional Neural Networks for Contact-Free Heart Rate Estimation Using Radar Signals | .085 |
| | | |
| | Jing-Ming Guo, Li-Wei Hsiao, Tsung-Neng Tsai, Wei-Wen Hsu, Meng-Yi Bai and Yu-Chi Wang | |
| #1164 | Design of a Lightweight Network Architecture for Palm Vein Recognition with Model Compression | .086 |
| | | |
| | Zih-Ching Chen, Sin-Ye Jhong and Chih-Hsien Hsia | |
| #1135 | Exposure Dosage Planning in Digital Lithography | .087 |
| | | |
| | Jian-Yang Li, Bo-Yuan Cai, Yu-Lin Wang and Hung Fei Kuo | |
| #1163 | A Rule-Base Granular Computing Approach for Stock Portfolio Optimization | .087 |
| | | |
| | Kao-Yi Shen, Hiroshi Sakai and San-Ting Lee | |

SS14 Consensus for Large-scale Group Decision Making

9/2 (WA-4) 【IB-505】 14:40-15:40

Chairmen: Prof. Jian Wu, Prof. Yucheng Dong, Zaiwu Gong,
Prof. Yejun Xu, and Prof. Zhen Zhang

Virtual conference: Virtual conference software: Zoom

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|-------|---|------|
| #1084 | A Joint Optimization Approach for Consensus in Large-scale Group Decision Making under Social Network | .088 |
| | | |
| | Jian Wu, Tian Tian Gai and Ming Shuo Cao | |
| #1099 | Dynamic Trust-driven Consensus Reaching Process in Social Network Multiple Attribute Group Decision Making | .089 |
| | | |
| | Fang Wang and Hengjie Zhang | |

SS15 Theory, method and application of conflict decision

9/2 (WA-4) 【IB-505】 14:40-15:40

Chairmen: Prof. Haiyan Xu and Prof. Ginger Y. Ke

Virtual conference: Virtual conference software: VooV

| | | |
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| #1066 | Multi-Level Option Form in Graph Model for Conflict Resolution | .089 |
| | | |
| | Shinan Zhao and Haiyan Xu | |
| #1173 | Methods on Inverse Problem for Different Behavior Patterns in Environmental Conflict Resolution | .090 |
| | | |
| | Yu Han and Haiyan Xu | |

SS05 Performance Analysis and Synthesis of Complex Systems

9/2 (WA-7) 【IB-505】 16:00-17:30

Chairmen: Prof. Jianwei Xia, Prof. Xudong Zhao, and Prof. Hao Shen

Virtual conference: Virtual conference software: VooV

| | | |
|-------|--|------|
| #1006 | Structural-algorithmic and Parametric Synthesis of N-Level Single Phase Voltage Source Inverter for Solar PV System | .091 |
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| | Hein Zaw Htet, Gennady Sergeevich Mytsyk and Hlaing Min Oo | |
| #1016 | Algebraic State Space Representation for Boolean Networks with Multiple Time-Delays | .092 |
| | | |
| | Guodong Zhao, Haitao Li and Yuanhua Wang | |
| #1030 | Fault Detection Observer Design for Nonlinear Discrete-Time Systems with Measurement Outliers | .092 |
| | | |
| | Qi Li, Hong Xue and Yingnan Pan | |
| #1061 | Adaptive Dynamic Programming for a Class of Two-player Stackelberg Differential Games | .093 |
| | | |
| | Ke Xu, Xudong Zhao and Xiumei Han | |
| #1066 | Sliding Mode Control for Double-pendulum Rotary Cranes | .093 |
| | | |
| | Huimin Ouyang, Xiang Xu and Huan Xi | |
| #1068 | Adaptive Event-triggered Tracking Control for a Class of Uncertain Nonlinear Systems | .093 |
| | | |
| | Wei Sun and Yuanwen Xing | |

SS06 Intelligent Control and Applications

9/2 (WA-8) 【IB-506】 16:00-17:30

Chairmen: Prof. Wen-Shyong Yu and Prof. Ching-Hung Lee

Virtual conference: Virtual conference software: Teams

| | | |
|-------|---|------|
| #1100 | Trajectory Tracking for a Two-Wheels Car Using Fuzzy Adaptive Balance Control | .094 |
| | | |
| | Wen-Shyong Yu and Jin-Liang Kuo | |
| #1122 | The Fixed-Point Implementations for Recurrent Neural Networks | .095 |
| | | |
| | Hsien-Ju Ko, Hao-Cheng Yang, Yuan-Bin Wang and Han He | |
| #1044 | Intelligent Harvesting System for Cherry Tomato | .096 |
| | | |
| | Wei-yuan Lien, Chun-Ta Chen, Chuang-Hung Jung, You-Fu Chiang, Yu-Cheng Wu and Tse-Min Lee | |
| #1056 | Application of a Wearable Lower-Limbed Assistance Robot on Sit-to-Stand Movement | .097 |
| | | |
| | Yu-Cheng Wu, Chun-Ta Chen, Wei-Yuan Lien, Tse-Min Lee, Huang Chen-En, Po-Hsiang Tsai, Mao-Chun Chang and Chi-Shiuan Lee | |
| #1105 | Formation Control of Multi-Agent Systems with Multiple Structures | .097 |
| | | |
| | Shun-Hung Tsai, Yu-Wen Chen, Ming-Li Chiang and Ying-Jen Chen | |
| #1152 | Mining High Fuzzy Average-Utility Itemsets | .098 |
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| | Tzung-Pei Hong, Meng-Ping Ku, Wei Ming Huang, Shu-Min Li and Chun-Wei Lin | |

Poster Session (II)

9/2: 16:00-17:30

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| #1010 | A Fuzzy C-Means Clustering Algorithm base on Spatial Context Model for Image Segmentation | .100 |
| | Tianyu Zhao, Jindong Xu and Guozheng Feng | |
| #1139 | A Social Media Analytical Framework Incorporating Fuzzy Regression for Affective Design | .101 |
| | Pratima Jain and Kit Yan Chan | |
| #1142 | Fast Finite-time Adaptive Event-triggered Tracking for Planar Nonlinear Systems | .101 |
| | Chao Zhou and Zong-Yao Sun | |
| #1143 | Evaluation of Intelligent Vehicle Safety Based on AHP and Fuzzy Comprehensive Evaluation | .102 |
| | Xiuru Chen, Hong Mo, Cang Zhou and Fan Le | |
| #1145 | An Unsupervised Multi-scale Micro-crack Segmentation Scheme for Multicrystalline Solar Cells | .102 |
| | Weijing Dou, Shuo Shan, Nawei Zhang, Jinxia Zhang, Kanjian Zhang and Haikun Wei | |
| #1146 | Event-Triggered Synchronization for Memristor-Based Neural Networks | .103 |
| | Jianbin Qiu, Hao Zhang, Tong Wang and Qingshuang Zeng | |
| #1147 | Nonlinearities Output-Feedback Adaptive Nonsingular Fast Terminal Sliding Mode Control for Redundant Parallel Manipulators | .103 |
| | Truong Van Nguyen, Shun-Feng Su, Thien Van Nguyen and Thuan Xuan Nguyen | |
| #1176 | Adaptive Weighted Image Fusion Algorithm based on NSCT Multi-scale Decomposition | .104 |
| | Jia Liu, Miyi Duan, Wen-Bai Chen and Haobin Shi | |
| #1109 | Trajectory Outlier Detection Algorithm Based on VAE-LSTM Model | .104 |
| | Jiliang Chang and Lei Xie | |
| #1040 | Nonlinear output feedback control of double-pendulum ship-mounted cranes with amplitude saturation and gravitational compensation | .105 |
| | Ning Sun | |
| SS04: | | |
| #1059 | Research of Wireless Sensor Network Positioning | .105 |
| | Chien-Wu Lan and Wei-Ting Jian | |
| #1060 | Re-orientation Planning based on Semantic Segmentation Keypoint Detection | .106 |
| | Liyu Yeh, Yu-Cheng Lai, Shao-Yu Chien, Ching-Chang Wong, Chih-Cheng Liu and Chi-Yi Tsai | |
| #1104 | Strategy Design in Archery Behavior of Humanoid Robot Based Hough Transformation | .106 |
| | YIQING Liao, Chih-Cheng Liu, Li-Hsiang Chou and Yu Ying Liu | |
| #1107 | Implementation of Dynamic Obstacle Avoidance for Mobile Robot Based on Gazebo Simulator | .107 |
| | Yu-Ming Kang, Li-Hsiang Chou, Shih-An Li, Yun Chien Chen and Chih-Cheng Liu | |

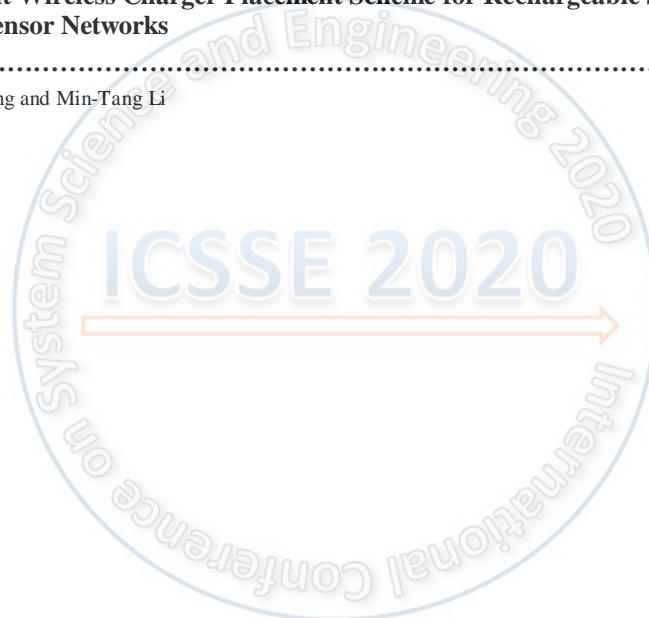
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|-------|--|------|
| #1115 | Design and Implementation of Two-Wheeled Self-Balancing Vehicle Based on Load Sensor | .108 |
| | Shao-Yu Chien, An-Sung Wang and Ching-Chang Wong | |
| #1171 | Design of Distributed Cloud Computing System | .108 |
| | Chin-Wang Tao, Rui-Qian Chang, Chia-Wen Chang and Sheng Kai Lin | |
| #1136 | Online Health Estimator of Hybrid Energy Storage System Based on Fuzzy Brain Emotional Learning Neural Network | .109 |
| | Zhifan Xu, Qiongbin Lin and Chih-Min Lin | |
| #1151 | Perception and Recognition of Underwater Cable Based on Deep Learning | .109 |
| | Zhenyi Bi, Yu-Long Wang and Lang Ma | |
| #1100 | Finger Motion Identification Based on Wrist EMG Analysis Using Machine Learning | .110 |
| | Kazuki Nagatomo, Fukumi Minoru, Momoyo Ito and Shin-ichi Ito | |
| #1013 | Aperiodic Sampled-data Controller Design of Stochastic Markovian Jump Neural Networks With Time-Varying Delay | .110 |
| | Guoliang Chen, Te Yang and Jianwei Xia | |
| #1019 | Admissibility Analysis and Stabilization for Degenerate Jump Systems with Distributed Delay and Discrete State Dela | .111 |
| | Guowei Zhao, Kun Ma, Guangming Zhuang, Wei Sun, Yuqian Lin and Jie Wang | |
| #1038 | Adaptive Fuzzy Finite-Time Fault-Tolerant Control for Uncertain Non-strict Feedback Nonlinear Systems | .111 |
| | Yanli Fan and Yongming Li | |
| #1074 | Consensus Output Regulation of a Class of Nonlinear Multi-agent Systems with Unknown Control Directions | .112 |
| | Chunling Wei, Shaoning Liu, Qiangde Wang and Zhengqiang Zhang | |
| #1075 | An LQG Optimal Linear Controller for Fin Stabilizer System of Marine Vessels | .113 |
| | Duy Quang Nguyen, Tieshan Li, Renhai Yu, Qihe Shan, Yue Wu and Jun Ning | |
| #1076 | Course Control of Unmanned Sailboat Based on BAS-PID Algorithm | .114 |
| | Lin Zhou, Kai Chen, Zhen Chen, Hang Dong and Qing Dong Song | |
| #1160 | Quasi-Synchronization of Coupled Reaction-Diffusion Neural Networks via Time-Space Sampled-Data Control | .114 |
| | Xingru Li and Xiaona Song | |
| #1108 | A Smart Face Recognition System for Companion Robot | .115 |
| | Kuo-Ho Su, Jui-Chen Wu and Te-Cheng Sung | |

Poster Session (III)

9/3: 10:00-11:30

SS02, SS03:

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| #1071 | Simple iOS Electronic Signature System | .116 |
| | Chen-Chia Chuang, Yu-Yun Tsai and Jin-Tsong Jeng | |
| #1083 | A Feature Selection Approach for People Trend Analysis | .117 |
| | Chih-Ching Hsiao, Jin-Tsong Jeng and Chen-Chia Chuang | |
| #1096 | An Online Fuzzy Control System for Parallel Manipulators | .117 |
| | Hsu-Chih Huang, Sendren Sheng-Dong Xu, Chien-Ming Chen and Jing-Jun Xu | |
| #1159 | An Intelligent Delta Robot for Maze Solving using Deep Q-Learning | .118 |
| | Li-Cheng Jin, Chun-Wen Wang, Xin-Chen Shen, I-Hsum Li and Lian-Wang Lee | |
| #1132 | An Efficient Wireless Charger Placement Scheme for Rechargeable Sensing Devices in Wireless Sensor Networks | .118 |
| | Jau-Yang Chang and Min-Tang Li | |



Abstracts of Contributed Papers

ICSSE 2020 Best Student Paper Award Competition

9/1 (TA-1) 【IB-505】 13:00-15:40

Chairman: Prof. Tzoo-Hseng S. Li

Co-Chairmen: Prof. Jih-Gau Juang and Prof. Pei-Jun Lee

Oral & Virtual conference: Virtual conference software: Zoom

- #1067 **Observer-based Sampled-Data Adaptive Fuzzy Output Feedback Control for MIMO Pure-Feedback Nonlinear Systems**
Kunting Yu and Yongming Li
- #1085 **A Descriptor System approach for Polynomial Fuzzy-Model-Based Control Design**
Fan-Nong Yu, Ying-Jen Chen, Kazuo Tanaka, Motoyasu Tanaka and Shun-Hung Tsai
- #1106 **Contour Based Region of Interest Selection for Remote Photoplethysmography Signals**
Chao-Yue Zeng, Po-Wei Huang and Bing-Fei Wu
- #1140 **Fixed-time Trajectory Tracking Control of an Unmanned Surface Vehicle**
Renhui Wang, Haoyuan Xue, Zhongkun Li, He Li, Ning Wang and Hong Zhao
- #1163 **Fast and Robust Underwater Obstacle Detection in Acoustic Vision**
Hengrui Liu, Deshan Chen, Di Zhang and Peng Zhou
- #1165 **Face Expression and Tone of Voice for Deception System**
Li-Wei Hsiao, Jing-Ming Guo, Gi-Luen Huang, Yi-Fang Hsieh,
Chih-Hsien Hsia and Herleeyandi Markoni

Observer-based Sampled-data Adaptive Fuzzy Output Feedback Control for MIMO Pure-feedback Nonlinear Systems

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Abstract—This paper has proposed an observer-based sampled-data adaptive fuzzy output feedback control strategy for a class of multiple-input-multiple-output (MIMO) purefeedback nonlinear systems. The MIMO pure-feedback nonlinear is connected by the unknown function in the subsystems, the states of the controlled plant have not to available for controller design. Fuzzy logical systems are employed to approximate the unknown nonlinear functions, and the immeasurable states are estimated by designing a sampled-data fuzzy state observer. Based on the theory of Lyapunov, a novel sampled-data adaptive fuzzy output feedback backstepping controller has been investigated. The proposed virtual control signals and sampled-data controller are only composed of the sampled-data, and they can make that all signals in the non-strict feedback nonlinear systems are semi-globally uniformly ultimately bounded (SGUUB).

Keywords: Adaptive fuzzy control, backstepping, sampled-data control, output-feedback control, MIMO pure-feedback systems.

A Descriptor System Approach for Polynomial Fuzzy-model-based Control Design

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Abstract—This paper proposes a descriptor system approach for polynomial fuzzy-model-based control design. The closedloop polynomial fuzzy-model-based (FMB) control system is expressed in descriptor form. With considering the operation domain, a semi-global stabilization criterion represented in terms of sum-of-squares (SOS) constraints is proposed. This paper provides two examples in which one example is to make a comparison with the existing polynomial FMB control design approach, and the other example verifies the applicability of this proposed control design method.

Keywords: Fuzzy descriptor system, polynomial fuzzy model, operation domain.

Contour Based Region of Interest Selection for Remote Photoplethysmography Signals

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Abstract—In the presence of motional artifacts (MA) and nonuniform lighting scenario, most remote photoplethysmography (rPPG) methods focus on signal extraction to eliminate the noises. However, the noises induced from the region of interest (ROI) are related rarely discussed. Hence, this article mainly discusses the selection method of ROI, especially in the nonuniform lighting and motional scenarios. Instead of measuring signal quality from human, two ideal experiments based on emulator are proposed to explore the impact of different ROIs under motional artifacts and non-uniform surfaces. During the experiments, a pseudo head was utilized as a subject and the pseudo rPPG signals were generated via a led of emulator. Based on the controlled environment, the human factors are eliminated and the relationship between ROI and signal quality can be unveiled, modelled, and verified. Based on the experiments, a contour ROI is proposed to improve signal to noise ratio (SNR) under motion artifacts and non-uniform lighting scenery. Two sets of public databases, PURE and UBFC, are used to verify the proposed method. Comparing with traditional ROI selection methods, the proposed method can attain better SNR in non-uniform environments.

Keywords: Heart rate, remote photoplethysmography (rPPG), blood volume pulse (BVP).

Fixed-time Trajectory Tracking Control of an Unmanned Surface Vehicle

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Abstract—In this paper, trajectory tracking control problem of an unmanned surface vehicle (USV) suffering from complex environmental disturbances is solved by designing a fixed-time trajectory tracking controller (FTTC), in which the finite-time exact disturbance observer (FEDO) and fixed-time fast sliding mode (FFSM) controller are devised. The excellent features of FTTC strategy are as follows. On the one hand, by combining terminal sliding mode technology with fixed-time theory, the FFSM controller is designed for achieving stable trajectory tracking within a fixed time. In particular, the fixed time is explicitly given irrelevant to system initial states. On the other hand, the FEDO is deployed to rapidly estimate disturbances arisen from complex environments. Finally, both feasibility and superiority of the proposed FTTC scheme are demonstrated by numerical simulations and comparisons.

Keywords: Fixed-time trajectory tracking control, finite-time exact disturbance observer, fixed-time fast sliding mode, unmanned surface vehicle.

Fast and Robust Underwater Obstacle Detection in Acoustic Vision

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Abstract—Sonar is a vital instrument for underwater detection. BlueView (BV) as an acoustic vision sensor is subject to structural noise during detection. This phenomenon has a negative impact on the detection and image restoration of sonar. In this paper, we propose an improved Bayes estimation method for acoustic vision object detection in the BV forward looking sonar images. The method is based on Gaussian mixture model and to represent background prior probability model for each pixel. The conditional probability model construction via an improved sigmoid model. As verified experimentally, the proposed method shows a fast yet robust result.

Keywords: Structural noise, underwater obstacles, robust detection, information fusion.

Face Expression and Tone of Voice for Deception System

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Abstract—Recently, the deception detection has been a new topic in biometrics. According to criminal psychology, there are many useful cues on human face and tone of voice, and we use these clues for deception detection. In this work, we propose a new deceptive system that combines 68 facial landmarks displacement, action unit (AU), and audio emotion unit (EU). It uses the clues proposed by criminal psychology to determine the facial expression changes in sequential frames and analyze the emotion changes with audio. Found that facial tensor may be a powerful feature for deception that use 68 facial landmarks to calculate the point changes between sequential frames. Finally, we use the public deceptive dataset, Real-life, Bag-of-lies and private dataset MSPL-YTD to verify our system. Overall, the proposed method is a good candidate for intelligent deception detection.

Keywords: Facial landmark, Action unit, Emotion unit, Speech recognition, Deception detection.

SI of IJFS (I)

9/1 (TA-2) 【IB-506】 13:00-15:40

Chairman: Prof. Jin-Tsong Jeng

Virtual conference: Virtual conference software: Zoom

- #1119 **The Normal T-spherical Fuzzy Taxonomy Method for Multiple Attribute Decision-making Problems**
Peide Liu and Dongyang Wang
- #1080 **Observer-Based Adaptive Fuzzy Prescribed Performance Control for Intelligent Ship Autopilot**
liyan zhu, Tieshan Li and Yue Wu
- #1011 **Morphological Reconstruction based Improved Fuzzy C-means Clustering Algorithm with Guided Filter for Image Segmentation**
Guangmei Xu, Jin Zhou, Jiwen Dong, Hui Jiang, Dong Wang, Lin Wang, Shiyuan Han and Yuehui Chen
- #1021 **A General Transfer Learning based Gaussian Mixture Model for Clustering**
Rongrong Wang, Jin Zhou, Hui Jiang, Shiyuan Han, Lin Wang, Dong Wang and Yuehui Chen
- #1149 **Fuzzy Control under Time-varying Universe and Phase Optimization in Traffic Lights**
Cang Zhou, Hong Mo, Xiuru Chen and Huan Wen
- #1167 **A PROMTHEE II Approach Based on Probabilistic Hesitant Fuzzy Linguistic Information with Applications to Multi-Criteria Group Decision Making**
Lu Chen, Haiyan Xu and Ginger Y. Ke
- #1094 **Continuous Attractors of Fuzzy Coupled Recurrent Neural Networks**
Zhixin Pang, Jiali Yu, Jinsong Leng, Chunxiao Wang and Bisen Liu

The Normal T-spherical Fuzzy Taxonomy Method for Multiple Attribute Decision-making Problems

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Abstract—In this paper, the normal T-spherical fuzzy numbers and their operational laws, score function, accuracy function, expectation as well as distance measure are proposed. To deal with multiple attribute decision-making problems with normal T-spherical fuzzy information and unknown attribute weights, we use the best worst method to obtain the subjective weights, use the criteria importance through inter-criteria correlation method to obtain the objective weights, and use the minimum total deviation approach to determine the combination weights. Then, the normal T-spherical fuzzy Taxonomy method is proposed.

Keywords: Multiple attribute decision-making (MADM), normal T-spherical fuzzy numbers (NT-SFNs), Taxonomy method, combination weights.

Observer-based Adaptive Fuzzy Prescribed Performance Control for Intelligent Ship Autopilot

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Abstract—In this paper, the design problem of intelligent ship autopilot with unmeasured yaw rate is investigated based on adaptive fuzzy control. By employing the fuzzy logic system (FLS) to estimate the unknown nonlinear function, an adaptive fuzzy state observer is designed to estimate the unmeasured state. To meet the specified performance constraints, the error transformed method is introduced. Combining a state observer model with backstepping method, an adaptive fuzzy output feedback control scheme is constructed. The proposed control scheme can reduce the conservativeness and the complexity of controller. Based on the Lyapunov theory, it is proved that all the signals in the closed-loop systems are bounded. Finally, the simulation results are verified to demonstrate the effectiveness of the proposed scheme.

Keywords: Autopilot, state observer, fuzzy logic system, prescribed performance.

Morphological Reconstruction Based Improved Fuzzy C-means Clustering Algorithm with Guided Filter for Image Segmentation

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Abstract—The guided filter is a novel explicit image filtering method, which implements smoothing filter on flat patch regions and ensures edge preserving on high variance regions. Recently, the guided filter is incorporated into the process of fuzzy c-means clustering to improve the performance on noise image segmentation. However, in existing application, the parameter of the guided filter is set to a fixed value, which weakens the ability of the guided filter adapting to different images. In this paper, we propose a guided filter based fuzzy c-means method with an influence factor (IFCM_GF), in which the guidance image of the guided filter is adjusted by the influence factor. By adjusting the value of the influence factor, the IFCM_GF achieves good performance on different noisy images. To improve the segmentation accuracy of heavy noise image and simplify the selection of the influence factor, we further propose a morphological reconstruction based improved fuzzy c-means clustering algorithm with guided filter (MRIFCM_GF). In this method, the original noisy image is reconstructed by the morphological reconstruction (MR) before clustering, and the IFCM_GF is performed on the reconstructed image with the guidance of the original noisy image. Due to the efficiency of the MR to remove noise, the MRIFCM_GF achieves better segmentation results than the IFCM_GF on heavy noisy images, and the selection of the influence factor for the MRIFCM_GF is simple. Experiments on synthetic images and Brain images show the superiority and effectiveness of the proposed methods.

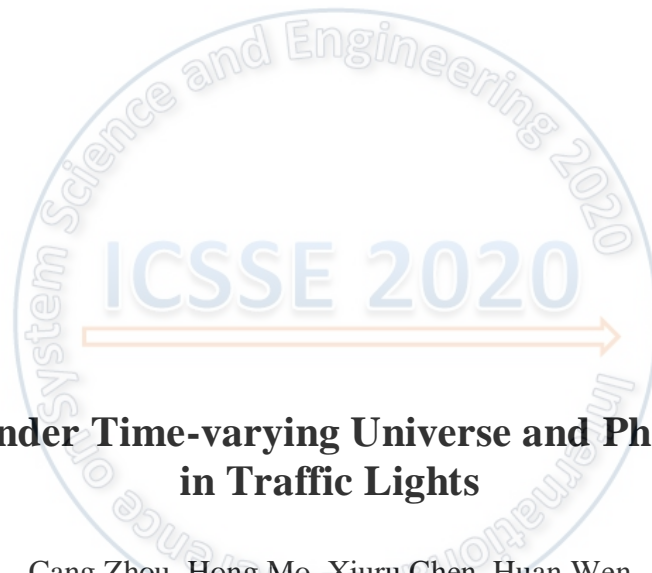
Keywords: Image segmentation, fuzzy c-means, guided filter, influence factor, morphological reconstruction.

A General Transfer Learning Based Gaussian Mixture Model for Clustering

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Abstract—Gaussian mixture model is a helpful method for data mining. However, when the data is scarce, the traditional clustering algorithm based on Gaussian mixture model is not effective anymore. To solve this issue, this paper presents a general transfer clustering method based on Gaussian mixture model, which utilizes the information of the data in the source domain to impact to cluster the data of the target domain. Experiments on synthetic datasets demonstrate the efficiency of the proposed method compared with several state-of-the-art transfer clustering algorithms.

Keywords: Transfer learning, Gaussian mixture model, data clustering.



Fuzzy Control under Time-varying Universe and Phase Optimization in Traffic Lights

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Abstract—As the pace of life accelerates, people are troubled by spending too much time on commuting, and people's waiting time for travel can be reduced by reasonable strategy of traffic control. The previous research on traffic control mainly focuses on timing and ignores the study of phase. For asymmetric or small traffic flow, the commonly timing project based on single-loop phase structure cannot achieve optimal control. Therefore, this paper proposed a fuzzy control method of traffic light under time-varying universe and the phase structure have been optimized. For asymmetric traffic flow, the phase structure is optimized by adding additional phases to form a double-loop phase structure. In slack hour, the phase structure is optimized by merging phase. Taking an intersection in Jing-Hong city as an example, the feasibility of the method is verified. The results show that the delay of vehicles can be reduced and the traffic capacity of the intersection can be improved by this method.

Keywords: Fuzzy control, time-varying universes, asymmetric traffic flow, phase optimization, phase merger.

A PROMTHEE II Approach Based on Probabilistic Hesitant Fuzzy Linguistic Information with Applications to Multi-criteria Group Decision Making

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Abstract—Complex multi-criterion group decision making (MCGDM) problems are very common in the real world. In order to better solve the MCGDM problems, it is necessary to propose a method that is more in line with the decision-making habits of decision makers. This paper proposed the integrated linguistic information, Probabilistic Hesitant Fuzzy Linguistic Sets (PHFLSs), which combines the Hesitant Fuzzy Linguistic Sets and Probabilistic Linguistic Term Sets for solving the multi-criterion group decision making problem. Firstly, in order to calculate the distance of different PHFLSs, we extended the Hausdorff distance into PHFLSs. Secondly, since the PROMETHEE II method is a decision-making method based on the optimal order relationship of pair-wise comparison schemes, it can reasonably avoid information deviations in data processing, and fully considers the objective facts of the preference of decision makers, so we combine the PROMETHEE II method and the proposed PHFLSs method to solve the MCGDM problem and choose the best one.

Keywords: Probabilistic Hesitant Fuzzy Linguistic Term Sets, PROMETHEE II, Hausdorff distance, multi-criterion group decision making.



Continuous Attractors of Fuzzy Coupled Recurrent Neural Networks

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Abstract—Abstract—In this paper, we mainly study the continuous attractors of Takagi-Sugeno (T-S) systems formed by coupling different nonlinear networks. Conditions for the global coupled system to have continuous attractor are obtained.

Keywords: Continuous attractor, coupled neural networks, T-S fuzzy systems.

SS10 Intelligent Learning in Control Systems

9/1 (TA-3) 【IB-507】 13:00-14:15

Chairman: Prof. Kao-Shing Hwang

Oral conference

- #1054 **Object Proximity Sensing based on 3D Point Cloud Segmentation**
Kao-Shing Hwang, Jin-Ling Lin and Wei-Cheng Jiang
- #1127 **TPSO-based Tracking Control of a Mobile Robot Using T-S Fuzzy Systems**
Gwo-Ruey Yu and Wei-Yi Wang
- #1133 **A Banknotes Recognition System Based on Yolact**
Kuan-Ting Chen, Wen-June Wang, Hsiang-Chieh Chen and Chen, Yi-Chieh Cai
- #1134 **An Intelligent 6-DOF Robotic Arm for Tracking and Facing Human's Forehead with a Fixed Distance**
Bo-Yi Li, Wen-June Wang, Hsiang-Chieh Chen and Wei-Kai Wang
- #1141 **Artificial Intelligence Visual Surveillance for Autonomous Farm Management**
Leel Vinod and Jin Tsong Jeng
- #1113 **Polyphase Watt-Hour Measurement Methods Based on Back Propagation Neural Network**
Chun-Liang Lu and Yong-Lin Kuo

Object Proximity Sensing Based on 3D Point Cloud Segmentation

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Abstract—This paper aims to develop a third-party proximity sensing system that detects whether an object is about to collide through external observation. This paper uses different 3D depth sensors to obtain point cloud information in a fixed range, from which the target point cloud of any shape target that is used to separate from the background point cloud, and then the point cloud in the space is detected. And according to the change of the point cloud, the system will give a corresponding collision warning. In experimental section, the proposed system is implemented using a variety of different shapes to verify the feasibility, so that the system can be used for proximity sensing of any shape target.

Keywords: 3D depth sensor, point cloud, minimum cut segmentation algorithm, octree, neighbors within radius search.

TPSO-based Tracking Control of a Mobile Robot Using T-S Fuzzy Systems

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Abstract—Path tracking of the mobile robot has been a significant theme recently. The control system of the mobile robot is nonlinear and nonholonomic. It is laborious to control the mobile robot using customary approaches. The T-S fuzzy model can approximate the nonlinear robot system and the control gains can be acquired by using the linear matrix inequality-based stability conditions which guarantee the robot is stable. However, this contriving launches many parameters which are hard to be determined for the optimal controller design. Thus, this paper proposes the Taguchi particle swarm optimization (TPSO) to design the optimal T-S fuzzy controller. Computer simulation shows the proposed TPSO approach is better than the existing LMI-based fuzzy control method.

Keywords: Mobile robot, T-S fuzzy systems, Taguchi particle swarm optimization.

A Banknotes Recognition System Based on Yolact

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Abstract—This study establishes an NTD (New Taiwan Dollar) banknotes recognition system for helping visually impaired people to shop. We designed an App for a smart phone which can perform the banknotes recognition from a photo taken by the camera of the smart phone. The open source You Only Look At CoefficientTs (Yolact) network is trained and its output is the features of banknotes in the photo. Based on the features recognized by Yolact, we also propose two algorithms to determine the number of each denomination banknote and the relative position of each banknote in the photo, respectively. This recognition system can recognize a single banknote or multiple banknotes even there is highly overlapping on the multiple banknotes. The experiment shows that there is almost 85% correctness rate by Sony Xperia Z4 smartphone.

Keywords: Image processing, banknotes recognition, deep learning.

An Intelligent 6-DOF Robotic Arm for Tracking and Facing Human's Forehead with a Fixed Distance

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Abstract—Nowadays, most people usually lie on the bed to use smartphone or tablet. In general, they may use a phone holder to hold the smartphone or tablet. However, the phone holder is fixed once we finish the adjustment. If the user changes posture, he/she must adjust the holder again to face the user's eyes. There is a webcam installed on the end of the robotic arm. This study is to develop a control trajectory based on the forward and inverse kinematics for a 6-DOF robotic arm such that the end of the robotic arm can always face the user's forehead with fixed distance automatically even the user changes the orientation of his/her face with limit angle. From the experiment, the robotic arm can automatically track human face in a fixed distance.

Keywords: Face detection, feature recognition, robotic arm, face tracking.



Artificial Intelligence Visual Surveillance for Autonomous Farm Management

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Abstract—This paper has implemented artificial intelligence visual surveillance to monitor various objects and their behaviors. The objectives covered in this paper are object detection, object tracking, direction detection and distance estimation to autonomously monitor farms. This paper also discusses on implementation on Nvidia Jetson AGX Xavier and Nvidia RTX 2080Ti with IP-based surveillance system to improve the efficiency of autonomous farm management.

Keywords: Artificial intelligence, farm management, surveillance, object tracking, distance estimation.

Polyphase Watt-hour Measurement Methods Based on Back Propagation Neural Network

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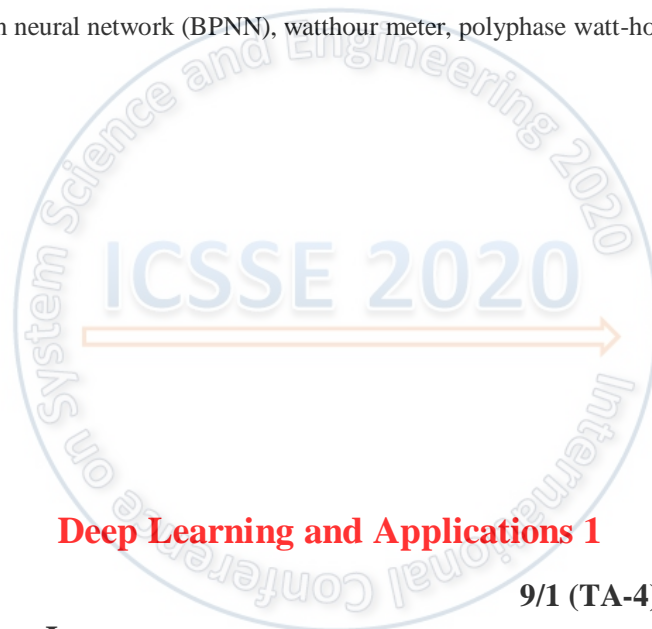
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Abstract—This paper proposes watt-hour measurement methods based on the back propagation neural network, and the watt-hour measurement accuracy is verified, where the measurement analysis in terms of its sensitivity is performed for the input data sets. Besides, the accuracy of the method is a function of the training data sets and multiple model parameters. The analysis is based on measurement method activities carried out by a real watt-hour accuracy measurement system validated by polyphase meters.

Keywords: Back propagation neural network (BPNN), watt-hour meter, polyphase watt-hour measurement.



Deep Learning and Applications 1

9/1 (TA-4) 【IB-507】 14:20-15:50

Chairman: Prof. Jih-Gau Juang

Oral conference

- #1057 **Deep Learning and Object Identification for Hexacopter Application**
Sheng-I Chang and Jih-Gau Juang
- #1058 **Real-time Path Planning and Fuzzy Based Obstacle Avoidance for UAV Application**
Tsung-Hsien Huang and Jih-Gau Juang
- #1126 **Navigation Application of Q-learning Neural Network**
Ying-Hao Chen, Wei-Cun Chen and Chian-Song Chiu
- #1161 **A Signal Fusion-based ANN Algorithm for Fault Diagnosis of Rotating Machinery**
Yennun Huang, Shang-Chih Lin, Chia-Wei Jen and Shun-Feng Su
- #1174 **Loading Optimization of Chiller Systems Using Deep Learning Method**
Kuang-Yow Lian, Yong-Jie Hong, Zhe-Wel Zhang, Yu-Wei Su and Kebba Jaiteh
- #1112 **Study of Metal 3D Printing-Assisted Pelvic Fracture Surgery**
Jia-En Chen, Tsu-Te Yeh, Sendren Sheng-Dong Xu, Yuan-Ta Li, Ching-Cheng Hsiao, Chin-Chieh Yi and Rui-Hong Wu

Deep Learning and Object Identification for Hexacopter Application

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Abstract—This study proposes a drone application in the net cage breeding industry. The main target is to obtain information of water environment which surrounds the net cages. In the object identification, deep learning neural network is applied to identify the net cages. Actual horizontal distance between the drone and the net cage is calculated by an onboard processor. This study integrates a drone, camera, Jetson TX2 board, pixhawk flight control board, servo motor, and GPS auto-cruise function to adjust the drone position, and control the servo motor retractable sensor to reach the desired target at an accurate location. The purpose of the study is to achieve assistance of net cage aquaculture.

Keywords: Image processing, deep learning neural network, object identification, net cage aquaculture, UAV.

Real-time Path Planning and Fuzzy Based Obstacle Avoidance for UAV Application

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Abstract—Unmanned aerial vehicles (UAVs) provide a wide range of application in recently. To autonomously complete the task safely and successfully, path planning and obstacle avoidance is an essential part in an operation. In this study, we implement a path planning algorithm combined with a fuzzy based obstacle avoidance system on an UAV. For global path planning, we utilize D* Lite algorithm to find the path between waypoints first. As for the local obstacle avoidance system, the information of obstacles is given by RealSense camera and ultrasonic sensors. Fuzzy set theory is applied to real-time navigation by sending control signal to the flight control board.

Keywords: Fuzzy set, path planning, obstacle avoidance, UAVs, RealSense camera.

Navigation Application of Q-learning Neural Network

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Abstract—Traditional navigation application has a problem with adaption for changing environment and time complexity. Reinforcement learning gives a better solution for time complexity. Taking Q-learning for example, thought Qvalue(score) for every state, Q-learning can choose action instantly, but it should take lots of memory to save Q-table (table for saving Q-value). Neural network is always a good idea to save memory and adapt in every kind of environment. By integrating the above concept, we finally use Deep Q-learning neural network (DQN) to do path planning and give a method to score the action and environment for make the choice of action.

Keywords—Navigation, neural network, Q-learning, DQN.

A Signal Fusion-based ANN Algorithm for Fault Diagnosis of Rotating Machinery

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Abstract—This research aims to propose a signal fusion based artificial neural network algorithm for fault diagnosis of rotating machinery. Firstly, the fused signal becomes the running track, and then it is scaled up to grasp the subtle features. However, after calculating the weights, the characteristic distribution of each operating state is obtained. In this way, the fused signal has more prominent characteristics. The experimental results show that pattern recognition networks and feedforward networks have relatively stable and excellent performance. In different cases, the accuracy is maintained at 94~100 %, and the calculation cost is 1~25 seconds. In future research, more system parameters and optimization of the algorithm are considered. It is expected that the robustness of the algorithm will be improved.

Keywords—rotating machinery, signal fusion, artificial neural network, fault diagnosis.

Loading Optimization of Chiller Systems Using Deep Learning Method

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Abstract—This paper proposes a novel optimal chiller loading network (OCLN) to solve the loading management problem for multiple chillers with different efficiency. The OCLN is composed of a generative adversarial network (GAN) and deep neural network (DNN). Most works on the optimal chiller loading (OCL) problem is to find out the setting of partial load rate (PLR) for each chiller. However, it is worthwhile to notice that PLR for each chiller cannot be controlled directly, and can only be achieved through setting chiller water supply temperature, which is also affected by environmental parameters like, enthalpy, humidity, and air temperature. In this work, GAN is employed to take these parameters as inputs to find the best load distribution which is used as inputs by DNN to produce the power consumption models and control instructions to achieve the desired energy saving. According to experiments, the power consumption model established by GAN and DNN driven by big data is better than the model established by typical regression methods.

Keywords: Optimal chiller loading, generative adversarial network, deep neural network, optimization.

Study of Metal 3D Printing-assisted Pelvic Fracture Surgery

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Abstract—In this research, we hope that we can conduct research on the production of titanium metal 3D printing equipment and directly generate customized metal steel plates. We explore the feasibility of future metal 3D printing in clinical surgery applications through automated steel plate production. Moreover, we combine metal 3D printing technology with automated steel plate generation technology to achieve customized metal steel plate generation. In the process of metal 3D printing assisted pelvic surgery, the physician will directly plan and analyze the steel plate on the computer and instantly generate the steel plate used for the operation through the metal printing equipment, which can provide patients with more customized services. With the discussed methods in the operation, complete planning and evaluation can be carried out to improve the quality of medical treatment.

Keywords: Metal 3D printing, patient-specific implant, pelvic fracture surgery.

WS04 Smart Manufacturing/Industry 4.0 Systems**9/1 (TA-5) 【IB-505】 16:00-17:30****Chairman: Prof. Ching-Chih Tsai****Oral conference**

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| | Chia-Feng Juang, Ching-Yu Chou and Yuan-Sue Yang | |
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Intelligent PID Injection Speed and Pressure Control Using ORBLS for Hydraulic Plunger Machine in Semiconductor

Die Packaging Yu-Ruy Cheng, Ching-Chih Tsai, Chun-Chieh Chan, Guo-Shun Hung
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Abstract—This paper presents one adaptive predictive proportional-integral-derivative (PID) control using output recurrent fuzzy broad learning system (ORBLS) for speed and pressure control of a compound plunger in the transfer molding machine in semiconductor die packaging machines. The proposed controller, abbreviated as ORBLS-APPID, is composed of an online ORBLS identifier for on-line parameter tuning and estimation, and an adaptive predictive PID control for accurate setpoint tracking and disturbance rejection. The performance and merit of the proposed ORBLS-APPID control method are well exemplified by conducting simulations on speed and pressure control of a real compound plunger, thus clearly showing its effectiveness.

Keywords: Adaptive PID, compound plunger, intelligent adaptive control, transfer mold module, semiconductor die packaging, output recurrent broad learning system (ORBLS).

Map-Free Path Planning of a Fuzzy-controlled Mobile Robot in Unknown Environments

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Abstract—This paper proposes a map-free path planning scheme to navigate a fuzzy controlled mobile robot in unknown environments. In this scheme, the robot online determines its local path by executing either the behavior of bypassing obstacles (BO) or reaching a target (RT). In the BO behavior, the robot executes either convex point seeking (CPS) sub-behavior or obstacle boundary following (OBF) sub-behavior. In the CPS sub-behavior, the robot moves towards the convex point of an obstacle to shorten its traveling route. The robot is controlled by a fuzzy or fuzzy PID controller to perform the BO or RT behavior, respectively. An experiment of navigating a real robot in an unknown environment is performed to show the effectiveness and efficiency of the navigation approach.

Keywords: Fuzzy controller, robot navigation, robot path planning.

Virtual Machining System Development for Electrical Discharge Machining

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Abstract—During the process to machining a product, machining parameters have huge impacts on the quality of the product. We need to adjust to a proper parameter set to obtain a desired quality. This study introduces a virtual machining system for electrical discharge machining system by experiment design, performance index measurement, and optimization algorithm. With the advent of the artificial intelligent (AI) era, we have implement an automatic parameter tuning method with PSO algorithm to obtain a desired machining quality. The method also offers a way to choose the quality preferences under multiple performance indexes, and the result is validated on a hole drilling electric discharge machining machine.

Keywords: Virtual system, machining, EDM, optimization.

Adaptive Neural Backstepping Control for Uncertain Robotic Manipulator

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Abstract—This paper presents the design of neural network control system that inherits backstepping method in error and unknown parameter of system for an n-link robot manipulator. The update law of neural network is used adaptive control method. The neural network method not only estimated the unknown value of system but also let the system error can be converged in design of update law.

Keywords: Backstepping method, adaptive control, Neural Network.

Simulation Implementation of MPPT Design under Partial Shading Effect of PV Panels

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Abstract—Under uniform PV illuminance intensity, only one maximum power point (MPP) is generated, the traditional maximum power point tracking (MPPT) methods are easy to find this MPP. However, when a partial shading effect occurs, PV modules will generate maximum power points in many regions, and traditional MPPT methods fall into the local MPP regions easily, resulting in the energy conversion efficiency of the solar array reduces. To avoid this drawback, a hybrid method by combining the incremental conductance method and grey wolf algorithm (GWA) for a DC stand-alone PV system is proposed. MATLAB simulation results of this system were performed to demonstrate that the proposed hybrid method has achieved global MPP in the cases of the uniform sunshine intensity and the partial shading influence.

Keywords: Maximum power point tracking (MPPT), Partial shading influence, photovoltaic (PV), grey wolf algorithm (GWA).

Visual Tracking Cleaner — A Robot Implements on the Whiteboard

Hsiao-Ni Chi, Pei-Jun Lee, Chia-Ling Lo
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Abstract—This paper designs a robotic cleaner, which is combined the functions of whiteboard climber, route planning, and image processing, then controlling all the functions through the VNC Viewer. To achieve the climber, utilizing magnets and powerful motors implements in an intelligent system. Moreover, we design a unique cleaner to accomplish the purpose of interactive monitor robot—Visual Tracking Cleaner. All the above motions are implemented by Raspberry Pi 3 Model B+ and sensors.

Keywords: Robotic cleaner, planning, image processing.

ICSSE 2020 Best Paper Awards Competition

9/1 (TA-6) **【IB-508】** 15:00-17:40

Chairman: Prof. Wen-June Wang

Co-Chairmen: Prof. Chin-Wang Tao and Prof. Kuang-Yow Lian

Oral & Virtual conference: Virtual conference software: Zoom

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| | Wen-Hau Jian and Mei-Yung Chen | |
| #1064 | Facial Recognition System Design Using Deep Learning Network for Authorized Access to Autonomous Vehicles | .121 |
| | Hsin Han Chiang, Zong-Yue Deng, Wei-Yen Wang, Shih-Ting Hung and Tsu-Tian Lee | |
| #1070 | Adaptive PID-Like Control Using Fuzzy Broad Learning System for Nonlinear Dynamic Systems | .127 |
| | Hung-Sheng Chen, Ching-Chih Tsai and Feng-Chun Tai | |
| #1098 | Estimation of Domain of Attraction for Positive Polynomial Fuzzy Systems with Input Saturation using Membership-Function-Dependent Analysis and Imperfect Premise Matching Concept | .133 |
| | Meng Han, H.K. Lam, Fucai Liu, Yuandi Li and Yinggan Tang | |
| #1124 | An Experimental Comparison Study of Artificial Supercavitation Generated by Air Injection Behind Disk-shaped Cavitators and Elliptical Disk-shaped Cavitators | .139 |
| | Guangyao Chen, Shaoqiong Yang, Tongshuai Sun and Peng Lv | |
| #1172 | Intelligent Non-Invasive Vital Signs Estimation from Image Analysis | .143 |
| | Tran Quoc Viet, Shun-Feng Su, Minh-Quang Tran and Truong Vi | |

Face Transformation and Local Feature Adjustment Algorithm Based on Facial Feature Points

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Abstract—In this paper, the application of facial image transformation and local feature adjustment functions are realized through the extraction of facial feature points and image processing technology, combined with difference algorithm to achieve facial image transformation and local feature modulation. The application of the complete function. The function of real-time facial adjustment is completed. The internal algorithm of the application includes two main function axes. The first is to realize the transformation algorithm of two facial images, and the second is the algorithm to zoom in and adjust the transformed facial images. The application includes both manual search and automatic search facial feature extraction methods. The user can use the slider on the application to use the difference calculation and the weight ratio set by the user. The real-time calculation method. The second set of algorithms in order to transform the processed face into the image, perform the partial enlargement and reduction function of the eyes, nose and mouth, use the internal difference method to fix the fixed circular area to deform the image, and realize the function of partial deformation. Other users can manually select any area to deform the local area of the face according to their needs, and finally can store the image in the displacement action.

Keywords: Image processing, face feature detection, face transformation, facial features adjustment.

Facial Recognition System Design Using Deep Learning Network for Authorized Access to Autonomous Vehicles

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Abstract—Despite substantial development of facial recognition in recent years, a brand-new architecture of deep network, which is named as FaceNet and presented by Google, has revealed superior accuracy of face recognition. However, most embedded systems cannot sustain the heavy computing load for face recognition while using deep learning network such as FaceNet. Nowadays, the face recognition has widely been used in surveillance systems, and further applied to intelligent security in vehicles. As such, this paper aims to develop a lightweight neural network based on FaceNet, which is called FN8, to solve high computing load which causes the system overload. In addition, FN8 takes advantage of the center loss with softmax loss, to reduce the variations of the intra-class features, instead of the triplet loss used by FaceNet. The model is trained by FN8, it can reduce the number of parameters and maintain a high degree of accuracy. In the end of this paper, we use LFW dataset to verify FN8 and use correlation value to analyze embedding vector of FN8.

Keywords: Face recognition, deep convolution neural network, lightweight network, optimization, autonomous vehicles.

Adaptive PID-Like Control Using Fuzzy Broad Learning System for Nonlinear Dynamic Systems

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Abstract—This paper presents a new learning control structure using fuzzy broad learning system (FBL) for adaptive PID-like control of unknown digital nonlinear time-delay dynamic systems. The proposed control method, abbreviated as FBLSPIDLC, is novel in combining FBL and model predictive control to develop a new PID-like control law for high performance set point tracking control and disturbance rejection. Comparative simulations on two renowned nonlinear digital time-delay systems are well used to show the effectiveness and superiority of the proposed method by comparing to five existing methods. The proposed FBL-SPIDLC method is also shown applicable by conducting temperature control of a heating barrel in a plastic injection molding machine.

Keywords: Fuzzy broad learning system, PID-Like control, nonlinear dynamic systems, Lyapunov stability theory.

Estimation of Domain of Attraction for Positive Polynomial Fuzzy Systems with Input Saturation using Membership-function-dependent Analysis and Imperfect Premise Matching Concept

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Abstract—This paper investigates the estimation of domain of attraction (DOA) for positive polynomial fuzzy-model-based (PPFMB) systems with input saturation. Imperfect premise matching (IPC) concept is used to design the fuzzy controller and auxiliary fuzzy controller, which means that the number of rules and the shape of premise membership functions of the polynomial fuzzy controller and auxiliary polynomial fuzzy controller are allowed to be different from those of the polynomial fuzzy model. This scenario improves the design flexibility and saves the implementation costs for the fuzzy controller. The estimation of DOA of PPFMB systems is analyzed based on attractive invariant sets theory and the (sum-of-squares) SOS based analysis approach. In order to relax the analysis results, the membership functions are regarded as symbolic variables, then the information of membership functions, including the property of the membership functions, the boundary information of the membership grades and premise variables, are introduced into stability conditions by using some Positivstellensatz multipliers. Finally, a simulation example is presented to demonstrate the effectiveness of the design and analysis method.

Keywords: Positive polynomial fuzzy-model-based (PPFMB) systems, imperfect premise matching (IPC) concept, symbolic variables, domain of attraction (DOA).

An Experimental Comparison Study of Artificial Supercavitation Generated by Air Injection Behind Disk-shaped Cavitators and Elliptical Disk-shaped Cavitators

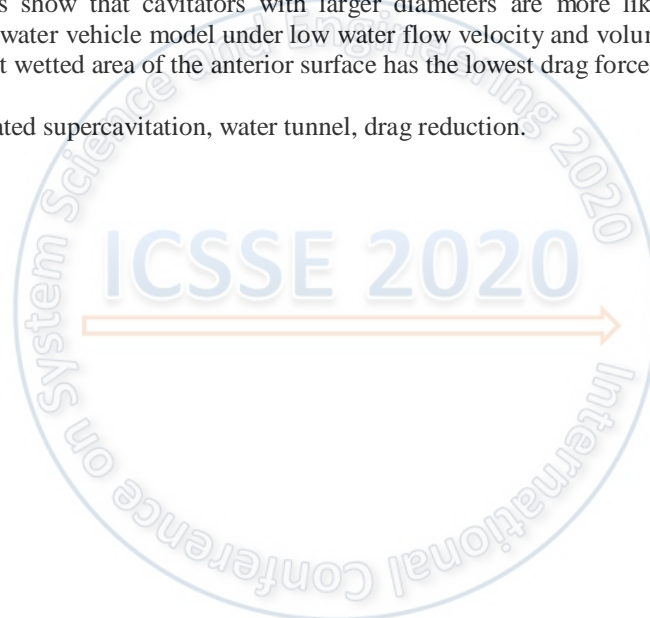
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Peng Lv

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Abstract—This paper presents an elliptical disk-shaped cavitator which is developed from a disk-shaped cavitator. The elliptical disk-shaped cavitator is specially designed for nonbody of revolution underwater vehicles. The high-speed water tunnel was used to conduct an experimental comparison on morphological characteristics of ventilated supercavity of diskshaped cavitators and elliptical disk-shaped cavitators. With controlled water flow velocity and static pressure in the water tunnel, the development process of the ventilated supercavity generated behind several different cavitators were observed. Simultaneously, the three-component strain gauge balance was used to collect transient drag data. The experiment results show that cavitators with larger diameters are more likely to form supercavity that completely enclose the underwater vehicle model under low water flow velocity and volumetric airflow rate. In addition, the cavitator with the smallest wetted area of the anterior surface has the lowest drag force.

Keywords: Cavitator, ventilated supercavitation, water tunnel, drag reduction.



Intelligent Non-invasive Vital Signs Estimation from Image Analysis

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Abstract—This study aims to build a fully intelligent noninvasive vital-sign signal detection from image analysis in terms of clinical scenarios to extract breathing rate, heart rate, and blood pressure values. The state-of-the-art object detection Yolov3 is used to localize the interesting bounding boxes (chest, face, palm), these ROIs are then tracked by the Mosse algorithm to boost the processing performance. Next, the Pyramidal Lucas-Kanade and remote photoplethysmography techniques are used for extracting the motion signals (breath, pulse) and subtle color change induced by pulse, respectively. Besides, digital signal processing is applied to remove undesired noises for obtaining a clean bio-signal. From experiments conducted, our system can detect breathing rate, heart rate in real-time at a long distance in terms of motion scenarios. Similar to the noninvasive blood pressure estimation system, the proposed deep learning model overcomes the dependence of the high speed camera in previous works. It satisfies two medical standards (British Hypertension Society and Association for the Advancement of Medical Instrumentations) in estimating Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) with the root mean squared error and mean absolute error for SBP/DBP are 7.942/7.912 mmHg and 6.556/6.372, respectively. The proposed approach estimates blood pressure reliably by only an ordinary webcam with 30 fps in a noncontact continuous manner. Thus, it can be concluded that our system can be applied to healthcare applications.

Keywords: Breath detection, heart rate, remote Photoplethysmography (rPPG), Lucas-Kanade, blood pressure, beat per minute (bpm), adaptive pulsatile plane (APP).

SI of IJFS (II)

9/1 (TA-7) 【IB-507】 15:50-16:40

Chairman: Prof. Jin-Tsong Jeng

Oral conference

- #1007 **A Wavelet K-Means Clustering and Fuzzy Based Method for Parkinson's Disease MRI Segmentation**
Kanika Bhalla, Yo-Ping Huang, Hung-Chi Chu and Si-Huei Lee
- #1168 **The Fuzzy Control Approach for a Quadruped Robot Guide Dog**
Kuo-Yi Chen and Chin-Yuan Tsui

A Wavelet K-means Clustering and Fuzzy Based Method for Parkinson's Disease MRI Segmentation

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Abstract—Early diagnosis of deadly Parkinson's diseases (PD) is important to mitigate the death cases. Magnetic resonance images (MRI) of PD consisted of gray matter, white matter and cerebrospinal fluids that provide important information for physician's diagnosis on investigating the severity from these areas. For this purpose, segmentation approach was used for the differentiation of these regions. However, it encountered difficulties in segmentation, such as (a) boundaries between gray and white matters are ambiguous in nature, and (b) regions contained inhomogeneous and unclear structures. Due to these reasons, segmentation of the PD MR images was considered as a challenging task. This study was motivated to propose a hybrid method of wavelet k-means clustering (KMC) and fuzzy median filter (FMF). First, detailed information from MRI was extracted using discrete wavelet transform (DWT) approach. Secondly, processed image was further fed to the KMC model for segmentation of the PD MRI. Thirdly, segmented image was input to the FMF for removing uncertainty and noise. Both qualitative and quantitative evaluation was presented by a dataset containing 20 MRI of PD. Statistical metrics, peak signal to noise ratio (PSNR) and mean-squared error (MSE), indicated the efficiency as compared to well-known existing segmentation methods. The analytical results can provide evidences to help early detection of PD from MRI.

Keywords—Discrete wavelet transform, fuzzy sets, k-means clustering, Parkinson's disease (PD).

The Fuzzy Control Approach for a Quadruped Robot Guide Dog

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Abstract—In order to meet the moving requirement of blinds, the trained dogs are usually to guide the blind. These dogs also as known as guide dogs. However, the number of guide dogs is much lower than actually blind requirement significantly. In order to improve this issue, the robot guide dogs are designed in this study. The quadruped design provides good movement for robot guide dogs. On the other hand, the architecture of four legs also leads to higher complexity in controlling. In this study, the fuzzy control approach is proposed to provide the better control performance for robot guide dogs than traditional approaches.

Keywords—Fuzzy control, robot dogs, bionics, quadruped robots.

ICSSE 2020
SS09 Healthcare Systems

9/1 (TA-8) 【IB-507】 16:50-17:30

Chairman: Prof. Yo-Ping Huang

Oral conference

- #1025 **Deep Reinforcement Learning Design for Collision Avoidance of Dual-Arm Robot**
Ching-Chang Wong, Hsuan-Ming Feng, Shao-Yu Chien and Hisasuki Aoyama
- #1062 **CNN-based Sound Classification Mechanism**
Hung-Chi Chu and Young-Lin Zhang
- #1089 **Visibility Stabilization Method for Vehicle Detection Under Extreme Weather Conditions**
Xiu-Zhi Chen, Chieh-Min Chang, Chao-Wei Yu and Yen-Lin Chen
- #1036 **Image-based Solar Irradiance Forecasting Using Recurrent Neural Networks**
Tsai-Ping Chu, Jian-Hua Jhou and Yih-Guang Leu

Deep Reinforcement Learning Design for Collision Avoidance of Dual-Arm Robot

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Abstract—A dual-arm robot system is designed based on Deep Reinforcement Learning (DRL) to let the robot has the self-collision avoidance ability. A collision detection based on the reinforcement learning method is proposed to train neural networks. The algorithm of Soft Actor-Critic (SAC) is applied to automatically construct two deep neural networks structure and select weights parameters at the same time. The trained neural networks control the end-effector of the arm to reach the desired position and orientation of target. A 3D dynamic Gazebo simulation environment is used to evaluate results. The powerful Soft Actor-Critic (SAC) method with the state estimation and reward actions is applied to validate the best objectives of collision avoidance.

Keywords: Dual-Arm Robot, Self-Collision Avoidance, Deep Reinforcement Learning, Soft Actor-Critic, Gazebo.

CNN-based Sound Classification Mechanism

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Abstract—In the traditional sound signal characteristics as a classification method, the accuracy of the classification results is not high because of the large amount of data and time-consuming processing, especially when the characteristics of the sound data are too similar. Therefore, this study proposes a Convolutional neural network (CNN) model in artificial intelligence to build a sound classification and prediction system. The proposed method uses the Mel-Frequency Cepstral Coefficients (MFCCs) principle to convert the sound signal into a spectrogram to meet the requirements that the input layer of the CNN model must be an image. We adjust and modify the pre-processing of input data and the parameters of the CNN model to build a sound classification system. Simulation results show that the proposed method is based on an open sound database, and the accuracy of its sound classification is 85%.

Keywords—convolutional neural network, classification.

Visibility Stabilization Method for Vehicle Detection Under Extreme Weather Conditions

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Abstract—Lots of vehicle detection methods were proposed so far, from traditional feature extraction learning to deep feature learning, the testing results of methods on public datasets were pretty good. The state-of-the-art method can detect vehicles accurately and classify them into multiple types of under real-time conditions. Nevertheless, none of the methods can successfully detect vehicles under low visibility which is one of the main influence to performances of those vision-based detection methods. Raindrops on lens, haze or strong light reflections, etc., these conditions change the features of the vehicles on the surveillance sequence and make them become hard to recognize for detection methods. Therefore, making the visibility stable is an important issue for vehicle detection. This study proposed a visibility stabilization method, including visibility assessment and correction module, which was validated the accuracy improvement through surveillance sequences.

Keywords: Vehicle detection, visibility assessment, visibility correction, extreme weather conditions.

Image-based Solar Irradiance Forecasting Using Recurrent Neural Networks

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Abstract—The solar power variability is due to the variability of solar irradiance. Several factors are involved in the situation, such as cloud thickness and air pollution. In this paper, we attempt to find a novel way to predict the amount of solar irradiance. An image-based forecasting method is developed, and Long Short-Term Memory (LSTM) neural network is applied for data training. Daily solar irradiance and sky images are record by the record system, and uploaded to the MySQL database for storage. Feature values obtained by analyzing sky images are used as the input of neural network with solar irradiance. After some performance evaluation indicators were demonstrated, we found that the proposed method has good predictive performance with 5 to 60 minutes in present.

Keywords: Solar irradiance forecasting, deep learning, recurrent neural network, image feature.

Poster Session (I)

9/1: 16:00-17:30

#1023 **Surface Defect Recognition for Calcium Silicate Boards Based on a Deep Learning Method**

Hao-Wei Chen, Chi-Yi Tsai, Yu-Hsiang Chen and Yu-Chen Hu

#1093 **The Study of Control-Consistency Space and Control Lyapunov Function for Nonlinear Descriptor Systems**

Jenq-Lang Wu, Jia-Yao Jhang and Chee-Fai Yung

#1097 **End-to-end Identification of Pharmaceutical Blister Packages Based on One-side Handheld Images**

Sheng-Luen Chung, Chang-Lin Cho and Shun-Feng Su

#1088 **A Novel Image Protection Algorithm with Double Hyperchaos Ciphering**

Shih-Yu Li, kai-chung Shih, Chin-Sheng Chen and Lap-Mou Tam

#1138 **Deep-Learning based Automatic Segmentation of Coronary Arteries in Computed Tomography Angiography Images**

Li-Syuan Pan, Wing P. Chan, Chia-Wei Li, Shee-Yen Tay and Shun-Feng Su

#1128 **A CNN-Based Human Head Detection Algorithm Implemented on Edge AI Chip**

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Surface Defect Recognition for Calcium Silicate Boards Based on a Deep Learning Method

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Abstract—This paper presents a convolutional neural network (CNN) architecture to identify surface defects of calcium silicate boards (CSBs) using visual image information based on the deep learning technique. The proposed CNN architecture comprises a feature extraction module and a surface-defect recognition module. The output of the system is the recognized defect category on the surface of the CSB. In the collection of the training dataset, we manually manipulated the CSB sample to take images of the defects presented on the surface and divided them into two datasets: one is a two category dataset including normal and abnormal categories, and the other one divides the defects into four categories, which are crash, dirty, uneven and normal. During the training phase, the proposed CNN model was trained through a supervised learning method based on the two different datasets, so that the CNN model learns how to recognize surface defects of the CSB by the RGB image information. Experimental results show that the proposed CNN model achieves an average recognition success rate of 84% in the four-class recognition and 85% in the two-class recognition. Moreover, both models achieve real-time computing speed about 44 fps and 52 fps, respectively.

Keywords: Deep learning, supervised learning, end-to-end learning, surface defect recognition, calcium silicate boards.

The Study of Control-consistency Space and Control Lyapunov Function for Nonlinear Descriptor Systems

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Abstract—This paper discusses control-consistency spaces and control Lyapunov functions for nonlinear descriptor systems (NDSs). We propose the expressions for control-consistency spaces and derive conditions for verifying control Lyapunov functions of NDSs.

Keywords: Nonlinear descriptor systems, control-consistency space, control Lyapunov functions.

End-to-end Identification of Pharmaceutical Blister Packages Based on One-side Handheld Images

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Abstract—Image-based identification of handheld pharmaceutical blister packages occurred during prescription dispensing process is challenging in that the packages are held in arbitrary positions with partial occlusion. Previous solutions rely on combining two complementary images of the handheld packages taken in opposite views, which are then processed in two stages: one for cropping the packages and the other for classification. In contrast, this paper presents solutions that rely on only one side images and require only one end-to-end deep learning network. In particular, Mask R-CNN and FOTS are utilized. Our experiments show that, given a pool of about 230 types of pharmaceutical blister packages commonly found in adult lozenges prescription stations, these two end-to-end solutions attain F1 scores of 99% and 96% for identification performance, comparable to that by previous two-staged architectures. Additional advantages of the new solutions include more compact architectures, faster runtime performance, with less training data and training process involved.

Keywords: Deep learning, end-to-end architecture, handheld object identification.

A Novel Image Protection Algorithm with Double Hyperchaos Ciphering

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Abstract—In this paper, a novel personal image encryption process is developed. A selected sliding window will be applying in the main encryption stage. Shuffling in higher level algorithm and image encryption combine two hyper chaotic system and selector that using the iteration result of logistic map. The multilevel ciphering process, comprising cipher data selector will increase the security. Simulation results show that the proposed advanced signal processing for image encryption is effective to protect the privacy of personal images.

Keywords: Chaos encryption, selector, moving window, hyper chaotic system.

Deep-Learning Based Automatic Segmentation of Coronary Arteries in Computed Tomography Angiography Images

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Abstract—Coronary artery disease is caused primarily by vessel narrowing. Extraction of the coronary artery area from images is the main procedure for diagnosing coronary diseases. In this study, a U-Net-based network architecture, 3D Dense U-Net, was adopted to perform fully automatic segmentation of the coronary artery. The network was applied to 480 coronary computed tomography (CT) angiography scans. Of these, 10% were used for testing. However, an imbalance between the foreground and background present a challenge in smaller object segmentation such as with the coronary arteries. The network was optimized and achieved a promising result when the focal loss concept was adopted. To evaluate the accuracy of the automatic segmentation approach, the dice similarity coefficient (DSC) was calculated. Results show that this proposed approach can achieve a DSC of 0.9691 compared to 0.8060 achieved by existing deep learning approaches. This study demonstrates that not only the convenience but also its high performance for automatic segmentation.

Keywords: Coronary artery, segmentation, 3D Dense-U-Net, class imbalance, focal loss.

A CNN-based Human Head Detection Algorithm Implemented on Edge AI Chip

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Abstract—This paper presents an integrated circuit implementation of a human head detection algorithm. The technique of image data augmentation for deep learning and the operating procedures of the evaluation board named as Mipy are described in the article. Experimental results demonstrate the effectiveness of the proposed evaluation board to detect the human heads in indoor environments.

Keywords: Convolutional neural network (CNN), human head detection, edge AI chip.

Vibration Signals Analysis Using Explainable Artificial Intelligence Approach of Convolutional Neural Networks

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Abstract—This study implements vibration signals analysis using the interpretability of convolutional neural networks (CNNs). Tool wear dataset is applied for discussion. The short time Fourier transform (STFT) time-frequency spectra are applied as inputs. A CNN is applied as classification model. The attention of model is generated by gradient class activation mapping (Grad-CAM). The attention of model can help pointing out the important frequency bands which contain information for classification. By explaining and verifying attention of model, the direction of further analysis can be carried out when analyzing unknown signals.

Keywords: CNN, vibration signals analysis, explainable AI, tool wear.

Motion and Balance Control for a Collinear Mecanum-Wheeled Self-Balancing Robot

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Abstract—This paper designs a collinear-Mecanum wheeled self-balancing robot (CSR), which extends the mobility of a two-wheeled inverted pendulum to allow for omnidirectional movement while simultaneously dynamically balancing in a single axis about the upright unstable equilibrium. Further, this paper proposes a motion and balance control (MABC) system for the CSR using a Proportional-Integral-Derivative (PID) control approach based on 8-bit Arduino microcontroller. Finally, the experimental results show that the CSR can move omni-direction while keeps itself balance with favorable motion performance using the proposed MABC system.

Keywords: Collinear Mecanum wheel, motion and balance control, omnidirection, microcontroller.

Intelligent Control of a Unicycle Balancing Robot

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Abstract—Unlike two wheel balancing robot which mechanically stable on one side, unicycle balancing robot (UBR) requires additional mechanisms to keep balancing robot on all sides. The UBR in this paper has two DC motors: one to drive the reaction disk for roll and the other to drive the rotating wheel for pitch. By assuming that both roll dynamics and pitch dynamics are decoupled, this paper proposes two intelligent controllers for a UBR system via fuzzy control approach. Fuzzy logic is utilized to compensate for the interactions between the pitch and roll dynamics in real time. Finally, the experimental results show that the UBR can be able to balance on pitch angle and roll angle.

Keywords: Unicycle balancing robot, fuzzy control, balance control, microcontroller.

Parameters Optimization for Group Search Algorithm

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Abstract—This paper used an optimization method to optimize parameters of group search optimizer (GSO). In GSO, there are four important parameters which are influenced the performance of GSO. For obtaining the parameter combination effectively and systematically, the proposed method is applied in this paper. In this paper, the proposed method is used to assist with searching the suitable value for an initial head angle ϕ_0 , a maximum turning angle α_{max} , and a maximum pursuit distance l_{max} . After that, three types for benchmark functions, including unimodal functions, multimodal functions, and morbid functions, are used to verify the performance of GSO. From the experimental results, the performance of GSO by using the parameter combination obtained by the proposed method is better than the existing GSO.

Keywords: Group search optimizer (GSO), parameter, optimization.

Improved Fractional-order Particle Swarm Optimizer Based on Sliding-Level Strategy

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Abstract—This paper proposed an improved fractional order particle swarm optimizer (FPSO) algorithm based on sliding-level (SL) strategy to overcome shortcomings of particle swarm optimizer (PSO) algorithm, such as its poor robustness and easy to obtain local optimum. There are four parameters in FPSO to influence the performance. The SL strategy is improved from orthogonal array (OA) in Taguchi method and introduced into FPSO to optimize the influenced parameters and particles. The OA can assist FPSO with selecting the suitable parameters and variables of particles. In this paper, the SL-FPSO algorithm is used to search the optimum of 7 benchmark functions in order to prove the effective improvement of the FPSO. From the experimental results, the solution obtained by the SL-FPSO is better than SL-PSO. Therefore, we can know that the SL-FPSO algorithm has good performance and robustness than SL-PSO.

Keywords: Fractional-order particle swarm optimizer, Taguchi method, orthogonal array, sliding-level strategy.

Solution of Unconstrained Optimization Problems by Using Hybrid Vector Multi-objective Genetic Algorithm

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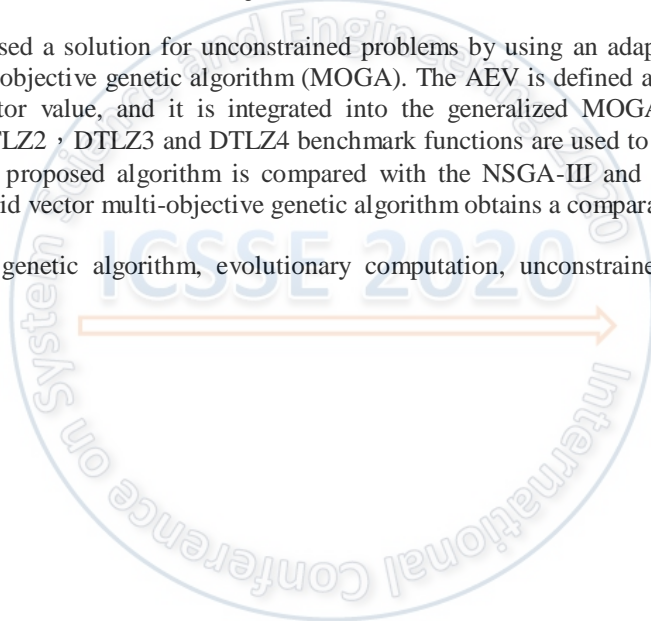
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Abstract—This paper proposed a solution for unconstrained problems by using an adaptive evaluated vector (AEV) which cooperates with multi-objective genetic algorithm (MOGA). The AEV is defined and evaluated through various objectives as a specific vector value, and it is integrated into the generalized MOGA as a global solver. In the experiment, the DTLZ1, DTLZ2, DTLZ3 and DTLZ4 benchmark functions are used to verify optimization problems with 3 - 15 objectives. Our proposed algorithm is compared with the NSGA-III and the MOEA/D, and from the experimental results, the hybrid vector multi-objective genetic algorithm obtains a comparable solution.

Keywords: Multi-objective genetic algorithm, evolutionary computation, unconstrained problems, many-objective optimization.



Parameter Optimization for Reinforcement Learning by Using Uniform Design

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Abstract—This paper focused on parameter optimization for reinforcement learning. In reinforcement learning, a greedy factor, a learning rate and a discount factor influence the entire performance, but few researches consider optimizing the combination of parameters. In general, they only consider one of them. In order to obtain the best parameter combination effectively, this paper used the uniform design to execute experiment design. The uniform design is a global parameter experiment design method. Compared with the Taguchi method and the trial-and-error method, the uniform design provided more flexible level cutting and is systematical method. This paper used U10 uniform layout to search the parameter combination. From the experimental results, the combination obtained by uniform design can get the best performance in any maze.

Keywords: Parameter optimization, reinforcement learning, Q-learning, uniform design.

An Active Data Augmentation Method to Improve Deep Learning Model for Surface Defect Detection with Scarce Samples

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Abstract—In recent years, manufacturers gradually adopt deep learning as the core algorithm to conduct surface defect detection. However, it is difficult to obtain sufficient defect data from a production line for training deep learning models. Traditional data augmentation techniques, such as cropping, shifting, flipping, and rotating input images, may be used to generate the required training datasets. Nonetheless, those generated data often lead to the overfitting of the defect detection model because they lack different defects from the actual datasets. This paper proposes a two-stage active data augmentation method to address this issue. Testing results validate the effectiveness of the proposed method.

Keywords: Surface defect detection, deep learning model, active data augmentation method.

Performance Optimization Research on Ultrasonic Vibration Assisted Turning

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Abstract—Explore Ultrasonic vibration assisted turning tool system for turning AISI 1045 by using Taguchi robust design method. In this experiment, to test analysis to compare the surface accuracy and to optimize the parameters of Ultrasonic vibration assisted turning by turning AISI 1045. Using Taguchi robust design method to know at frequency 20Khz, voltage-75v, cutting speed-150(m/min), feed rate 0.05(mm/rev) is optimal parameters for this experiment, and to explore the differences between optimal parameters when the presence of Ultrasonic vibration assisted turning for the surface roughness, which found in Surface roughness Ultrasonic vibration assisted machining is better than without Ultrasonic vibration assisted machining.

Keywords: Ultrasonic assisted vibration turning tool system, Ultrasonic assisted vibration machining, Taguchi robust design method.

Trajectory Recognition of Spinning Ball for Ping-Pong Robots

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Abstract—This study investigates a trajectory recognition system of spinning ball for the ping-pong robot. A vision system is developed to track the trajectory of a spinning ping-pong ball. The trajectory is recognized through deep learning neural network in real-time. Four types of spin, including topspin, underspin, left sidespin, and right sidespin, and two different ball speeds are considered in this study. Experimental results show that the trajectory recognition rate of the developed deep recurrent neural networks is greater than 98%. **Keywords**— trajectory recognition, spinning ball, ping-pong robot, deep learning neural network.

Keywords: Trajectory recognition, spinning ball, ping-pong robot, deep learning neural network.

Mobilenet-SSDv2: An Improved Object Detection Model for Embedded Systems

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Abstract—Object detection plays an important role in the field of computer vision. Many superior object detection algorithms have been proposed in literature; however, most of them are designed to improve the detection accuracy. As a result, the requirement of reducing computational complexity is usually ignored. To achieve real-time performance, these superior object detectors need to operate with a high-end GPU. In this paper, we introduce a lightweight object detection model, which is developed based on Mobilenet-v2. The proposed real-time object detector can be applied in embedded systems with limited computational resources. This is one of the key features in the design of modern autonomous driving assistance systems (ADAS). Besides, we also integrate a feature pyramid network (FPN) with the proposed object detection model to effectively improve detection accuracy and detection stability. Experimental results show that the proposed lightweight object detection model achieves up to 75.9% mAP in the VOC dataset. Compared with the existing Mobilenet-SSD detector, the detection accuracy of the proposed detector is improved about 3.5%. In addition, when implemented on the Nvidia Jetson AGX Xavier platform, the proposed detector achieves an average of 19 frames per second (FPS) in processing 720p video streams. Therefore, the proposed lightweight object detector has great application prospects.

Keywords: Single-shot multi-box detector (SSD), mobilenetv2, mobilenet-ssd, feature pyramid network, embedded systems.

Omni-directional Drive Autonomous Mobile Robot

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Abstract—In this paper, a design and implementation method of a vision-based four-wheeled omni-directional autonomous mobile robot is proposed. First, a four-wheeled omni-directional mobile chassis is described and its kinematics model is derived. Then, a fuzzy control design method is proposed to control this four-wheeled mobile robot. Finally, a Four-Wheeled Omni-Directional Mobile Robot (FWODMR) is constructed so that this implemented robot can move to a desired position autonomously. Some experimental results are presented to illustrate that the proposed method is available and effective in the design and implementation of an omni-directional drive autonomous mobile robot.

Keywords: Omni-directional drive, autonomous mobile robot, fuzzy control.

Road User Intention Classify by K-means algorithm

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Abstract—To make the autonomous vehicle understanding the traffic environment, this paper classify the road users traffic intentions such as motor rider turn right, motor rider turn left, biker turn right, biker turn left, and pedestrian walk or stop by K-means clustering algorithm. The experimental result show that the method proposed can detect the road user intentions. This system will not only be helpful for autonomous vehicles but also semi-autonomous driving in complex traffic environments.

Keywords: autonomous vehicle, K-means clustering algorithm, traffic environments.

Surrounding View Advanced Driver Assistance Systems Base on Lightweight technology

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Abstract—This thesis proposed a lightweight deep learning approach, which is based on the Single Shot Multi box Detector (SSD) framework, MobileNetV2 and a lightweight convolutional neural network designed specifically to minimize model size while maintaining object detection performance. The detection time of the PC has also increased, and the resulting lightweight SSD possess a model size. Beside this study use lightweight SSD and MobileNet that can be designed for embedded system with the same accuracy. It is solved the problem that the VGG16-SSD model that is too large and cannot be implemented on the embedded system.

Keywords: Deep learning, MobileNetV2, single shot multi-box detector.

SS11 PHM for Complex Systems 1

9/2 (WM-1) 【IB-505】 08:50-10:20

Chairmen: Prof. Xiao-jian Yi, Prof. Hui-Na Mu and Prof. Ya-juan Liu

Virtual conference: Virtual conference software: Zoom

#1022 **Reliability Model of Single Internal and External Meshing Planetary Gear Transmission Mechanism Considering Load Correlation**

Shulin Liu, Zili Wang, xiaojian Yi and Peng Hou

#1033 **Application of Multi-sensor Information Fusion Technology in Fault Diagnosis of Transport Vehicle Engine**

Zhao Yao, Shen Yu, Zhannan Guo, Jianxin He, xiaojian Yi and Yingshun Li

#1034 **Research on Fault Diagnosis of Armored Delivery Vehicle Based on Oil Monitoring Information**

Yingshun Li, Ji yao Lu, Zhannan Guo, Aina Wang, Jianxin He and xiaojian Yi

#1042 **A Survey Of Equipment Fault Diagnosis and Condition Evaluation Methods Based On Data Driven**

Yingshun Li, Aina Wang and xiaojian Yi

#1072 **A Maintenance Analysis Method Associated Functional Structure for Complex Equipment**

Na Jiao, Wenjun Guo, Meng Zhang and xiaojian Yi

Reliability Model of Single Internal and External Meshing Planetary Gear Transmission Mechanism Considering Load Correlation

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Abstract—The reliability model for single internal and external meshing planetary gear transmission mechanism considering load correlation is studied in this paper. Then, the reliability of single internal and external meshing three planetary gear transmission mechanisms is calculated using this method. Finally, in order to verify the engineering applicability and rationality, this method is compared with the Monte Carlo simulation method. The results show the rationality, advantage and applicability of this new method. Meanwhile, the reliability model considering correlation provides a general method for single internal and external meshing planetary gear transmission mechanism.

Keywords: Reliability model, mechanical system, load correlation, Monte Carlo simulation.

Application of Multi-sensor Information Fusion Technology in Fault Diagnosis of Transport Vehicle Engine

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Abstract—Traditional fault diagnosis methods often use a single parameter to diagnose complex systems. The diagnosis results have problems such as incomplete information and low diagnostic accuracy. This paper analyzes the disadvantages of the single parameter fault diagnosis method, introduces the characteristics of multi-source information fusion technology, and proposes the application of BP neural network based on Levenberg-Marquardt(L-M) algorithm in fault diagnosis of transport vehicle engine aiming at the problems of traditional BP neural network that are prone to fall into local minimums and slow convergence. Combined with the data of the specific operating conditions of the specific transport vehicle engine, it is verified that the multi-sensor information fusion technology improves the diagnostic accuracy compared with the traditional single parameter fault diagnosis technology. It illustrates the feasibility and effectiveness of multi-sensor information fusion technology in fault diagnosis system.

Keywords: Fault diagnosis, information fusion, L-M algorithm, BP neural network.

Research on Fault Diagnosis of Armored Delivery Vehicle Based on Oil Monitoring Information

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Abstract—Armored delivery vehicles play an important role in our army's modern battlefield, and fault diagnosis of their transmissions will have a great influence on their performance. Generally, the testing way of lubricant being used is offline testing, but that has a disadvantage of untimely detection. In order to improve the timeliness and accuracy of gearbox fault diagnosis, we use online oil sensors to collect lubricant information, and a fault diagnosis algorithm based on the combination of principal component analysis and improved neural network is proposed. There is a close correlativity between various indexes of transmission lubricants, so the first step is to reduce the dimension of gearbox diagnosis indexes by the method of PCA and then use the improved BP neural network to diagnose gearbox faults. The results by Matlab show that, the PCA-improved neural network model can effectively improve the accuracy of gearbox fault diagnosis and simplify the neural network structure of inputting. The fault diagnosis algorithm not only improves the convergence and stability of the network, but also can diagnose the gearbox of armored vehicles timely and accurately.

Keywords: Online oil sensor, fault diagnosis, principal component analysis, neural network.

A Survey of Equipment Fault Diagnosis and Condition Evaluation Methods Based on Data Driven

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Abstract—The fault diagnosis and health assessment of equipment greatly improve the level of equipment management, and ensure the safety and reliability of production and operation. And improve the combat effectiveness of the equipment system, effectively reduce the life cycle cost of the equipment, and improve the combat readiness and mission accessibility of the equipment. At present, there are many fault diagnosis and health assessment methods based on equipment data, mainly involving signal processing, expert system and multi-source information fusion and processing. Based on the above three aspects, this paper discusses the research status of data-driven equipment fault diagnosis and condition evaluation technology at home and abroad, and analyzes the advantages and disadvantages of several methods. Finally, the application of fault diagnosis and condition evaluation technology in complex industrial system is pointed out.

Keywords: Weapon equipment, data driven, fault diagnosis, condition evaluation.

A Maintenance Analysis Method Associated Functional Structure for Complex Equipment

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Abstract—This study proposes a maintenance analysis method associated functional structure for complex equipment from aspects of analyzing system maintenance items, conducting functional structure association feature model on qualitative design and quantitative requirements of maintainability, and conducting association analysis among maintenance qualitative factors, quantitative factors and system functional structure features. In order to illustrate the reasonability and engineering applicability, the action systems of special vehicle is taking as an example to conduct maintenance analysis associated functional structure. Finally, the analysis results show that the maintenance qualitative and quantitative design requirements are closely combined with the functional structural features, so that the forward design of maintainability can be operated in skinny system. All in all, this study not only provides a new research idea for maintenance analysis, but also can be as a typical example to guide the similar problems.

Keywords: Functional characteristics, structural characteristics, maintainability, association analysis.

SS11 PHM for Complex Systems 2

9/2 (WM-3) 【IB-505】 10:40-12:10

Chairmen: Prof. Xiao-jian Yi, Prof. Hui-Na Mu and Prof. Ya-juan Liu

Virtual conference: Virtual conference software: ZooM

- #1150 **Simulation Analysis on Safety Prediction of Front Impact of Special Vehicles**
Zhongliang Wei, Xingguo Zhao, Minhui Chen, Liang Ling Fang Xie, Li Li and Sijuan Zheng
- #1153 **Study on Mental Load Test and Evaluation of Special Vehicle Crew**
Fang Xie, Sijuan Zheng, Liang Ling, Zhongliang Wei and Wei Hu
- #1154 **Study on Electric and Electric Hybrid Energy Matching of Off-Road Vehicle Based on Ragone Curve**
Jianguo Lv, Xuelian Xiao, Yuankun Dong, Chunlin Liu, Chaofan Wang and Zhiyuan Guo
- #1018 **Aggregation and Comparison of Probabilistic Linguistic Term Sets with Interval Probabilities**
Huchang Liao and Xingli Wu

Simulation Analysis on Safety Prediction of Front Impact of Special Vehicles

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Abstract—Due to their special purpose, special vehicles will encounter roads such as trenches and cliffs, and they will also encounter emergencies, causing impact damage to the occupants, threatening the implementation of the mission and the safety of the occupants. Aiming at the threats faced by the occupants, this paper takes a special vehicle as an example to analyze the impact safety status, hazards and impact characteristics of the vehicle, using digital virtual simulation methods, and using finite element analysis methods to establish the vehicle body, seats and occupants. The finite element model predicts the impact safety of cabin occupants by simulating the frontal impact environment. Through improved design, accumulate methods for special vehicle occupant impact safety protection control.

Keywords: Vehicle, finite element analysis, impact, safety.

Study on Mental Load Test and Evaluation of Special Vehicle Crew

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Abstract—This paper starts with the quantitative evaluation of the mental load of the occupant of a special vehicle, and based on the multi-resource theory, combines subjective evaluation, main task method, sub-task method and physiological measurement method to evaluate the mental load of the occupant in the process of a specific task. Through the analysis of occupant tasks, the long-distance target task and the close target task were selected as the test scenes to carry out the occupant mental load test research. Through the main task flow and sub-task method, the quantitative results of occupant overall workload and the variation rule and trend of occupant workload in the task process were obtained.

Keywords: Mental load, Multi-resource theory, Testing and evaluation.



Study on Electric and Electric Hybrid Energy Matching of Off-road Vehicle Based on Ragone Curve

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Abstract—Compared with the category of road vehicles, most considered sources define the term "off-road vehicle" as being intended to be able to drive on public roads, especially on rough terrains such as unpaved roads, trails, and beaches. Aiming at the demand of all electric energy drive for off-road vehicles, this paper studies the optimal matching of electric and electric hybrid energy based on the Ragone curve, studies the power distribution law of hydrogen fuel cell and battery, and optimizes the electric and electric power mix ratio, so that the system has the best Ragone curve characteristics.

Keywords: Ragone diagram, hydrogen fuel cell, battery, electric hybrid, power hybrid ratio.

Aggregation and Comparison of Probabilistic Linguistic Term Sets with Interval Probabilities

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Abstract—The probabilistic linguistic term set (PLTS), composed by linguistic terms and their probabilities, is effective to represent uncertain evaluations. Given that the precise probabilities are weaker than interval forms to portray uncertainty, this paper investigates the PLTS with interval probabilities. A probabilistic linguistic dominance method is proposed to determine the preference relation between PLTSs. In addition, we develop a pair of programming models to aggregate PLTSs that maximum and minimum combined PLTSs can be estimated. A framework of multi-criteria decision making is introduced to measure the performances of alternatives considering both comprehensive evaluations and the ability to achieve the toleration and expectation values of criteria. The method is illustrated by a case study of elderly health care.

Keywords: Multi-criteria decision making, probabilistic linguistic term set, interval uncertainty, elderly health care.

ICSSE 2020
Deep Learning and Applications 2

9/2 (WM-2) 【IB-506】 08:50-10:20

Chairman: Prof. Chen Chien Hsu

Virtual conference: Virtual conference software: Zoom

- #1026 **A Tiny Neural Network Model for Estimating Next 24 Hour Temperature Transition**
Huidong Tang, Yuichiro Mori and Masahiko Toyonga
- #1048 **Deep Learning Based Real-Time Multiple-Person Action Recognition System**
Jen-Kai Tsai, Chen-Chien Hsu and Wei-Yen Wang
- #1050 **Object Pose Estimation System for Pick and Place Automation**
Hsin-Hung Chen, Chen-Chien Hsu and Wei-Yen Wang
- #1123 **Should Kernels Be Trained in CNN?- a Paradigm of AG-Net**
Jingchen Li, Haobin Shi and Kao-Shing Hwang

A Tiny Neural Network Model for Estimating Next 24 Hour Temperature Transition

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Abstract—We propose a new tiny neural network model for estimating next 24 hour temperature transition. Conventional neural network models for temperature estimation are mainly focusing on the maximum or minimum temperature with huge nodes and connections, while our model is targeting the full 24 hour temperature with simple size. Our neural network model consists of minimum configuration, i.e. it consists of 24 hour temperature and pressure input nodes and output nodes with fully connections. According to the experiments by applying five major cities in Japan, it is found that MAPEs (Mean Absolute Percentage Errors) of the 24 hour temperature transition by our model are from 1.62% to 3.24% that is comparable accuracy to previous works. As the correlation between the temperature transition and the agriculture productivity or the electric power consumption, this model is useful for the domestic small local industry such as the local agriculture or the power supply company.

Keywords: Tiny neural network, fully connected, temperature estimation, MAPE (Mean Absolute Percentage Error).

Deep Learning Based Real-Time Multiple-Person Action Recognition System

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Abstract—Smart surveillance has a huge advantage in the aspect of human recognition and interpretation. It can be applied to the field of care, such as home, kindergarten, nursing home and day-care center. For caregivers, it supplies real-time activity detection to avoid accidents when they take care of patients. For agency and society, it solves the shortage of human resources. With the rapid development of artificial intelligence and related applications, how to use action recognition to achieve the purpose of real-time smart surveillance is an important issue. Therefore, we propose a deep-learning-based multiple-person action recognition system to establish a smart surveillance system for a long-care environment. Combining YOLOv3 and SORT algorithm, we can detect and track multiple people from a video. Thanks to the high resolution of images from the camera, we develop a 'Zoom in' approach according to the size of the bounding boxes to obtain a more satisfactory action recognition results for people locating at longer distance in the environment. To achieve a robust recognition result, video frames including the bounding boxes are sent to I3D to detect the action of the people where background areas are blurred to reduce noise. Finally, a NMS approach is adopted based on the results from I3D due to various sliding windows to improve the accuracy of the recognition result. Experimental results show that real-time performance for multi-people action recognition can be achieved by using the proposed approach. The main contributions are listed below: firstly, we extend the I3D single person recognition to multiple-person recognition and its speed can attain real-time. Second, we use the pre-processing method to improve the accuracy of action recognition. In the method, using the individual processing of the characters and frame segmentation to process the video which will input to the neural networks. Third, for long-distance people, using the original high-definition images can increase the accuracy. Lastly, the NMS method can greatly decrease the unstable phenomenon when the identification category is uncertain, and enhance the stability of the recognition result. Experimental results show that real-time performance for multi-people action recognition can be achieved by using the proposed approach.

Keywords: Action recognition, deep learning, human tracking, smart surveillance.

Object Pose Estimation System for Pick and Place Automation

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Abstract—In this paper, we propose an object pose estimation system for pick and place automation. There are three parts of the system. In the first part, we use a single camera to develop an object pose estimation system based on Deep Object Pose Estimation (DOPE). Then we use a Kinova JACO2 4-DoF robotic arm to perform object picking through Robot Operating System (ROS). Finally, a Graphical User Interface (GUI) is designed to integrate the pose estimation system and robotic arm, so that users can obtain object estimation and arm execution information through a single interface. To validate the viability, the proposed system is applied to a simplified production-line automation environment, where a robotic arm is able to properly pick objects based on the pose estimated to achieve processing and sorting automation.

Keywords: deep learning, ROS, object pose estimate, synthetic data, robotic arm, GUI.

Should Kernels Be Trained in CNN?- a Paradigm of AG-Net

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Abstract—The Convolutional Neural Network constantly updates the weights of kernels to learn the feature representation, which makes the computational cost unaffordable. This work first proposed a Randomized Convolution Kernel with a kernel group to extract the multidimensional feature of each pixel. An AG-Net is then constructed, which can generate a layer containing multiple Gaussian Mixture Models to replace the convolutional layer. There are several Randomized Convolution Kernels in AG-Net to generate several multidimensional feature sets according to different multidimensional features. And each multidimensional feature set gets a Gaussian Mixture Model with Adaptive Resonance Theory. In training, each input is mapped by the Gaussian Mixture Models and the kernel sets. Then a fully connected layer is used for high-level reasoning. Experiments show that the weights of kernels can be random, and the feature maps based on the similarity of pixels in multidimensional features can be well used in image processing.

Keywords: Gaussian Mixture Model, Adaptive Resonance Theory, convolutional neural network.

WS03 Reliability Design and Resilient Control of Intelligent Mechatronic Systems

9/2 (WM-4) 【IB-506】 10:40-12:10

Chairmen: Prof. Zhengtian Wu and Prof. Xiaona Song

Virtual conference: Virtual conference software: Zoom

- #1158 **Sliding Mode Control of Temperature and Humidity in Air Conditioners**
Zhengtian Wu, Lijian Yang and Baoping Yang
- #1101 **A New Fuzzy DEA Model for Green Supplier Evaluation Considering Undesirable Outputs**
Huidong Wang, Mingguang Dong and Lei Wang
- #1137 **Data-driven Robust PID Control of Unknown USVs**
Dong Nan, Yongpeng Weng and Ning Wang
- #1028 **L_1/H_∞ Filter Design for Affine Fuzzy Systems with Imperfect Premise Matching**
Huimin Wang, Xinyue Shen and Xiao-Jian Li

Sliding Mode Control of Temperature and Humidity in Air Conditioners

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Abstract—This paper proposes a sliding mode control (SMC) strategy to solve the problem of independent control of temperature and humidity in air conditioners, the complexity increases due to the need to make full use of the wind side for cooling. First, dynamics of indoor temperature and humidity is determined based on mathematical models. Second, the independent control of temperature and humidity is realized via a novel reaching law and a fuzzy rule is proposed to design the sliding mode parameters while reducing the chattering effect of SMC and coordinating indoor conditions to satisfy people's needs. Finally, simulation results are provided to verify the effectiveness of the proposed method.

Keywords: Independent control, Fuzzy sliding mode control, Temperature and humidity control, Air conditioner.

A new fuzzy DEA model for green supplier evaluation considering undesirable outputs

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Abstract—Suppliers will produce undesirable outputs, such as CO₂, during the production process. It is vital to take such undesirable outputs into account for the evaluation and selection of green suppliers. We propose a new fuzzy DEA model with undesirable outputs (FDEA-UO) based on general fuzzy measure. The general fuzzy measure is convex combination of possibility (Pos) measure and necessity (Nec) measure, which can allow decision makers to obtain more comprehensive results by adjusting optimistic-pessimistic parameters. An example of green supplier evaluation is used to illustrate the effectiveness of our approach.

Keywords: Supplier evaluation, fuzzy DEA, general fuzzy measure.

Data-driven robust PID control of unknown USVs

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Abstract—A new data-driven robust PID control (DRPIDC) is presented to solve tracking control problem of unmanned surface vehicles (USVs) with uncertainties, disturbances and unmodeled dynamics. Main contributions are threefold: 1) Utilizing data-driven technology, an equivalent model based on data of USVs is established, which effectively solves the problem of unknown model. 2) within this scheme, a novel control method including PID control and sliding mode control is designed, which has both simple structure and strong robustness. 3) The simulation studies are used to verify the effectiveness of the presented DRPIDC strategy.

Keywords: Unmanned surface vehicles (USVs), sliding mode control, robustness.

L_1/H_∞ Filter Design for Affine Fuzzy Systems with Imperfect Premise Matching

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Abstract—This paper addresses the robust filtering problem for a class of continuous-time nonlinear systems described by affine fuzzy models. The system outputs are chosen as premise variables of the fuzzy model, and their measured values are chosen as premise variables and inputs of the fuzzy filter. Performance requirements of the augmented system are stated as fuzzy summations, related to Lyapunov function. Different from the existing results, the influence of measurement errors on premise variables is considered, and as a result, the nice characteristic given by the perfect premise matching cannot be used for the filter design. With the introduction of slack matrices, relaxed linear matrix inequality (LMI)-based L_1/H_∞ fuzzy filter design conditions are obtained using Lyapunov-based approach, which consider the information of the membership functions and measurement errors. Finally, a numerical example is given to show the effectiveness and merits of the proposed approach.

Keywords: Nonlinear systems, affine fuzzy models, measurement error, imperfect premise matching, L_1/H_∞ fuzzy filter.

SS12 Robotic Vision & It's Application

9/2 (WM-5) 【IB-507】 10:40-12:10

Chairman: Prof. Mei-Yung Chen

Virtual conference: Virtual conference software: Zoom

#1095 Virtual Reality Exposure Therapy for Driving Phobia Disorder: A System Design and Development

Ru-Ting Kuo, Amy J.C. Trappey, Charles Trappey, Chia-Ming Chang,
Chih-Hsuan Nieh and Pin-Chun Lin

#1121 Analysis and Prediction of Chaotic Time Series Based on Deep Learning Neural Networks

Cheng-Hsiung Yang and Hui-Yu Shen

#1027 Improvement of Deep Learning Based Human Action Recognition with Motion Prediction System

Yu Cho, Xin-Hong Ho and Cheng-Ming Huang

Virtual Reality Exposure Therapy for Driving Phobia Disorder: A System Design and Development

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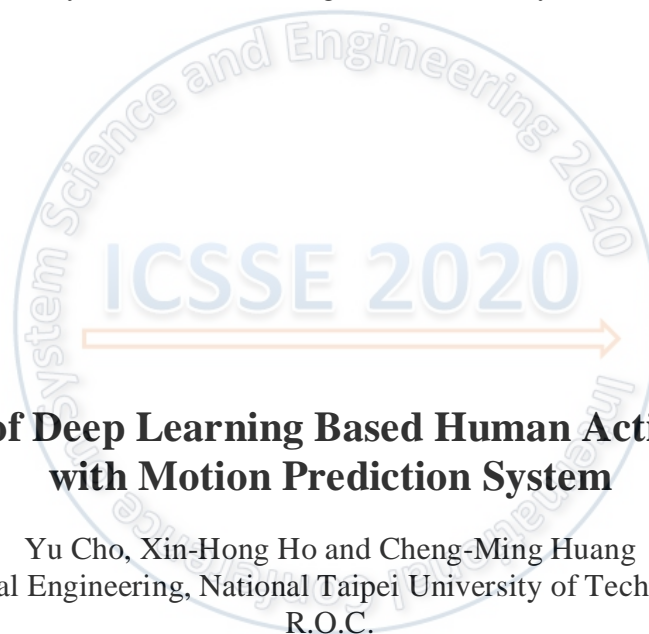
Analysis and Prediction of Chaotic Time Series Based on Deep Learning Neural Networks

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Abstract—In this paper, we propose a Differencing Long Short-Term Memory (D-LSTM) architecture as an extension of recurrent neural networks. The differencing is the latter value minus the previous value, which can reduce the noise of the original data to make it smooth and improve the prediction accuracy. We design a 3D nonlinear chaotic system and analyze its properties and dynamic behaviors by phase portraits, equilibrium points, Lyapunov exponents, spectral entropy. We study prediction result by change the initial value and the coefficient for our chaotic system. We compare D-LSTM with Adaptive Neuro Fuzzy Inference system (ANFIS) and original Long Short-Term Memory (LSTM), using Root Mean Square Error (RMSE) to measure their performance. The result shows that our model is almost better than others.

Keywords: Differencing, Chaotic system, Time series, Long-short term memory.



Improvement of Deep Learning Based Human Action Recognition with Motion Prediction System

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Abstract—In the field of machine intelligence, it is a necessary task also a challenge for machines to understand human behavior. In order to improve the efficiency of human-machine interaction, the accuracy of scene understanding or the early warning of unexpected situations, human action recognition and motion prediction become important keys. First, in the human action recognition task, this thesis regards it as a classification problem, and uses the sequence of the human body pose to classify the action labels. A simple action recognition neural network architecture is employed to achieve the purpose of real-time application. The performance of action recognition is further improved by combining the results of motion prediction. In the processing of human motion prediction, we regard it as a regression task and utilizes the pose sequence from the past time period to predict the future pose sequence results. By considering the momentum of skeleton and the estimating confidence of each joint, the mean pose problem in motion prediction can be solved in this thesis, and the discriminating ability when joints obscured is also increased.

Keywords: Motion prediction, deep learning, human-machine interaction, regression.

SS07 Intelligent and Learning Control of Nonlinear Systems: Theory and Applications

9/2 (WA-1) 【IB-505】 13:00-14:30

Chairmen: Prof. Yongming Li and Prof. Tieshan Li

Virtual conference: Virtual conference software: VooV

- #1043 **Adaptive Fuzzy Finite-Time Bipartite Containment Control for Stochastic Multi-Agent Systems**
Ying Wu, Hong Xue, Ying Tian and Hongjing Liang
- #1082 **Adaptive Fixed-Time Prescribed Performance Control for a Class of Nonlinear Systems with Quantized Input Signals**
Ming Chen, Man Yu
, Long yan Zhang and Qing huan Wang
- #1086 **Fault Tree Analysis of Electronic-controlled Air Suspension**
Yi-Xian Fang and Rui Bai
- #1177 **Research on Classification and Detection System of Common Household Tools for Home Service Robot**
Weizhao Chen, Wenbai Chen, Chao He, Nan Liu, Peiliang Wu and Haobin Shi

Adaptive Fuzzy Finite-time Bipartite Containment Control for Stochastic Multi-agent Systems

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Abstract—This paper proposes the adaptive fuzzy finite-time bipartite containment control scheme for stochastic multi-agent systems subject to dead zone and sensor faults. The fuzzy logic systems are employed to compensate unknown nonlinear functions. The adaptive compensation control method is used to overcome the obstacle caused by sensor faults. Moreover, unlike most existing finite-time control results, the proposed control method can be applied to stochastic MASs and the nonlinear functions of the systems are completely unknown. In addition, the tracking differentiator is used to avoid the problem of ‘explosion of complexity’ existed in backstepping method. By employing the stochastic Lyapunov stability theorem, it is proved that all signals of the closed-loop systems are semi-global practical finite-time stable in probability and the bipartite containment control performance for stochastic MASs can be achieved. Finally, simulation results are presented to verify the availability of the proposed control scheme.

Keywords: Finite-time, adaptive fuzzy control, sensor faults, tracking differentiator.

Adaptive Fixed-time Prescribed Performance Control for a Class of Nonlinear Systems with Quantized Input Signals

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Abstract—This paper investigates an adaptive fixed-time prescribed performance control of nonlinear systems with quantized input signals. Based on backstepping scheme and fuzzy logic control, a new quantized control is achieved with prescribed performance, in which a hysteretic quantizer is used to avoid the problem of fast switching and buffeting of the quantized signals. Fuzzy logic systems are introduced to approximate unknown nonlinear functions. The proposed fixed-time prescribed performance controller ensures that the closed-loop system is practical fixed-time stable, especially, the output variable tracks the desired output signal at a fixed-time, and the tracking error converges to the prescribed boundary constraints. Meanwhile, all signals of the closed-loop system are bounded. Finally, the proposed method is effective through a numerical simulation example.

Keywords: Prescribed performance, fixed-time control, backstepping, hysteretic quantizer, nonlinear systems.

Fault Tree Analysis of Electronic-controlled Air Suspension

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Abstract—With the development of electronic control technology, Electronic-controlled Air Suspension (ECAS) system improves the stability and comfort of driving. As fault diagnosis technology evolves, Fault Tree Analysis (FTA) has become an effective diagnosis method. In this paper, four main components of ECAS are analyzed in detail by FTA, and then the practicability is verified by an example.

Keywords: Electronic-controlled air suspension, fault tree analysis, sensors.

Research on Classification and Detection System of Common Household Tools for Home Service Robot

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Abstract— In recent years, the application of vision processing algorithm based on deep network in robot and other mobile devices has become a research problem that attracts wide attention. In order to solve the problems of limited storage space, long prediction time, low algorithm performance and weak computing power of object detection on mobile devices such as home service robot, this paper designs a classification detection model of common household tools based on the lightweight convolution neural network MobileNetV2[1]. Firstly, MobileNetV2 is selected as the backbone network of feature extraction. By decomposing the standard convolution into deep convolution and pointwise convolution, the multiscale prediction part is reserved, and the parameters are effectively reduced; then, the full connection layer network and Softmax classifier are used to realize the classification and recognition of common household tools. Compared with the common classification algorithms, the network algorithm has higher prediction accuracy, smaller network model and better performance, so it is better applied to the system platform of home service robot.

Keywords: Object detection, home service robot, MobileNetV2, Softmax.

WS01 Workshop on Offshore Robotics 1

9/2 (WA-2) 【IB-506】 13:00-14:30

Chairman: Prof. Hongde Qin

Virtual conference: Virtual conference software: Zoom

- #1081 **Research on Structural Health Monitoring of Pressure Cabin Based on Stress Intensity Factor**
Changli Yua, Runfa Gea, Myung Hyun Kimb, Xiaobo Gongc and Zhen Xin Yang
- #1111 **Research on Underwater Image Recognition Based on Deep Learning**
Chong Wang, Yu Jiang, Ge Liu and Fenglin Wei
- #1118 **A Real Time Multi-thread Underwater Images Enhancement System**
Xiaofeng Liu, Risheng Liu, Ming Zhu, Wei Zhong, Xin Fan, Zhongxuan Luo and Wanhui Zhang
- #1120 **Planning for Fish Net Inspection with an Autonomous OSV**
Tony Xiaotong Lin, Qiuyang Tao and Fumin Zhang
- #1125 **Design and Simulation of Open Frame Underwater Towing Vehicle**
Guangzhao Zhou, Xianbo Xiang and Chuan Liu

Research on Structural Health Monitoring of Pressure Cabin Based on Stress Intensity Factor

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Abstract—Intelligent system of structural health monitoring is the most important and effective approaches to avoid structural failure caused by cyclic loading and structural deterioration in harsh marine environments for used Human Occupied Vehicle (HOV). The research focused on the basic theory research of intelligent system of structural health monitoring, and studied the acquisition of stress intensity factor (SIF) based on macro fiber composite (MFC) sensor to estimate crack propagation life guided by SIF. The SIF was obtained by the tensile failure test of single-edge-notch tension (SENT) specimen, and simulated by the finite element method. Designed and inspected the structural health monitoring platform, comparing the experiment with empirical formulas and numerical simulation results, proving the correctness of numerical simulation and the feasibility of using MFC sensors to monitor fatigue cracks.

Key words: Deep submersible, intelligent system of structural health monitoring, MFC sensor, stress intensity factor.

Research on Underwater Image Recognition Based on Deep Learning

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Abstract—In terms of the Autonomous Underwater Vehicle (AUV), the underwater optical visual perception is vital to fulfill the required tasks and autonomous intelligent decision-making. Meanwhile, the accuracy and speed problems can be effectively improved by deep learning techniques. Therefore, the Faster RCNN algorithm of deep learning is applied for underwater image recognition for the problems of complex and not easily identifiable underwater environment. The underwater image dataset is established firstly, and then the underwater image recognition system is designed and constructed using VGGNet and ResNet network structure, respectively, to study the influence of different network structures and depths on the accuracy of underwater image recognition, and conduct the comparative analysis of experiments. According to the results, the underwater image recognition accuracy of ResNet is higher than that of VGGNet; Appropriate increase in the network depth of ResNet can raise the recognition accuracy, however, too deep networks would lead to a decrease in the recognition accuracy.

Keywords: Underwater image recognition, faster R-CNN, VGGNet, ResNet.

A Real Time Multi-thread Underwater Images Enhancement System

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Abstract—Underwater images provide the most information for man-machine collaboration of underwater operations, however severe image quality degradation due to light absorption and scattering in water medium with suspended matter greatly affects efficiency to perceive the surrounding environment. In this paper, we develop a system for fast underwater enhancement to assist efficient underwater operations by giving more detailed and clear vision information. It uses auto multi-thread method to squeeze computing ability of hardware by creating an optimal number of processing threads considering both consistency and real time. And it is flexible to apply other algorithms or methods with a few changes as it is a method irrelevant framework and it can improve their efficiency.

Keywords: Image enhancement system, auto multi-thread, efficiency.

Planning for Fish Net Inspection with an Autonomous OSV

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Abstract—In aquaculture farming, escaping fish can lead to large economic losses and major local environmental impacts. As such, the careful inspection of fishnets for breaks or holes presents an important problem. In this paper, we extend upon our previous work in the design of an omnidirectional surface vehicle (OSV) for fishnet inspection by incorporating AI (artificial intelligence) planning methods. For large aquaculture sites, closely inspecting the surface of the net may lead to inefficient performance as holes may occur infrequently. We leverage a hierarchical task network planner to construct plans on when to evaluate a net closely and when to evaluate a net at a distance in order to survey the net with a wider range. Simulation results are provided.

Keywords: Omnidirectional surface vehicle, hierarchical task network planning.

Design and Simulation of Open Frame Underwater Towing Vehicle

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Technology, Wuhan, Hubei, China

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Abstract—By investigating the constraints of some underwater observer platforms, such as the weak payload capacity and the inability to stabilize the depth and attitude, a multi-degree-of-freedom open frame underwater towing vehicle capable of controlling the depth and attitude is proposed in this paper, which can be used as an underwater platform to carry on observer instruments. This underwater towing vehicle can improve the efficiency of underwater operations while meeting the needs to get accurate data in a stable platform. The towing vehicle is composed of four buoys, eight rudders, a control cabin, and the middle support frame. The depth of the towing vehicle is achieved by controlling the horizontal rudder in the front to generate the vertical lift force, and the pitch angle is achieved by controlling the horizontal rudder in the rear to generate the torque. The yaw angle in the horizontal plane is controlled with the same as the depth surface. Simulation results show that the designed towing vehicle has the characteristics of good stability by adopting a simple control mechanism to achieve underwater operations.

Keywords: Underwater robot, Towing vehicle, Structural design, Motion simulation.

WS01 Workshop on Offshore Robotics 2

9/2 (WA-5) 【IB-506】 14:40-15:40

Chairman: Prof. Hongde Qin

Virtual conference: Virtual conference software: Zoom

- #1129 **Recognition and 3D Pose Estimation for Underwater Objects Using Deep Convolutional Neural Network and Point Cloud Registration**
Xin-Xin Wang, Jian Gao and Lei Feng
- #1144 **Adaptive Localisation for USVs Using IMU-IMM**
Bryan Gunawan, Yuanchang Liu and Xudong Li
- #1156 **Online Reinforcement Learning-Based Adaptive Tracking Control of an Unknown Unmanned Surface Vehicle with Input**
Ning Wang and Yongpeng Weng

Recognition and 3D Pose Estimation for Underwater Objects Using Deep Convolutional Neural Network and Point Cloud Registration

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Abstract—Acquiring high-precision spatial position and posture of the object is essential for operation of underwater vehicle. The traditional methods of pose estimation based on point cloud require the manual extraction of the object point cloud, which have poor autonomy and low efficiency. For this problem, a novel method based on Convolutional Neural Network (CNN) and point cloud registration is proposed. In this paper, we use the center and range recognized by CNN of object to guide clustering segmentation of the point cloud data, and then extract the point cloud of the object. Finally, we complete the precise positioning of the object through coarse point cloud registration and fine point cloud registration. We build underwater experimental environment, and the results show that our method can effectively estimate the position of irregular object with high accuracy.

Keywords: Underwater vehicle, Convolutional Neural Network, clustering segmentation of point cloud, point cloud registration, pose estimation.

Adaptive Localisation for Unmanned Surface Vehicles Using IMU-Interacting Multiple Model

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Abstract—Current navigational practice in Unmanned Surface Vehicles (USVs) largely employs multi-sensor fusion that is structured upon Unscented Kalman Filter (UKF). However, the unpredictability of USVs makes it difficult for standard UKF to operate with satisfactory accuracy. This paper proposes that by substituting single model UKF with Interacting Multiple Model (IMM), provided estimations can better indicate and represent USVs' motion behaviour. To further develop the sensor fusion process, angular velocity from Inertial Measurement Unit (IMU) are exploited into IMM as auxiliary information, heightening confidence in identifying USV modes. The designed localisation algorithm is capable of adaptively recognise mode changes, yielding more responsive and reliable outcomes. Computer-based simulations of proposed IMU-based IMM with respect to other algorithms in maritime settings were done and results are shown to support stated improvements.

Keywords: Interacting multiple model (IMM), adaptive estimation, USV navigation, GPS/IMU.

Online Reinforcement Learning-based Adaptive Tracking Control of an Unknown Unmanned Surface Vehicle with Input Saturations

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Abstract—In this paper, a novel online reinforcement learning-based optimal tracking control scheme is proposed for an unmanned surface vehicle (USV) in the presence of input saturations. To be specific, the saturation function can be expressed as a combination of a hyperbolic tangent function function and a bounded function which is encapsulated into lumped tracking error dynamics. An auxiliary design system is introduced to compensate for the nonlinear term arising from the input saturations. In order to derive a practically optimal solution, the exponent index function is defined to ensure that the long-term cumulative reward is bounded, moreover, the NNs-based actor-critic reinforcement learning framework is built to recursively approximate the totally optimal policy and cost function. Eventually, the closed-loop system stability and tracking accuracy can be guaranteed by theoretical analysis, subject to optimal cost. Simulation results and comprehensive comparisons on a prototype USV demonstrate remarkable effectiveness and superiority.

Keywords: Online reinforcement learning-based control, optimal tracking control, adaptive control, input saturation, unmanned surface vehicle.

SS13 Intelligent Systems in Biometrics and Physiological Measurements

9/2 (WA-3) 【IB-507】 13:00-14:30

Chairman: Prof. Jing-Ming Guo

Virtual conference: Virtual conference software: Zoom

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|-------|---|------|
| #1077 | Spectrogram Analysis with Convolutional Neural Networks for Contact-Free Heart Rate Estimation Using Radar Signals | .371 |
| | | |
| | Jing-Ming Guo, Li-Wei Hsiao, Tsung-Neng Tsai, Wei-Wen Hsu, Meng-Yi Bai and Yu-Chi Wang | |
| #1164 | Design of a Lightweight Network Architecture for Palm Vein Recognition with Model Compression | .375 |
| | | |
| | Zih-Ching Chen, Sin-Ye Jhong and Chih-Hsien Hsia | |
| #1135 | Exposure Dosage Planning in Digital Lithography | .379 |
| | | |
| | Jian-Yang Li, Bo-Yuan Cai, Yu-Lin Wang and Hung Fei Kuo | |
| #1163 | A Rule-Base Granular Computing Approach for Stock Portfolio Optimization | .381 |
| | | |
| | Kao-Yi Shen, Hiroshi Sakai and San-Ting Lee | |

Spectrogram Analysis with Convolutional Neural Networks for Contact-Free Heart Rate Estimation Using Radar Signals

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|--|--|--|
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Abstract—In recent years, population aging has been a serious problem in many countries, and thus long-term care has become more and more important due to the shortage of labor. In this study, a contactless heart rate estimation system is proposed, which is expected to meet the clinical requirement and facilitate the process flow of healthcare. In the proposed system, the frequency-modulated continuous-wave (FM-CW) radar was used for measurement, and the characteristics of detailed signals can be extracted by its millimeter wave in data acquisition. Moreover, the raw signals from radar were transformed to the frequency domain by the Short-Time Fourier Transform (STFT) to obtain the time-frequency spectrograms. For spectrogram analysis, the deep neural networks structure was applied for frequency screening. To the best of our understanding, this is the first heart rate estimation system based on radar with spectrogram analysis. Experimental results show the regression model with deep convolutional networks can be used for heart rate estimation effectively and efficiently for long-term healthcare.

Keywords: Spectrogram analysis, contact-free heart rate estimation, frequency modulated continuous wave, residual module.

Design of a Lightweight Palm Vein Authentication System Based on Model Compression

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Sin-Ye Jhong

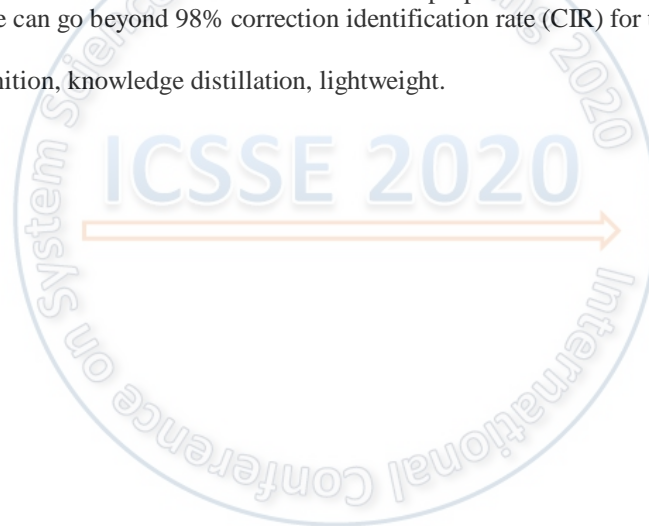
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Abstract—Palm vein authentication is a secure and highly accurate vein feature authentication technology that has recently gained a lot of attention. Convolutional neural networks (CNN) provide relatively high performance in the field of image recognition and have been adapted for feature learning of palm vein images. However, they often require high computation that not only are infeasible for real-time vein verification but also a challenge to apply on mobile devices. To address this limitation, we proposed a lightweight MobileNet based deep-learning (DL) architecture. Through the depth of separable convolution, the number of model parameters is significantly decreased, while still remaining high accuracy and stable performance. As results show that the size of the proposed model is 40 times less than the ResNet18 model, while the performance can go beyond 98% correction identification rate (CIR) for the CASIA database.

Keywords: Palm vein recognition, knowledge distillation, lightweight.



Exposure Dosage Planning in Digital Lithography

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Abstract—This research explores the spot array dosage planning reflected by the digital micromirror device (DMD) required for the digital lithography system. Due to the reusability and rapid ability to change exposure images based on DMD digital lithography, using DMD to expose can effectively reduce costs and increase exposure freedom for real-time compensation compared to the high manufacturing costs of traditional mask and the inability to change patterns. The dosage planning algorithm for this study is based on the improvement of the taboo search algorithm and the dosage planning algorithm based on the digital lithography process to solve optical errors and re-plan the dosage distribution to predict the image results on photoresist. In addition, the difference between the resist pattern and the target pattern is controlled below 10% to meet the manufacturing standards of advanced lithography processes.

Keywords: Exposure dosage, optimization, printed circuit board, advanced semiconductor packaging, digital lithography.

A Rule-base Granular Computing Approach for Stock Portfolio Optimization

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Abstract—This study proposes a novel interactive portfolio optimization approach based on: (a) rough set theory, (b) interactive granular computing, and (c) multi-objective optimization techniques. To illustrate this research idea, we adopt the TW50 (i.e., the top 50 blue-chip stocks of Taiwan's stock market) as an exemplary case. This novel approach adopts the rough set theory (RST) to explore critical rules to evaluate targeted stocks' financial prospects, and it integrates an investor's risk preference while forming the optimization model. Besides, investors may form reasonable expectation spaces, regarding return (gain) and risk (loss), to resolve the optimization problem in an interactive approach.

Keywords: Rough set theory (RST), granular computing, multi-objective decision-making (MODM), portfolio optimization.

SS14 Consensus for Large-scale Group Decision Making

9/2 (WA-4) 【IB-505】 14:40-15:40

**Chairmen: Prof. Jian Wu, Prof. Yucheng Dong, Zaiwu Gong,
Prof. Yejun Xu, and Prof. Zhen Zhang**

Virtual conference: Virtual conference software: ZooM

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|-------|---|
| #1084 | <p>A Joint Optimization Approach for Consensus in Large-scale Group Decision Making under Social Network</p> <p>Jian Wu, Tian Tian Gai and Ming Shuo Cao</p> |
| #1099 | <p>Dynamic Trust-driven Consensus Reaching Process in Social Network Multiple Attribute Group Decision Making</p> <p>Fang Wang and Hengjie Zhang</p> |

A Joint Optimization Approach for Consensus in Large-scale Group Decision Making under Social Network

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Abstract—This article mainly contributes to the application of social network and a joint feedback mechanism considering behavior. In the aspect of the application of social network in large-scale group decision making, this paper concludes that the importance degree of each decision-maker will be diluted with the expansion of social network scale, and the nodes' weights of the original social network are strictly monotonically decreasing. In addition, the range of parameter value can be obtained when the weight of the decision maker with highest importance is limited to a specific interval. In the aspect of the validity of joint feedback mechanism, this article proved that there will be a higher consensus level for the non-consensus decision makers after joint feedback process. Simultaneously, through the comparative analysis of numerical example, we figure out that the joint feedback mechanism with inconsistent feedback behavior has a higher general harmony degree than the one with consistent feedback behavior. Furthermore, this article pointed out some directions worth exploring, such as, bargaining model and interaction behavior.

Keywords: Group decision making, consensus.

Dynamic Trust-driven Consensus Reaching Process in Social Network Multiple Attribute Group Decision Making

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Abstract—The development of society and information technology has led to the emergence of social network multiple attribute group decision-making. This study proposes a dynamic trust-driven consensus reaching process to deal with social network multiple attribute group decision-making. In the dynamic trust-driven consensus reaching process, a trust-based feedback mechanism is designed to provide personalized preference-modifications suggestions based on the assumption that decision makers will refer to the preferences of the decision makers they trusted when updating preferences. Notably, the personalized preference-modifications suggestions for a specific decision maker are obtained from the preferences of the decision makers he/she trusted. Moreover, the social network updating mechanism is presented to facilitate the consensus reaching by creating influential decision makers. Compared to existing works on consensus-based social network multiple attribute group decision-making, our proposal has two distinct features: (i) personalized preference-modifications suggestions are generated for guiding the consensus reaching; (ii) the social network in our proposal is dynamic updated to promote the consensus building among decision makes.

Keywords: Multiple attribute group decision making, consensus, social network, personalized feedback mechanism.

SS15 Theory, method and application of conflict decision

9/2 (WA-4) 【IB-505】 14:40-15:40

Chairmen: Prof. Haiyan Xu and Prof. Ginger Y. Ke

Virtual conference: Virtual conference software: VooV

#1066 Multi-Level Option Form in Graph Model for Conflict Resolution

Shinan Zhao and Haiyan Xu

#1173 Methods on Inverse Problem for Different Behavior Patterns in Environmental Conflict Resolution

Yu Han and Haiyan Xu

Multi-level Option Form in Graph Model for Conflict Resolution

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Abstract—In real-world conflicts, a decision maker (DM) may own an option with more than two scenario selections. The multi-level option form is purposefully developed in this research within the framework of the graph model for conflict resolution for conveniently representing DMs' various choices of options. Furthermore, a case study is presented to show the equivalence relation between two-level and three-level option forms.

Keywords: Graph model for conflict resolution, option form, multi-level option.

Methods on Inverse Problem for Different Behavior Patterns in Environmental Conflict Resolution

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Abstract—A novel modeling and solving method is proposed using an integer programming considering different behavior pattern cognition of opponents' information based on the graph model for conflict resolution (GMCR), decision makers (DMs) or analysts can ascertain all the potentially possible preferences of each DMs to solve inverse problem in a conflict. As demonstrated by analysis of the garbage disposal controversy that took place in the Chinese city of Xiamen, this novel conflict resolution methodology can be readily applied to real-world strategic conflicts to gain an enhanced understanding of the effects of inverse perspective.

Keywords: Inverse graph model for conflict solution, matrix representation, solution concepts, integer programming.

SS05 Performance Analysis and Synthesis of Complex Systems

9/2 (WA-7) 【IB-505】 16:00-17:30

Chairmen: Prof. Jianwei Xia, Prof. Xudong Zhao, and Prof. Hao Shen

Virtual conference: Virtual conference software: VooV

- #1006 **Structural-algorithmic and Parametric Synthesis of N-Level Single Phase Voltage Source Inverter for Solar PV System**
Hein Zaw Htet, Gennady Sergeevich Mytsyk and Hlaing Min Oo
- #1016 **Algebraic State Space Representation for Boolean Networks with Multiple Time-Delays**
Guodong Zhao, Haitao Li and Yuanhua Wang
- #1030 **Fault Detection Observer Design for Nonlinear Discrete-Time Systems with Measurement Outliers**
Qi Li, Hong Xue and Yingnan Pan
- #1061 **Adaptive Dynamic Programming for a Class of Two-player Stackelberg Differential Games**
Ke Xu, Xudong Zhao and Xiumei Han
- #1066 **Sliding Mode Control for Double-pendulum Rotary Cranes**
Huimin Ouyang, Xiang Xu and Huan Xi
- #1068 **Adaptive Event-triggered Tracking Control for a Class of Uncertain Nonlinear Systems**
Wei Sun and Yuanwen Xing

Structural-algorithmic and parametric synthesis of Nlevel Single Phase Voltage source inverter for solar PV system

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Abstract—This paper describes a solution to the problem of structural-algorithmic and parametric synthesis (SAPS) for Nlevel single phase voltage source inverters (N-level SPVSI) with the optimization of these voltage levels to minimize total harmonic distortion (THD) of the output voltage. To solve this problem, the voltage source with intermediate taps with the required (optimal) values of voltage quantization levels is required. The results of solving the mathematical problem of the synthesis of the voltage waveform with pulse amplitude modulation (PAM) with equal-time quantization intervals and the founding for optimal values of quantization levels in the general case of a given number of levels “N” at a quarter of the output voltage N-level SPVSI are presented. The structural and algorithmic solutions synthesized based on the obtained results allow reducing the installed power and mass of the output filter of the N-level SPVSI. The results of numerical experiments to determine these quality indicators, which obtain based on computer simulation for N-level SPVSI at different output power values for several values of the number “N” are presented. Recommendations are given that are necessary for a comparative assessment of options and design. For the synthesis of N level SPVSI with the increasing power, is used the principle of multichannel conversion (MCC) of energy flow. **Keywords**— solar photovoltaic power plants (SPPP), solar modules (SM), structural-algorithmic and parametric synthesis (SAPS), N-level single-phase voltage source inverters (N-level SPVSI), pulse amplitude modulation (PAM); total harmonic distortion (THD), minimization of voltage distortion with PAM, voltage filtering, comparative analysis, model description, computer simulation, design, multi-channel conversion (MCC) of energy flow. **Abstract**— This paper describes a solution to the problem of structural-algorithmic and parametric synthesis (SAPS) for Nlevel single phase voltage source inverters (N-level SPVSI) with the optimization of these voltage levels to minimize total harmonic distortion (THD) of the output voltage. To solve this problem, the voltage source with intermediate taps with the required (optimal) values of voltage quantization levels is required. The results of solving the mathematical problem of the synthesis of the voltage waveform with pulse amplitude modulation (PAM) with equal-time quantization intervals and the founding for optimal values of quantization levels in the general case of a given number of levels “N” at a quarter of the output voltage N-level SPVSI are presented. The structural and algorithmic solutions synthesized based on the obtained results allow reducing the installed power and mass of the output filter of the N-level SPVSI. The results of numerical experiments to determine these quality indicators, which obtain based on computer simulation for N-level SPVSI at different output power values for several values of the number “N” are presented. Recommendations are given that are necessary for a comparative assessment of options and design. For the synthesis of N level SPVSI with the increasing power, is used the principle of multichannel conversion (MCC) of energy flow.

Keywords: Solar photovoltaic power plants (SPPP), solar modules (SM), structural-algorithmic and parametric synthesis (SAPS), N-level single-phase voltage source inverters (N-level SPVSI), pulse amplitude modulation (PAM); total harmonic distortion (THD), minimization of voltage distortion with PAM, voltage filtering, comparative analysis, model description, computer simulation, design, multi-channel conversion (MCC) of energy flow.

Algebraic State Space Representation for Boolean Networks with Multiple Time-delays

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Abstract—This paper studies the equivalence relationship between Boolean control networks with multiple time-delays (BCNMT) and higher order Boolean control networks, and gives a number of new results. Firstly, the relationship between BCNMTs and higher order Boolean control networks is analyzed. After that, BCNMTs are considered as some kinds of higher order Boolean control networks. Finally, an illustrative example is worked out to support the obtained new results.

Keywords: Boolean control networks, multiple time-delays, semi-tensor product method.

Fault Detection Observer Design for Nonlinear Discrete-Time Systems with Measurement Outliers

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Abstract—This paper focuses on the fault detection (FD) observer design issue for a category of nonlinear discrete-time Takagi-Sugeno (T-S) fuzzy systems, in which measurement outliers are considered. Based on the scheme of saturation function, a novel FD observer is designed to reduce the influence of abnormal measurement signals in the considered system. Then, sufficient conditions are provided to ensure the error system is stable and satisfies performance requirements. Compared with the existing works, the false alarm which may produce by measurement outliers is avoided by the designed observer. Lastly, simulation example is given to identify the effectiveness of the presented technique.

Keywords: Nonlinear systems, observer design, measurement outliers, fault detection.

Adaptive Dynamic Programming for a Class of Two-player Stackelberg Differential Games

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Abstract—Thank In this paper, we propose an adaptive dynamic programming algorithm based on policy iteration to solve the two-player nonlinear Stackelberg differential game. Stackelberg differential game is a hierarchical decision problem that allows the leader to choose its own optimal decision by predicting the follower's response to its decision. In this paper, Stackelberg feedback equilibrium solution is obtained by solving the coupled partial differential equations to ensure the stability of the system. A new strategy iterative algorithm for Stackelberg differential game problem is proposed. The effectiveness of the algorithm is illustrated by an example.

Keywords: Adaptive dynamic programming, stackelberg differential games, policy Iteration, neural networks.

Sliding Mode Control for Double-pendulum Rotary Cranes

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Abstract—The dynamic performance analysis and controller design become more difficult, when the load sways present double-pendulum characteristics. Moreover, achieving both high-precision tracking control and load sway suppression are a more significant issue for crane systems. In order to solve the aforementioned problems, the nonlinear dynamics of rotary crane with double-pendulum effect is derived and decoupled using a disturbance observer for controller design. Then, a novel sliding mode controller with nonlinear sliding surface is presented. Unlike a traditional linear sliding surface, the nonlinear one can change the damping ratio of the closed-loop system from its initial low value to final high value. Numerical simulations validate that the proposed method has superior control performance.

Keywords: Sliding mode control, tracking control, double-pendulum.

Adaptive Event-triggered Tracking Control for a class of Uncertain Nonlinear Systems

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Abstract—This paper considers the problem of event-triggered adaptive fuzzy control for a class of uncertain nonlinear systems. By combining the command filter techniques, backstepping control method with fuzzy logic systems, an adaptive event-triggered controller is designed. In this design, the problem of the explosion of complexity in traditional backstepping approach is addressed by employing command filter technique. The proposed event-triggered adaptive fuzzy controller guarantees that all signals in the closed systems are bounded and saves greatly network communication resource. Finally, the simulation results demonstrate the effectiveness of the proposed control strategy.

Keywords: Tracking control, adaptive fuzzy control, event triggered control.

SS06 Intelligent Control and Applications

9/2 (WA-8) 【IB-506】 16:00-17:30

Chairmen: Prof. Wen-Shyong Yu and Prof. Ching-Hung Lee

Virtual conference: Virtual conference software: Teams

- #1100 **Trajectory Tracking for a Two-Wheels Car Using Fuzzy Adaptive Balance Control**
Wen-Shyong Yu and Jin-Liang Kuo
- #1122 **The Fixed-Point Implementations for Recurrent Neural Networks**
Hsien-Ju Ko, Hao-Cheng Yang, Yuan-Bin Wang and Han He
- #1044 **Intelligent Harvesting System for Cherry Tomato**
Wei-yuan Lien, Chun-Ta Chen, Chuang-Hung Jung, You-Fu Chiang, Yu-Cheng Wu and Tse-Min Lee
- #1056 **Application of a Wearable Lower-Limbed Assistance Robot on Sit-to-Stand Movement**
Yu-Cheng Wu, Chun-Ta Chen, Wei-Yuan Lien, Tse-Min Lee, Huang Chen-En, Po-Hsiang Tsai, Mao-Chun Chang and Chi-Shiuan Lee
- #1105 **Formation Control of Multi-Agent Systems with Multiple Structures**
Shun-Hung Tsai, Yu-Wen Chen, Ming-Li Chiang and Ying-Jen Chen
- #1152 **Mining High Fuzzy Average-Utility Itemsets**
Tzung-Pei Hong, Meng-Ping Ku, Wei Ming Huang, Shu-Min Li and Chun-Wei Lin

Trajectory Tracking for a Two-Wheels Car Using Adaptive Fuzzy Balance Control

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Abstract—This paper mainly studies the realization of the two-left/right-wheels car (TLRWC) using adaptive fuzzy balance control design for trajectory tracking purpose. Two-wheels are driven by two DC motors, respectively, which are controlled by Arduino Mega 2560 microcontroller using three-axis gyroscope with three-axis accelerometer sensing module feedback. The adaptive fuzzy control is used to keep balancing of the car to follow the pre-specified trajectory in accordance with current standards without constructing sector dead-zone inverse due to motors hysteresis, where the control parameters of the fuzzy model are obtained both from the fuzzy inference and online update laws. By using the angles from the gyro sensing feedback to detect the vertical line of the car, the proposed control algorithm is given for obtaining the tracking distance error and fast tracking time. The control scheme is derived to stabilize the closed-loop system such that all states of the system are guaranteed to be bounded and tracking performance is achieved due to uncertainties, dead-zone nonlinearities, and external disturbances. Finally, experimental results are provided to verify the validity of the proposed control scheme.

Keywords: Two left/right wheels car, adaptive fuzzy control, gyro sensing feedback, forward/inverse kinematics, C#.

The Fixed-point Implementations for Recurrent Neural Networks

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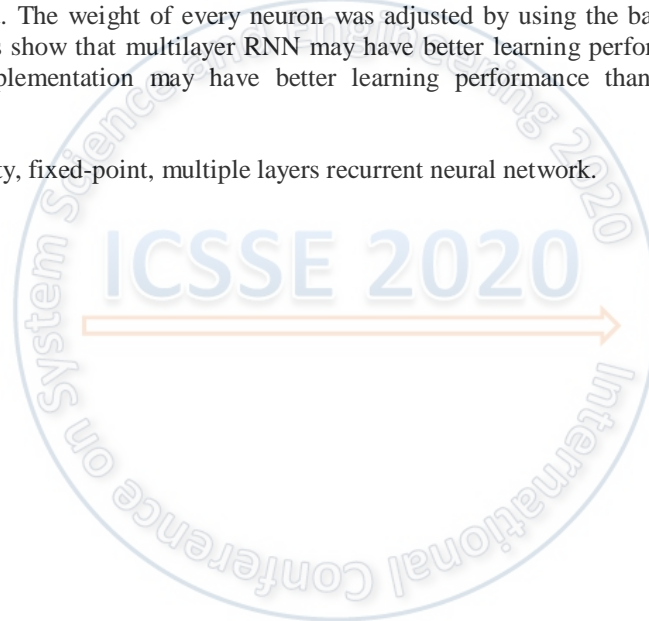
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Abstract—In this paper, the learning efficiency of the single layer and multiple-layer locally recurrent neural networks (RNN) were investigated. In the RNN structure, piecewise linear activation functions were used. In addition, infinite impulse response digital filter played the role of signal recursions. In RNN implementation, pole- L_2 sensitivity minimization was performed. The weight of every neuron was adjusted by using the back-propagation (BP) learning algorithm. Simulation results show that multilayer RNN may have better learning performance. In addition, the RNN with optimal IIR filter implementation may have better learning performance than that of the canonical-form realization.

Keywords: Pole- L_2 sensitivity, fixed-point, multiple layers recurrent neural network.



Intelligent Harvesting System for Cherry Tomato

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Abstract—Facing up to the problem of agricultural surplus labor decreasing however global population rising lead to increasing food demand, one of the better choices is using agricultural robot to assist human. With the development of modern agriculture, there are several technology development trends in robot and intelligence machine. For instance, increasing product value and reducing dependence on skilled labor have become major challenges for agriculture. Traditional agriculture is labor-intensive. In other words, it includes many unknown and unexpected tasks. In this paper, the goal is using designed robot to pick cherry tomato which is a kind of soft crops. Developed an intelligent agricultural robot system that combines machine vision, designed harvesting devices, robotic arms and automatic guided vehicles. Moreover, intelligent agricultural robots have been successfully tested under different conditions including farms. It has been verified that the system can maintain the success rate of separated cherry tomatoes above 80% in various fields.

Keywords: Agricultural robot, machine vision, harvesting device, cherry tomatoes.

Application of a Wearable Lower-Limbed Assistance Robot on Sit-to-Stand Movement

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Abstract— In this research, the objective is to develop a wearable lower-limbed assistance robot to help PD patients for home-based multi-reablement. Compared to conventional lower-limbed exoskeleton robots, the developed assistance robot is for the rehabilitation evaluation of PD patients with the action ability, expecting to evaluate the action rehabilitation with less medical staffs and family, and enable the wearable lower-limbed assistance robot to initiate the sit-to-stand transition. The research include the analysis of change in joint torque during sitting-to-standing movements that carried out on healthy people and patients with Parkinson's disease. The performance on our sitting-to-standing movement control strategy and its optimization, and the implementation in lab and clinical evaluation are also included.

Keywords: PD, wearable assistance robot, sit-to-stand transition.

Formation Control of Multi-agent Systems with Multiple Structures

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Abstract—This paper focused on the design of a control law for the multi-agent system such that the system can form into arbitrary shape and rotate while tracking a given trajectory. The formation strategy is further extended to the multi-layered structure such that we can handle the situation with a large number of agents. The proposed scheme generates the reference trajectories for a group of agents by a virtual formation motion which is also driven by the designed formation controller. That is, first we construct the trajectories for some virtual agents, and then the trajectories of these virtual agents become the reference trajectories of the agents in several groups. With such hierarchical design, we can systematically deal with the case which has a large number of agents. Some simulation examples are given illustrate the proposed design.

Keywords: Formation control, consensus, multiagent systems.

Mining High Fuzzy Average-Utility Itemsets

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Abstract—Fuzzy utility mining (FUM) has evolved into a new research issue. The average-utility measure is a variant of utility and is useful in some situations. In this work, we combine it and fuzzy sets, and propose a fuzzy average-utility mining method to mine linguistic average-utility itemsets. Experiments are also conducted to show the performance of the proposed approach.

Keywords: Average-utility measure, fuzzy set, fuzzy utility mining, linguistic itemset, two-phase mining.

Poster Session (II)

9/2: 16:00-17:30

#1010 **A Fuzzy C-Means Clustering Algorithm base on Spatial Context Model for Image Segmentation**

Tianyu Zhao, Jindong Xu and Guozheng Feng

#1139 **A Social Media Analytical Framework Incorporating Fuzzy Regression for Affective Design**

Pratima Jain and Kit Yan Chan

#1142 **Fast Finite-time Adaptive Event-triggered Tracking for Planar Nonlinear Systems**

Chao Zhou and Zong-Yao Sun

#1143 **Evaluation of Intelligent Vehicle Safety Based on AHP and Fuzzy Comprehensive Evaluation**

Xiuru Chen, Hong Mo, Cang Zhou and Fan Le

#1145 **An Unsupervised Multi-scale Micro-crack Segmentation Scheme for Multicrystalline Solar Cells**

Weijing Dou, Shuo Shan, Nawei Zhang, Jinxia Zhang, Kanjian Zhang and Haikun Wei

#1146 **Event-Triggered Synchronization for Memristor-Based Neural Networks**

Jianbin Qiu, Hao Zhang, Tong Wang and Qingshuang Zeng

#1147 **Nonlinearities Output-Feedback Adaptive Nonsingular Fast Terminal Sliding Mode Control for Redundant Parallel Manipulators**

Truong Van Nguyen, Shun-Feng Su, Thien Van Nguyen and Thuan Xuan Nguyen

#1176 **Adaptive Weighted Image Fusion Algorithm based on NSCT Multi-scale Decomposition**

Jia Liu, Miyi Duan, Wen-Bai Chen and Haobin Shi

- #1109 **Trajectory Outlier Detection Algorithm Based on VAE-LSTM Model**
Jiliang Chang and Lei Xie
- #1040 **Nonlinear output feedback control of double-pendulum ship-mounted cranes with amplitude saturation and gravitational compensation**
Ning Sun
- SS04:**
- #1059 **Research of Wireless Sensor Network Positioning**
Chien-Wu Lan and Wei-Ting Jian
- #1060 **Re-orientation Planning based on Semantic Segmentation Keypoint Detection**
Liyu Yeh, Yu-Cheng Lai, Shao-Yu Chien, Ching-Chang Wong, Chih-Cheng Liu and Chi-Yi Tsai
- #1104 **Strategy Design in Archery Behavior of Humanoid Robot Based Hough Transformation**
YIQING Liao, Chih-Cheng Liu, Li-Hsiang Chou
and Yu Ying Liu
- #1107 **Implementation of Dynamic Obstacle Avoidance for Mobile Robot Based on Gazebo Simulator**
Yu-Ming Kang, Li-Hsiang Chou, Shih-An Li, Yun Chien Chen and Chih-Cheng Liu
- #1115 **Design and Implementation of Two-Wheeled Self-Balancing Vehicle Based on Load Sensor**
Shao-Yu Chien, An-Sung Wang and Ching-Chang Wong
- #1171 **Design of Distributed Cloud Computing System**
Chin-Wang Tao, Rui-Qian Chang, Chia-Wen Chang and Sheng Kai Lin
- #1136 **Online Health Estimator of Hybrid Energy Storage System Based on Fuzzy Brain Emotional Learning Neural Network**
Zhifan Xu, Qiongbbin Lin and Chih-Min Lin
- #1151 **Perception and Recognition of Underwater Cable Based on Deep Learning**
Zhenyi Bi, Yu-Long Wang and Lang Ma
- #1100 **Finger Motion Identification Based on Wrist EMG Analysis Using Machine Learning**
Kazuki Nagatomo, Fukumi Minoru, Momoyo Ito and Shin-ichi Ito
- #1013 **Aperiodic Sampled-data Controller Design of Stochastic Markovian Jump Neural Networks With Time-Varying Delay**
Guoliang Chen, Te Yang and Jianwei Xia
- #1019 **Admissibility Analysis and Stabilization for Degenerate Jump Systems with Distributed Delay and Discrete State Dela**
Guowei Zhao, Kun Ma, Guangming Zhuang, Wei Sun, Yuqian Lin and Jie Wang
- #1038 **Adaptive Fuzzy Finite-Time Fault-Tolerant Control for Uncertain Non-strict Feedback Nonlinear Systems**
Yanli Fan and Yongming Li
- #1074 **Consensus Output Regulation of a Class of Nonlinear Multi-agent Systems with Unknown Control Directions**
Chunling Wei, Shaoning Liu, Qiande Wang and Zhengqiang Zhang
- #1075 **An LQG Optimal Linear Controller for Fin Stabilizer System of Marine Vessels**
Duy Quang Nguyen, Tieshan Li, Renhai Yu, Qihe Shan, Yue Wu and Jun Ning
- #1076 **Course Control of Unmanned Sailboat Based on BAS-PID Algorithm**
Lin Zhou, Kai Chen, Zhen Chen, Hang Dong and Qing Dong Song
- #1160 **Quasi-Synchronization of Coupled Reaction-Diffusion Neural Networks via Time-Space Sampled-Data Control**
Xingru Li and Xiaona Song
- #1108 **A Smart Face Recognition System for Companion Robot**
Kuo-Ho Su, Jui-Chen Wu and Te-Cheng Sung

A Fuzzy C-Means Clustering Algorithm Base on Spatial Context Model for Image Segmentation

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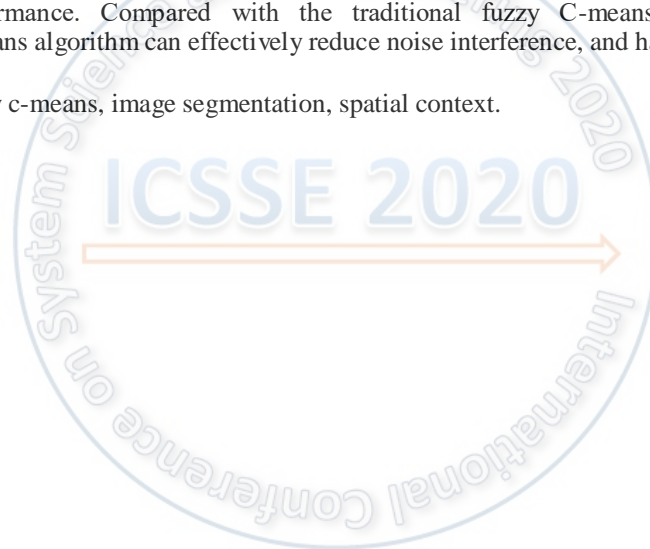
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Abstract—An improved fuzzy C-means algorithm based on spatial context reliability model is proposed for image segmentation, which is called spatial context reliability-based fuzzy C-means (RSFCM) algorithm. Aiming to improve the robustness and accuracy of the clustering algorithm, spatial context reliability-based fuzzy C-means algorithm integrates neighborhood correlation model with the reliability measurement to describe the spatial relationship of the target. It can make up for the shortcomings of the known fuzzy C-means algorithm which is sensitive to noise. Furthermore, spatial context reliability-based fuzzy C-means algorithm preserves details of the image by balancing the insensitivity of noise and the reduction of edge blur using a new fuzzy measure indicator. A synthetic image was used to test the algorithm's performance. Compared with the traditional fuzzy C-means algorithm, spatial context reliability-based fuzzy C-means algorithm can effectively reduce noise interference, and has better robustness.

Keywords: Clustering, fuzzy c-means, image segmentation, spatial context.



A Social Media Analytical Framework Incorporating Fuzzy Regression for Affective Design

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Abstract—Rapidly changing world has increased the demand and requirement for a new product. A new product is now required to satisfy users' emotional desires along with elementary functions. Affective design plays an important role in the success of new products. Determining affective needs assist in understanding consumers' requirement. Since affective needs are subjective and varies individually, evaluating affective needs contains certain amount of uncertainty or fuzziness. This paper proposes a social media analytical framework, namely SMAF that utilizes consumer opinion data from social media in order to measure affective qualities in new product. The SMAF is integrated with fuzzy regression to predict affective quality; fuzzy regression is used to evaluate uncertainty which exists in users' affective quality perceptions. The mechanism of the proposed framework is demonstrated by a case study on affective design of automobiles. The SMAF framework attempts to analyze uncertainty while evaluating affective qualities of car models with different brands. Additionally, the framework is utilized to extract and analyze affective design data from real and diverse population. The result shows that uncertainty varies with colors on affective qualities of automobiles.

Keywords: Affective design, fuzzy regression, social media data framework, social media, big data.

Fast Finite-time Adaptive Event-triggered Tracking for Planar Nonlinear Systems

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Abstract—This work investigates a fast finite-time adaptive event-triggered tracking control problem for a class of high-order nonlinear systems from a new point of view. A new concept, named Fast Finite-time Performance Function (FFTPF), is defined in this paper for the first time. Moreover, prescribed performance function clearly reflects that the tracking error converges to an arbitrarily small residual set within a finite-time interval, with convergence rate no less than a prespecified value, exhibiting a maximum overshoot less than a sufficiently small prespecified constant. At the same time, the event-triggered rule is designed to reduce the amount of communication from the controller to the actuator. Finally, a simulation example confirms the effectiveness of theoretical results.

Keywords: fast finite-time adaptive tracking, event-triggered rules, high-order uncertain nonlinear systems.

Evaluation of Intelligent Vehicle Safety Based on AHP and Fuzzy Comprehensive Evaluation

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Abstract: From April 20, 2020, the intelligent taxi (Robotaxi) has entered citizens' lives for the first time in Changsha without restrictions. In order to improve the road safety of intelligent vehicle driving, this paper proposes a method for evaluating the safety level of intelligent vehicle driving, which provides a reference for the improvement of intelligent vehicle design and safety. In this paper, some safety situation are considered firstly, which includes common road safety scenarios and vehicle driving safety state, the factors that affect driving safety are analyzed, then the weights of various safety scenarios according to the influencing factors are analyzed, and finally the evaluation method based on the fuzzy comprehensive evaluation method are discussed, and its feasibility ability are verified.

Keywords: Intelligent vehicle, safety risk, fuzzy analytic hierarchy process (AHP), fuzzy comprehensive evaluation.

An Unsupervised Multi-scale Micro-crack Segmentation Scheme for Multicrystalline Solar Cells

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Abstract—Solar cells play a key part in photovoltaic power system. Micro-crack is one of the common defaults, which will reduce the conversion efficiency and usable lifetime of solar cells enormously. So it is essential to locate it and identify the shape to help us obtain more detailed assessment of power loss. However, the automatic detection and segmentation of micro-crack from electroluminescence (EL) images of solar cells have been a challenging task. In this work, we propose an unsupervised multiscale micro-crack segmentation scheme for multicrystalline solar cells, which takes advantages of both of the superpixel-level and the pixel-level segmentation on the EL images. Firstly, in order to avoid disturbances from the grid of the cell, we partition the EL image of a single cell into pieces. Then, a fusion of superpixel and pixel outcomes is employed to obtain the accurate pixel-level micro-crack by considering the global and local features collectively. Finally, we restore the results of each pixel on the piece to the cell corresponding location. The experimental results show that the proposed scheme is more accurate, and the shape and area of micro-crack can be evaluated particularly.

Keywords: Micro-crack, segmentation, multiscale, superpixel, pixel, solar cells.

Event-Triggered Synchronization for Memristor-based Neural Networks

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Abstract—This paper studies the synchronization problem of memristor-based neural networks under networked environment, in which the network bandwidth and computational resources are limited. An event-triggered state feedback control strategy is proposed. By taking the proposed triggering mechanism into account, some new sufficient conditions are obtained to ensure that memristor-based neural networks achieve synchronization with limited network bandwidth and computational resource. Different from the previous related works, continuous event detectors are adopted to determine whether the current data should be sampled or not, and the Zeno phenomena are considered. Finally, a numerical simulation example is given to verify the effectiveness of the proposed strategy.

Keywords: Synchronization, memristor-based neural networks, event-triggered scheme.

Nonlinearities Output-Feedback Adaptive Nonsingular Fast Terminal Sliding Mode Control for Redundant Parallel Manipulators

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Abstract—In this paper, the nonlinearities output-feedback adaptive nonsingular fast terminal sliding mode controller is proposed for finite-time tracking control of redundant parallel manipulators in the case of high-speed motions. In the literature, there has not been any study of hybrid of the nonsingular fast terminal sliding mode control (NFTSMC) and nonlinearities output-feedback (NOF) for high-speed trajectory tracking control. Based on the NOF and NFTSMC, the proposed approach enhances the nonsingular fast terminal sliding mode control. The proposed control has several advantages such as rapid response, robustness, nonsingular, and convergence faster to the finite-time stable equilibrium. Besides, since the proposed approach is a hybrid scheme of NOF and NFTSMC, the proposed control scheme can have superior tracking control performance and uncertainties rejection ability compared with standard NFTSMC. Finally, simulation results are clearly demonstrated to provide that the proposed approach can indeed outperform previous existing methods.

Keywords: Redundant parallel manipulator, nonsingular fast terminal sliding mode control, nonlinearities outputfeedback, high-speed motion, trajectory tracking.

Adaptive Weighted Image Fusion Algorithm Based on NSCT Multi-scale Decomposition

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Abstract—The purpose of infrared image and visible light image fusion is to preserve as much as possible the target information in the infrared image and the detailed information in the visible light image. For this purpose, this paper first extracts the infrared image saliency map based on guided filtering, uses NSCT to decompose infrared and visible light images at multiple scales, adds the infrared image saliency map to the low-frequency component, and applies weighted average fusion through the adaptive infrared weight map. In the high frequency component, the absolute value of the maximum coefficient is taken to be the maximum for fusion. This method takes into account the generally high brightness of human targets in infrared images, maintains the edge information of the image, and fully considers the anti-noise performance of the fusion method, and can adaptively take into account the complex and changeable environment.

Keywords: Infrared image, visible light image, image fusion, saliency map, NSCT.

Trajectory Outlier Detection Algorithm Based on VAE-LSTM Model

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Abstract—The rapid advances in positioning technology have created huge marine vehicle spatio-temporal trajectory data, and there are always obvious aberrant outliers in marine vehicle trajectory data. It is critical to improving data quality and the accuracy of subsequent trajectory data mining tasks in detecting outliers in the marine vehicle trajectory. In this paper, we propose a marine vehicle trajectory outlier detection algorithm based on a VAE-LSTM model. First, a 3-dimensional motion feature vector is built and then we construct a VAELSTM model by combining Variational Auto-Encoder (VAE) with Long Short-Term Memory (LSTM) model. The VAE-LSTM model can automatically learn the feature of the abnormal trajectory points in the 3-dimensional motion feature and identify abnormal trajectory points by reconstructing errors. Experimental results based on a real marine vehicle trajectory annotation data show that the performance of our proposed marine vehicle trajectory outlier detection algorithm exceeds classical machine learning classification algorithms.

Keywords: Marine vehicle trajectory data, outlier detection, variational auto-encoder, long short-term memory.

Nonlinear Output Feedback Control of Double-pendulum Ship-mounted Cranes with Amplitude Saturation and Gravitational Compensation

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Abstract—An amplitude-saturated output feedback control method is first proposed for double-pendulum ship-mounted crane systems to eliminate steady errors and unexpected cargo swings. No velocity signal is required, reducing additional sensor costs and preventing introducing differential noises. Additionally, a new adaptive law is designed which can accurately identify unknown gravitational parameters. More practically, the designed controller provides saturated control inputs by constraining the amplitudes within tunable boundaries. Simulation results are given.

Keywords: Ship-mounted cranes, double-pendulum effects, output feedback control, gravitational compensation, amplitude saturation.

Research of Wireless Sensor Network Positioning

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Abstract—Since GPS signal is blocked by buildings, how to realize indoor locating without using GPS is becoming popular. However, due to the influences of signal attenuation, difference of signal strength, and signal reflected by obstacle, the error of indoor locating is difficult to be reduced. In this study, neural networks and Kalman filter are used on RFID sensor network locating system is proposed to improve locating accuracy. At beginning, received signal strength (RSS) of each three RFID locating reference anchor nodes are measured at particular locations. The measured results are used for neural networks to learn the relationships between signal states of anchors and RFID tag location. Besides, positions calculated from different three anchors at the same location are used to predict position that is more accurate by Kalman filter. Finally, the effectiveness of the indoor position system using the proposed neural network and Kalman filter to improve the locating accuracy has been demonstrated by several experimental results.

Keywords: Indoor locating, neural network, Kalman filter, RFID sensor network.

Reorientation Planning Based on Semantic Segmentation Keypoint Detection

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Abstract—In this paper, an issue of re-orientating an object to the specified position from arbitrary posture by using a robot manipulator was explored. At the outset, the task were defined into two components: (1) a visual 6 Degree-of-Freedom (DoF) pose estimation system based on Mask R-CNN and semantic segmentation and (2) the manipulation of a planning system for object reorientation. The pose estimation component used 3D keypoints as object representation, through which the geometry costs and constraints that enable operation targets to be specified could be simplified and easily interpretable, providing a flexible overview of existing pose-based operation methods. In addition, it generated the 3D suction point of the object both in target and goal through the given the target suction point and the goal suction point of the object. The manipulation component produced the sequence of robot movements and grasp their configurations so as to re-orientate the object from the initial pose to the target pose. The proposed method was demonstrated on a laboratory-made 7 DoF robot manipulator and a vacuum suction gripper.

Keywords: Object reorientation, pick-and-place, mask R-CNN, semantic segmentation, 3D keypoint detection.

Strategy Design in Archery Behavior of Humanoid Robot Based Hough Transformation

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Abstract—In the FIRA robot competition, the rules of the archery competition are being more challenging. Therefore, this paper uses Hough transform algorithm to obtain the edge of the target and find the center of the target so that the humanoid robot can complete the task of archery. Experiments result shows that this algorithm can reduce the probability of misjudgment of the target caused by light exposure. And the Hough transform algorithm proposed in this paper is applied to target identification, which can effectively increase the hit rate of archery.

Keywords: Hough transform, humanoid robot, image edge detection, image processing.

Implementation of Dynamic Obstacle Avoidance for Mobile Robot Based on Gazebo Simulator

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Abstract—In this paper, we proposed a path planning method that combines an improved dynamic window approach (IDWA) and artificial potential field algorithm to avoid obstacles. This method implemented in the wheeled robot of the Gazebo simulator. This paper follow FIRA RoboSot's obstacle avoidance challenge as the experimental environment. First, we use the IDWA algorithm to plan the starting path in the environment. When the robot is too close to an obstacle on this path, it will trigger the APF algorithm to modify the original path, so that the robot can complete obstacle avoidance more effectively. We use scan line data obtained from the Gazebo sensor kit as the input, and the output is the motion vector of the robot. In the experimental results, it can be observed that the method proposed in this paper can avoid obstacles in the experimental environment with high success rate and complete obstacle avoidance with a smoothly path.

Keywords: Improved dynamic window approach (IDWA), artificial potential field (APF), gazebo simulator, wheeled Robot, obstacle avoidance.

Design and Implementation of Two-Wheeled Self-Balancing Vehicle Based on Load Sensors

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Abstract—In this paper, an easy-to-use two-wheeled self-balancing vehicle was implemented by using an Arduino control board, inertial measurement unit, and six load sensors. The two-wheeled balance vehicle designed in this paper is based on the inertial sensor to detect the inclination of vehicle, and a load sensor is added to detect the driver's posture of standing on the two-wheeled balance vehicle. In order to improve the situation that the motor output is not as expected due to the ankle angle change causing the vehicle to misjudge the center of gravity angle, the load sensors were not only to detect the left and right changes of center of human's gravity, but also used to detect the front and rear changes of center of gravity to correct the angle difference of the center of human's gravity and the center of the vehicle. In addition, the load sensors were also used to estimate the height of the center of human's gravity, so that people with different heights and weights can have a similar riding experience.

Keywords: Inertial measurement unit, two-wheeled self-balancing vehicle, segway, inertial sensor, posture estimation, control system

Design of Distributed Cloud Computing System

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Abstract—This paper aims to develop a user-friendly distributed cloud computing system based on Hadoop and Spark. A Web-based graphical user interface (WGUI) is built with PHP to supply some functions including data store, data backup, and computing etc. The user can create a new folder into the Hadoop distributed file system (HDFS) through the developed WGUI. Then, the data-file or the code-file can be upload to the folder. Finally, the source code would be executed by the cloud computing system and the execution results would be feedback to the WGUI.

Keywords: Hadoop, spark, distributed system, cloud computing.

Online Health Estimate of Hybrid Energy Storage System Based on Fuzzy Brain Emotional Learning Neural Networks

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Abstract—This paper aims to propose a more efficient estimator and applies it to health estimation for battery and supercapacitor in the hybrid energy storage system (HESS). A novel method for online health estimator based on fuzzy brain emotional learning neural network (FBELNN) is proposed. It's different from conventional fuzzy brain emotional learning neural network that the fuzzy inference system and the novel reward signal are applied in this paper. The proposed method uses wavelet packet decomposition (WPD) and principal component analysis (PCA) to extract features from impulse respond of load surges. The parameter adaptation laws of the FBELNN are derived and wavelet packet function selection method based on the frequency band energy entropy is presented. The method of WPD-PCA can reduce the workload of feature extraction. Through the neural network estimate the capacity of battery and supercapacitor in real-time, one can better ensure the safety of HESS. The training samples and test samples are collected from the response of voltage signals in HESS simulation platform. Compared to other conventional methods, it's shown that the anti-noise performance and the accuracy are improved by the proposed method.

Keywords: Feature extraction, fuzzy brain emotional learning neural network, hybrid energy storage system, impulse load, state of health.

Perception and Recognition of Underwater Cable Based on Deep Learning

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Abstract—Aiming at the problems of blurring, low contrast and high noise of underwater target data sets, this paper proposes an underwater image enhancement method based on weight fusion to enhance the image of underwater cables. This method introduces the idea of image fusion to fuse the pictures processed by the white balance algorithm and the auto level algorithm according to a certain weight. It achieves the performance of color correction and target enhancement. The characteristics of the underwater cable are clearer after the image enhancement preprocessing. In addition, an underwater target recognition system based on deep learning is established. The Faster RCNN and SSD deep learning algorithms are utilized to realize underwater cable recognition. Good recognition accuracy and performance are demonstrated through an experiment on data set of underwater cables.

Keywords: underwater image enhancement, deep learning, target recognition.

Finger Motion Identification Based on Wrist EMG Analysis Using Machine Learning

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Abstract—In our paper, we identify 3 pattern motions that are Rock-scissors-paper finger motions. Conventional work recognized such motions using EMG (Electromyogram) in a stable state. We try to identify the motions by using the short-time wrist EMG at the beginning of movement and SVM. As a result, we obtained identification accuracy of 82%:

Keywords: wrist EMG, SVM, dry type sensor.

Aperiodic Sampled-data Controller Design of Stochastic Markovian Jump Neural Networks With Time-varying Delay

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Abstract—In this paper, aperiodic sampled-data controller design problem for stochastic Markovian jump neural networks (SMJNNs) with time-varying delay is considered. By constructing mode-dependent looped-functional based functional and using Ito[^] formula, stochastic stability criteria are proposed for SMJNNs with time-varying delay. Based on this stability conditions, mode dependent aperiodic sampled-data controller is designed for SMNNs. A Numerical example is provided to illustrate the effectiveness of the proposed method.

Keywords: Stochastic Markovian jump neural networks, sampled-data control, time-delay, stability.

Admissibility Analysis and Stabilization for Degenerate Jump Systems with Distributed Delay and Discrete State Delay

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Abstract—This work is concerned with admissibility analysis and stabilization for degenerate jump systems (DJSs) with distributed delay and discrete state delay. Firstly, admissibility analysis is studied for the unforced delay DJSs based on singular value decomposition (SVD) technique and Lyapunov stability theory. Secondly, mode-dependent state feedback controller is designed to realize stabilization of the delayed closed-loop DJSs. By choosing L-K functional with delay and MJ modes information, admissibility and stabilization conditions are expressed in terms of linear matrix inequalities (LMIs). A simulation example is employed to certify the validity of the admissibilization method.

Keywords: Degenerate jump systems, admissibility analysis, stabilization, distributed delay and discrete state delay, Singular value decomposition.

Adaptive Fuzzy Finite-time Fault-Tolerant Control for Uncertain Non-strict Feedback Nonlinear Systems

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Abstract—In this paper, the finite-time fault-tolerant control design problem is addressed for non-strict feedback nonlinear systems. The considered nonlinear systems contain bias fault and loss of effectiveness in actuator. The fuzzy logic systems (FLSs) are introduced to approximate the unknown nonlinear functions. Combined with adding one power integrator method, fault-tolerant processing technique and backstepping design technique, a finite-time fault-tolerant controller is constructed. The proposed control approach is capable of ensuring the semi-global practical finite-time stability for the plant systems. Finally, a simulation example is given to illustrate the effectiveness of the proposed adaptive finite-time fault-tolerant control strategy.

Keywords: Adaptive fuzzy control, fault-tolerant control, finite-time control, adding one power integrator technique.

Consensus Output Regulation of a Class of Nonlinear Multi-agent Systems with Unknown Control Directions

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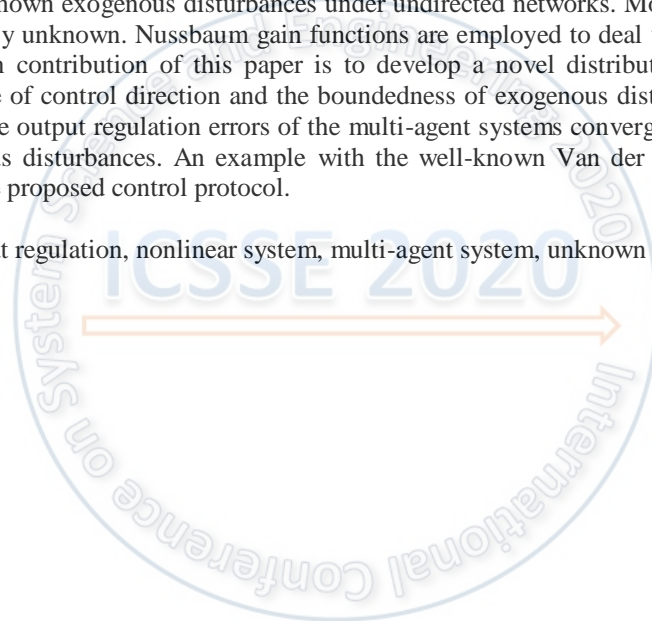
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Abstract—In this paper, we consider the consensus output regulation of a class of unknown high-order nonlinear multiagent systems with unknown exogenous disturbances under undirected networks. Moreover, the control directions are supposed to be completely unknown. Nussbaum gain functions are employed to deal with the problem of unknown control directions. The main contribution of this paper is to develop a novel distributed adaptive control protocol without using the knowledge of control direction and the boundedness of exogenous disturbance. It is verified that all variables are bounded and the output regulation errors of the multi-agent systems converge asymptotically to zero even in the presence of exogenous disturbances. An example with the well-known Van der Pol oscillator is presented to prove the effectiveness of the proposed control protocol.

Keywords: Consensus output regulation, nonlinear system, multi-agent system, unknown control direction.



An LQG Optimal Linear Controller for Fin Stabilizer System of Marine Vessels

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Abstract—When sailing at sea, the ship's rolling motion will greatly affect the safety of the ship and the cargo, as well as the health of the crew. As a common means for roll reduction, active fins are usually installed on ships, and the roll reduction efficiency of these fins depends primarily on the controller. In our work, a Linear Quadratic Gaussian (LQG) optimal controller is proposed for the ship linear fin stabilizer system. Specifically, this LQG control method is combined by the linear quadratic regulator (LQR) method and the linear quadratic estimator (LQE) method, the latter of which is also known as the Kalman filter. Therefore, the separation principle is used in this paper to solve the roll reduction problem of ships, namely the LQG controller is derived by solving the predestined optimal control problem and the optimal state estimation problem. Finally, the stability and efficiency of the proposed LQG controller is validated by conducting contrast simulation with the LQR controller, and the result of which shows better performance of the designed LQG strategy.

Keywords: Fin stabilizer, linear quadratic gaussian, optimal control, linear quadratic regulator, kalman filter.

Course Control of Unmanned Sailboat Based on BAS-PID Algorithm

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Abstract—Unmanned sailboat course control is the core of unmanned sailboat automatic navigation. In order to improve the stability of navigation course control, a compound PID controller combining beetle search algorithm (BAS-PID) and PID strategy is proposed to control the steering gear to achieve the course control of unmanned sailboat. Firstly, the Nomoto motion and steering gear mathematical model were established by Matlab/Simulink modeling tools. Secondly, the PID parameter adjustment problem is transformed into a three-dimensional parameter optimization problem, and the beetle search algorithm is used to optimize the PID parameters. Finally, the comparison of the performance indicators of different algorithms is simulated, and the result shows that the BAS-PID controller has a better control effect which provides a reference for the course control design of unmanned sailboat.

Keywords: Sailboat, BAS-PID, course control, nomoto.

Quasi-synchronization of Coupled Reaction-diffusion Neural Networks via Time-space Sampled-data Control

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Abstract—This paper investigates the quasi-synchronization of reaction-diffusion neural networks with state coupling and mismatched parameter via the time-space sampled-data control strategy. Compared with traditional control strategies, the time-space sampled-data control mechanism not only is effective to save the limited networks bandwidth but also improve the cybersecurity of communications. First, in the case of parameter mismatch, quasi-synchronization criteria are derived by Lyapunov Krasovskii functional and inequality techniques. Second, by solving a set of linear matrix inequalities, the desired time-space sampled-data control gains are obtained. Finally, a numerical example is given to demonstrate the effectiveness of the proposed control method.

Keywords: Neural networks, time-space sampled-data control, quasi-synchronization, parameter mismatch.

A Smart Face Recognition System for Companion Robot

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Abstract—Through deep learning and convolutional neural networks, a new era of Facenet has been opened. Since the output of the Facenet model is a quantified value, this value can be used to compare the degree of difference between multiple faces. If Multi-task Cascaded Convolutional Neural Network (MTCNN) is arranged in groups, the recognition performance will possess better accuracy. After some comparisons, this study adopts Googlenet to establish face model and optimize it by using MTCNN. In addition, to realize the face recognition on the camera side and no need to connect to large computer, above model and recognition procedure are carried out in a smart controller. In this research, the Intel Neural Compute Stick2 vision processing unit (VPU) is used as the vision processing chip. In terms of deep learning framework, Tensorflow is selected as deep learning framework to construct a smart face recognition system in the first part of this research. Furthermore, in order to improve the interaction requirements between the companion robot and the host, the second part of this study embeds above smart face identification system into robot as its main controller. Such that the robot can interact with the host based on the controller's latest emotional status. To verify its feasibility, some simulation results are provided and a prototype is implemented in this research.

Keywords: Googlenet, multi-task cascaded convolutional neural networks, vision processing unit, companion robot, raspberry Pi microcontroller.

Poster Session (III)

9/3: 10:00-11:30

SS02, SS03:

- #1071 **Simple iOS Electronic Signature System**
Chen-Chia Chuang, Yu-Yun Tsai and Jin-Tsong Jeng
- #1083 **A Feature Selection Approach for People Trend Analysis**
Chih-Ching Hsiao, Jin-Tsong Jeng and Chen-Chia Chuang
- #1096 **An Online Fuzzy Control System for Parallel Manipulators**
Hsu-Chih Huang, Sendren Sheng-Dong Xu, Chien-Ming Chen and Jing-Jun Xu
- #1159 **An Intelligent Delta Robot for Maze Solving using Deep Q-Learning**
Li-Cheng Jin, Chun-Wen Wang, Xin-Chen Shen, I-Hsum Li and Lian-Wang Lee
- #1132 **An Efficient Wireless Charger Placement Scheme for Rechargeable Sensing Devices in Wireless Sensor Networks**
Jau-Yang Chang and Min-Tang Li

Simple iOS Electronic Signature System

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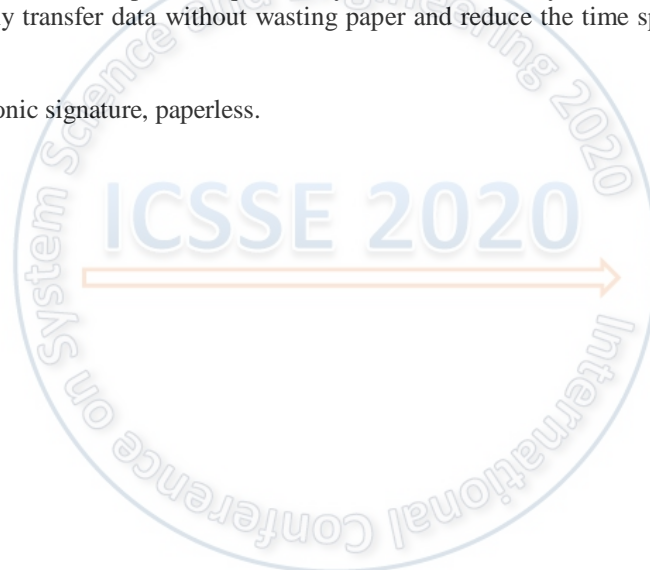
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Abstract—With the gradual progress of technology, mobile devices have also been integrated into people's lives and the rise of environmental awareness, and gradually turned paper documents into digital and paperless, and even tablet computers have replaced textbooks. Since many current important documents are transmitted by the mobile phone and printed out, they are manually filled in and then faxed or photographed and returned. In this process, paper is often wasted. Therefore, the proposed App is written in the iOS Swift language. It can take screenshots of the data and import it into the App to allow users to directly use electronic signatures, fill in all kinds of data, and adjust the thickness, size, color, and position that users want. Save to the picture, just send the picture back by email to achieve the function we want. The in-app design allows users to operate it quite easily and understandably, and can use it without teaching, so as to allow users to conveniently transfer data without wasting paper and reduce the time spent in the process to achieve the same function.

Keywords: iOS, App, electronic signature, paperless.



A Feature Selection Approach for People Trend Analysis

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Abstract—In this paper, it mainly discuss about feature selection for big data and people trend prediction application. The so-called People trend includes the people flow and consuming behavior. The big data including exhibition features (traffic flow, commodities, ...) and people features (Age, Gender, ...), will be collected by Beacon network. The feedback may include many features, we will deal with this problem based on multi-view feature selection approach. Feature feedback can complement traditional active learning in this application.

Keywords: People trend, feature selection, feature feedback.

An Online Fuzzy Control System for Parallel Manipulators

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Abstract—This paper presents an online fuzzy control system for parallel manipulators. Having the derived kinematic equation of Stewart robotic manipulator, an online fuzzy PID (proportional-integral-derivative) control scheme is developed to achieve motion control. The fuzzy theory is combined with PID control strategy to online tune the PID parameters. Simulation results demonstrate the effectiveness of the proposed methods.

Keywords: Fuzzy control, online control, parallel manipulators.

An Intelligent Delta Robot for Maze Solving with Deep Q-Learning

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Abstract—This paper presents an intelligent delta robot for maze solving problem by using a deep Q-Learning. The intelligent delta robot can solve maze problem with an optimal path from a remote high-performance server. The MQTT technique is applied to build the communication between the delta robot and the server in this paper. An experimental result presented here to show the effectiveness and usefulness for our presented intelligent delta robot.

Keyword: Delta Robot, Deep Q-Learning, Maze Solving problem.

An Efficient Wireless Charger Placement Scheme for Rechargeable Sensing Devices in Wireless Sensor Networks

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Abstract—It is important and necessary to develop an efficient charger placement scheme for rechargeable sensing devices in wireless sensor networks. We propose the clustering charger placement scheme and algorithm to create a uniform cluster by calculating the average distance among the entire sensing devices. According to the candidate location of charger, the location of the deployment charger can be selected based on the uniform cluster structure. The reasonable deployment costs of chargers can be achieved and the coverage of charging equipment is increased. Additionally, the goal of extending the lifetime of wireless sensor networks can be implemented.

Keywords: Charger, coverage, deployment budget, sensing device, wireless sensor networks.

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