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ICDL 2023 Sponsors

We acknowledge the support of the following sponsors to the IEEE International Conference on Development and Learning 2023.
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WELCOME MESSAGE

On behalf of the IEEE ICDL 2023 Conference Organizing Committee, we are very pleased to welcome you to Macau, China for the 2023 IEEE International Conference on Development and Learning. We are proud to announce that the IEEE ICDL 2023 conference accepted 84 papers from 129 submissions, resulting in an acceptance rate of 65%. We should mention that the IEEE ICDL 2023 Program Committee worked extremely hard to review the paper submissions in order to maintain the quality of the conference. We regret that many excellent papers could not be included in the conference program.

IEEE ICDL 2023 is highlighted by 5 plenary/keynote speeches. ICDL community focuses on the understanding of how biological agents take advantage of interaction with social and physical environments to develop their cognitive capabilities. Moreover, how this knowledge can be used to improve future computing and robotic systems. IEEE ICDL 2023 promises to offer participants a great experience with excellent technical and social programs.

We wish to express our appreciation and thanks to all the individuals who have contributed to IEEE ICDL 2023 in a variety of ways. Special thanks are extended to our colleagues in the Program Committee for their thorough review of all the submitted papers, which is vital to the success of this conference. We must also extend our thanks to all the members in the Organizing Committee and our volunteer students who have dedicated their time and efforts and helping the conference. Last but not least, our special thanks go to distinguished plenary speakers, keynote speakers and all the authors for contributing their research work, and to the participants and the exhibitors in making the 2023 ICDL a great event. Thank you and wish you a great conference experience and enjoyable stay in Macau.

Zhijun Li
General Chair
Univ. of Sci. and Tech. of China, China

Jianqiang Li
Program Chair
Shenzhen Univ., China

Chenguang Yang
Organizing Chair
Bristol Robotics Laboratory UK
## CONFERENCE COMMITTEE

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<td>Yaochu Jin</td>
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<td>J. M. Garibaldi</td>
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<td>J. S. Dai</td>
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<td>Gary Yen</td>
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<td>Qingsong Xu</td>
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<tr>
<td>Lorenzo Jamone</td>
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<td>Yukie Nagai</td>
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<td>Dingsheng Luo</td>
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<td>Xiao Wang</td>
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<td>Qinghua Huang</td>
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<td>Rongxin Cui</td>
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<td>Haisheng Xia</td>
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<td>Guoxin Li</td>
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CONFERENCE INFORMATION

IEEE International Conference on Development and Learning 2023 (ICDL) will take place in Macau, China from November 9 to 11, 2023. Macau is just across the Pearl River Delta from Hong Kong, and its giant casinos and extravagant malls have earned it the nickname as “Las Vegas of Asia.” It will not only provide the attendees with a great venue for this event, but also an unparalleled experience in a mixed culture of Portuguese and Chinese.

ICDL is a highly selective annual international conference that aims to showcase and share the very best interdisciplinary and multidisciplinary research on how humans and animals develop sensing, reasoning and actions.

Language

The official language of the conference is English.

Conference Registration

All conference attendees are required to register.

Registration fees are as follows:

<table>
<thead>
<tr>
<th>Registration Type</th>
<th>Early Registration September 10 – September 30, 2023</th>
<th>Advance registration October 1 – October 31, 2023</th>
<th>Electronic Proceedings &amp; Banquet</th>
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<td>IEEE Member</td>
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<tr>
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<td>800 USD</td>
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*Conference registration fee includes admission to all technical sessions, lunches, dinners.

Onsite Registration Hours and Location

Date: Nov. 8, 2023. Time: 13:00 -18:00. Venue: Sheraton Grand Macao Hotel.
VENUE INFORMATION

Sheraton Grand Macao Hotel

Address: The Londoner Macao, Estrada do Istmo, s/n, Cotai, Macau
Contact number: (853) 2880 2000
Website: https://www.londonermacao.com/hotels/sheraton-macao.html
Floor Map of Resort

Transportation

Hong Kong International Airport – 45 minutes by high speed ferry or 60 minutes via the new Hong Kong- Zhuhai-Macao Bridge (HZMB). Travelers transit to Macau and bypass customs with convenient baggage tag-through services on most airlines.

➢ Macau International Airport provides regional connections to most major Asian ports.
➢ 60 minutes by high speed ferry at the Sheung Wan Ferry Terminal on Hong Kong Island or Tsim Sha Tsui Ferry in Kowloon.
➢ China border crossing into Guangdong province at Zhuhai or Hengqin.
➢ Sheraton Grand Macao is located 10 minutes from Macau International Airport and the Taipa Ferry Terminal. The Macau ferry terminal is 20 minutes away.

Parking

On-site parking: No Charge for all in-house guests.
# CONFERENCE SCHEDULE

## Wednesday, November 8, 2023

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>13:00 - 18:00</td>
<td>Registration Desk Open</td>
<td>Sheraton Grand Macao Hotel</td>
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## Thursday, November 9, 2023

### Morning

**Location:** University of Macau  E4-G078  
(Mr and Mrs Lau Chor Tak Lecture Theatre  刘佐德伉俪演讲厅)

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker Information</th>
</tr>
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<tbody>
<tr>
<td>08:30 - 09:00</td>
<td>Opening Ceremony</td>
<td>Host: Zhijun Li</td>
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</table>
| 09:00 - 9:40   | Title: Vision-Based Robot Localization, Navigation, and Control  
**Speaker:** Hesheng Wang, Professor, Shanghai Jiao Tong University, China | Host: Zhijun Li                                          |
| 9:40 - 10:20   | Title: Neuromorphic Cognitive Computing to Build Robotic Brain  
**Speaker:** Huajin Tang, Professor, Zhejiang University, China | Host: Jianqiang Li                                       |
| 10:20 - 11:00  | Title: Designing Exoskeletons and Prosthetic Limbs that Enhance Human Locomotor Performance  
**Speaker:** Steven Hartley Collins, Professor, Stanford University, US | Host: Chenguang Yang                                     |
| 11:00 - 11:40  | Title: Skin-Integrated Electronics as Human Machine Interface for VR/AR  
**Speaker:** Xinge Yu, Professor, City University of Hong Kong, China | Host: Jianqiang Li                                       |
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Location</th>
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</table>
| 11:40 - 12:20| **Title:** Fuzzy Broad Learning (Neuro) Systems (FBLS): Explainability and Analysis on the Tradeoff between Accuracy and Complexity  
**Speaker:** C.L. Philip Chen, Dean, School of Computer Science and Engineering, South China University and Technology, China | **Host:** Jianqiang Li |
| 12:20 - 14:00| Lunch Break                                                            |                           |

**Afternoon**

**Location:** Sheraton Grand Macao Hotel

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Location</th>
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<tr>
<td>14:00 - 16:00</td>
<td>Regular Session ThPMA1: Award I</td>
<td>Hamadan 6-1</td>
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<td>Regular Session ThPMA2: Award II</td>
<td>Hamadan 6-2</td>
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<td>Regular Session ThPMR1: Machine Learning Methods for Robot Development</td>
<td>Hamadan 6-16</td>
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<tr>
<td>16:00 - 16:15</td>
<td>Tea Break</td>
<td>Foyer</td>
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<td>16:15 - 18:15</td>
<td>Regular Session ThPMR2: Development of Skills in Biological Systems and Robots</td>
<td>Hamadan 6-16</td>
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<td>Regular Session ThPMR3: Human-human and Human-robot Interaction and Communication</td>
<td>Hamadan 6-1</td>
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<tr>
<td></td>
<td>Regular Session ThPMR4: Robot Prototyping of Human and Animal Skills</td>
<td>Hamadan 6-2</td>
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<tr>
<td>18:15 - 21:00</td>
<td>Welcome Banquet</td>
<td>Hamadan 6 -12</td>
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**Friday, November 10, 2023**

**Morning**

**Free Time**

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<th>Time</th>
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<td>Time</td>
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<tr>
<td>14:00 - 15:30</td>
<td>Regular Session FrPMR1: Cognitive Vision</td>
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<td>Regular Session FrPMR2: Multimodal Perception/Haptic and Tactile Perception</td>
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<td>Regular Session FrPMR3: Language / Concept / Active Learning</td>
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<tr>
<td>15:30 - 15:45</td>
<td>Tea Break</td>
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<td>15:45 - 18:00</td>
<td>Regular Session FrPMR4: Grounding of Knowledge and Development of Representations /Multimodal Perception</td>
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<td>Regular Session FrPMR5: Active Learning / Statistical Learning</td>
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<td></td>
<td>Regular Session FrPMR6: Prediction, Planning and Problem Solving</td>
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<tr>
<td>18:00 - 21:00</td>
<td>Award Banquet</td>
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**Saturday, November 11, 2023**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session Description</th>
<th>Location</th>
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<tr>
<td>09:00-11:30</td>
<td>Lab Tour (Professor Qingsong Xu)</td>
<td>Smart and Micro/Nano Systems Laboratory</td>
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</table>

**Location:** University of Macau
Plenary-Keynote Talk:

November 9 09:00-09:40  University of Macau

Vision-Based Robot Localization, Navigation, and Control

Hesheng Wang,
Shanghai Jiao Tong University

Abstract: This report focuses on the two core functions of service robots: mobility and manipulation. First, an overview of the current status of the service robot industry and technological development, along with the challenges faced, is provided. Next, the report introduces the key achievements of the team’s long-term efforts in addressing the core technical challenges of mobility and manipulation. To tackle the issue of velocity perception and localization failure caused by the complex dynamics of non-holonomic mobile robots and dynamic environmental interferences, a computation method that integrates attention-based back-end optimization and explicit occlusion handling is proposed. This method achieves robust perception and localization of mobile robots through visual fusion in complex and large scenes. To address the problem of traditional calibrated control algorithms being prone to failure in uncalibrated environments, an adaptive visual servoing framework is developed that entirely relies on visual feedback without prior environmental information. This framework solves the challenge of high-precision robotic operations without calibration. A practical and versatile vision-based method system has been established, elevating the critical technological level of service robots.

Biography: Hesheng Wang received the Ph.D. degree from the Chinese University of Hong Kong. Currently, he is a Distinguished Professor of Shanghai Jiao Tong University, China. He has published more than 200 papers in refereed journals and conferences. He is an associate editor of IEEE Transactions on Automation Science Engineering, IEEE Robotics and Automation Letters, Assembly Automation and International Journal of Humanoid Robotics, a Technical Editor of IEEE/ASME
Transactions on Mechatronics. He served as an associate editor for IEEE Transactions on Robotics from 2015 to 2019. He was the general chair of IEEE RCAR2016 and IEEE ROBIO2022, and program chair of IEEE AIM2019 and IEEE ROBIO2014. He was a recipient of The National Science Fund for Outstanding Young Scholars in 2017, Shanghai Shuguang Scholar in 2019 and The National Science Fund for Distinguished Young Scholars in 2022. He will be the General Chair of IROS2025.
Plenary-Keynote Talk:

November 9  9:40-10:20  University of Macau

Neuromorphic Cognitive Computing to Build Robotic Brain

Huajin Tang
Zhejiang University

Abstract: Mimicking the computation, learning and decision making of biological brains is a key challenge for brain science and brain-inspired intelligence research. There are various ways and efforts to model biological brains and transform the modeling methods to embodied robotic intelligence. We hypothesize that the crucial steps are to emulate the computational substrates and the perception, learning, and decision making capabilities emerging from the neural modalities. Neuromorphic cognitive computing is a new theme of computing technology that aims for brain-like computing efficiency and intelligence, and holds a high potential to build robotic brain with computational advantages analog to biological brains. This talk will focus on some recent research progresses, including spike-based learning, sensory processing, and our efforts to build robotic brain.

Biography: Huajin Tang received the Ph.D. degree from the National University of Singapore in 2005. He was an R&D Engineer with STMicroelectronics, Singapore from 2004 to 2006. From 2006, he was a Postdoc with Queensland Brain Institute, University of Queensland, Australia. From 2008-2015 he was the Lab Head of Robotic Cognition at the Institute for Infocomm Research (A*STAR) Singapore. He has been a Professor and Director of the Neuromorphic Computing Research Center, Sichuan University, China. Currently he is a Professor with College of Computer Science and Technology, Zhejiang University. His research work on Brain GPS was reported by MIT Technology Review and Communications of ACM, etc. He received the 2016 Outstanding IEEE TNNLS Award and 2019 Outstanding IEEE CIM Paper Award. Prof. Tang is EIC for IEEE Trans. on Cognitive and Developmental Systems (TCDS), and a Board of Governor member of International Neural Networks Society (INNS).
Plenary-Keynote Talk:

November 9  10: 20-11: 00  University of Macau

Designing Exoskeletons and Prosthetic Limbs that Enhance Human Locomotor Performance

Steven Hartley Collins
Stanford University

Abstract: Exoskeletons and active prosthetic limbs could improve mobility for tens of millions of people, but two serious challenges must first be overcome: we need ways of identifying what a device should do to benefit an individual user, and we need cheap, efficient hardware that can do it. In this talk, we will describe an approach to the design of wearable robots based on versatile emulator systems and algorithms that automatically customize assistance, which we call human-in-the-loop optimization. We will discuss recent successes of the approach, including large improvements to the energy economy and speed of walking and running through optimized exoskeleton assistance, in both laboratory and real-world conditions. We will also discuss the design of exoskeletons that use no energy themselves yet reduce the energy cost of human walking, and ultra-efficient electroadhesive actuators that could make wearable robots substantially cheaper and more effective.

Biography: Steven H. Collins is an Associate Professor of Mechanical Engineering and, by courtesy, Bioengineering at Stanford University, where he directs the Stanford Biomechatronics Laboratory. His research is focused on speeding and systematizing the design of prostheses and exoskeletons using versatile emulator hardware (Zhang et al. 2017, Science) and algorithms for human-in-the-loop optimization (Slade et al., 2022, Nature). Another interest is efficient autonomous devices, such as passive-dynamic walking robots (Collins et al. 2005, Science) and unpowered exoskeletons (Collins et al. 2015, Nature). Prof. Collins received his B.S. in Mechanical Engineering in 2002 from Cornell University, where he performed research on passive dynamics with Andy Ruina. He received his Ph.D. in Mechanical Engineering in 2008 from the
University of Michigan, where he performed research on the biomechanics of human walking with Art Kuo. He performed postdoctoral research on humanoid robots with Martijn Wisse at T. U. Delft in the Netherlands. He was a professor of Mechanical Engineering and Robotics at Carnegie Mellon University before joining Stanford in 2017. Prof. Collins teaches courses on design and robotics and is the Faculty Director of making@stanford. He is a member of the Boards of Dynamic Walking and Science Robotics. He has received the Young Scientist Award from the American Society of Biomechanics and the Best Medical Devices Paper from the International Conference on Robotics and Automation. His teaching has been recognized with student-voted awards including the Tau Beta Pi Teaching Honor Roll and Professor of the Year in his department.
Plenary-Keynote Talk:

November 9  11:00 - 11:40  University of Macau

Skin-Integrated Electronics as Human Machine Interface for VR/AR

Xinge Yu
City University of Hong Kong

Abstract: Skin-integrated electronics have attracted great attentions due to the advantages of soft, lightweight, ultrathin architecture, and stretchable/bendable, thus has the potential to apply in various areas, especially in the field of biomedical engineering. By engineering the classes of materials processing and devices integration, the mechanical properties of the flexible electronics can well match the soft biological tissues to enable measuring bio signals and monitoring human body health. In this report, we will present materials, device structures, power delivery strategies and communication schemes as the basis for novel soft bio-integrated electronics. For instance, we will discuss a wireless, battery-free platform of electronic systems and haptic interfaces capable of softly laminating onto the skin to communicate information via spatio-temporally programmable patterns of localized mechanical vibrations. The resulting technology, which we refer as epidermal VR, creates many opportunities where the skin provides an electronically programmable communication and sensory input channel to the body, as demonstrated through example applications in social media/personal engagement, prosthetic control/feedback and gaming/entertainment.

Biography: Xinge Yu is currently an Associate Professor of Biomedical Engineering at City University of Hong Kong (CityU), Associate Director of Hong Kong Centre for Cerebro-cardiovascular Health Engineering, and Associate Director of the CAS-CityU Joint Lab on Robotics. He is the recipient of Hong Kong RGC Fellow, NSFC Excellent Young Scientist Grant (Hong Kong & Macao), Innovators under 35 China (MIT Technology Review), New Innovator of IEEE NanoMed, MINE Young Scientist Award, Gold Medal in the Inventions Geneva, CityU Outstanding Research Award,
Stanford’s top 2% most highly cited scientists 2022 etc. Xinge Yu’s research group is focusing on skin-integrated electronics and systems for VR and biomedical applications. Now he serves the Associate Editor of Microsystem & NanoEngineering and IEEE Open Journal of Nanotechnology; Editorial Boards for 14 journals, such as Soft Science, Materials Today Physics etc. He has published 160 papers in Nature, Nature Materials, Nature Biomedical Engineering, Nature Machine Intelligence, Nature Communications, Science Advances etc..
Plenary-Keynote Talk:

November 9  11: 40 - 12: 20  University of Macau

Fuzzy Broad Learning (Neuro) Systems (FBLS):

Explainability and Analysis on the Tradeoff between Accuracy and Complexity

C.L. Philip Chen
South China University and Technology

Abstract: The fuzzy broad learning system (FBLS) is a recently proposed neuro-fuzzy model that shares the similar structure of a broad learning system (BLS). It shows high accuracy in both classification and regression tasks and inherits the fast computational nature of a BLS. However, the ensemble of several fuzzy subsystems in an FBLS decreases the possibility of understanding the fuzzy model since the fuzzy rules from different fuzzy systems are difficult to combine together while keeping the consistence.

To balance the model accuracy and complexity, this talk is to discuss a synthetically simplified FBLS with better interpretability, named compact FBLS (CFBLS), which can generate much fewer and more explainable fuzzy rules for understanding. In such a way, only one traditional Takagi–Sugeno–Kang fuzzy system is employed in the feature layer of a CFBLS, and the input universe of discourse is equally partitioned to obtain the fuzzy sets with proper linguistic labels accordingly. The random feature selection matrix and rule combination matrix are employed to reduce the total number of fuzzy rules and to avoid the “curse of dimensionality.” The experiments on the popular datasets indicate that the CFBLS can generate a smaller set of comprehensible fuzzy rules and achieve much higher accuracy than some state-of-the-art neuro-fuzzy models. Moreover, the advantage of CFBLS is also verified in a real-world application.

Biography: C. L. Philip Chen is the Chair Professor and Dean of the College of Computer Science and Engineering, South China University of Technology. He is a Fellow of IEEE, AAAS, IAPR, CAA, CAAI and HKIE; a member of Academia
Europaea (AE), and a member of European Academy of Sciences and Arts (EASA). He received IEEE Norbert Wiener Award in 2018 for his contribution in systems and cybernetics, and machine learnings, and IEEE Joseph G. Wohl Outstanding Career award, and Wu WenJun (吴文俊) Outstanding Contribution award from Chinese AI Association, received two times best transactions paper award from IEEE Transactions on Neural Networks and Learning Systems for his papers in 2014 and 2018. He is a highly cited researcher by Clarivate Analytics from 2018-2022. His current research interests include cybernetics, systems, and computational intelligence. He was the Editor-in-Chief of the IEEE Transactions on Cybernetics, the Editor-in-Chief of the IEEE Transactions on Systems, Man, and Cybernetics: Systems, and the President of IEEE Systems, Man, and Cybernetics Society.
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<th>Room</th>
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<tr>
<td>14:00 - 16:00</td>
<td>Regular Session ThPMA1: Award I</td>
<td>Hamadan 6-1</td>
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<td>Regular Session ThPMA2: Award II</td>
<td>Hamadan 6-2</td>
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<td></td>
<td>Regular Session ThPMR1: Machine Learning Methods for Robot Development</td>
<td>Hamadan 6-16</td>
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<td>16:15 - 18:15</td>
<td>Regular Session ThPMR2: Development of Skills in Biological Systems and Robots</td>
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<td>Regular Session ThPMR4: Robot Prototyping of Human and Animal Skills</td>
<td>Hamadan 6-2</td>
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IEEE ICDL 2023 Conference Digest

ThPMA1: Award Session I

Sheraton Grand Macao Hotel, Hamadan 6-1, 14:00 - 16:00, Thursday, Nov. 9, 2023

ThPMA1.1  ID: 0009  14:00 - 14:15
Learning, Fast and Slow: A Goal-Directed Memory-Based Approach for Dynamic Environments
John Tan Chong Min and Mehul Motani
Dept of Electrical and Computer Engineering, National University of Singapore

- Uses a Fast Neural-Network-Based Goal-Directed Network to select next action without reward learning (learned with self-supervised learning without rewards)
- Uses a Slow Memory-Based Retrieval Network to identify trajectories to goal state in parallel and repeat next successful action
- Achieved 95.9% score rate in a dynamically changing grid world (better than PPO (61.2%), TRPO (28.1%), Q2C (20.5%), DDQN (4.9%))
- Code: https://github.com/tanchongmin/learning-fast-and-slow

ThPMA1.2  ID: 0016  14:15 - 14:30
Lexical Acquisition from Audio-Visual Streams using a Multimodal Recurrent State-Space Model
Soichiro Kamata, Kaito Yoshida, Masayuki, Akira Taniguchi, and Tadahiro Taniguchi
Showa University, Japan

- We propose a MoPQe-RSM model designed to form shared representations and perform cross-modal inference with visual and audio information
- We applied the proposed MoPQe-RSM to a stream of audio-visual data for modeling lexical acquisition
- The results suggest that the network can learn words and that multimodal input improved its prediction performance
- However, an MoPQe-RSM structure alone was not able to predict the probability of transitions between words sufficiently.

ThPMA1.3  ID: 0038  14:30 - 14:45
Interplay Between Neural Computational Energy and Multimodal Processing in Robot-Robot Interaction
Huiyi Zhou, Jingyi Guo, Yuan Zhang, Yanyu Wang, and Yanyi Hang

- Interpretable model-based interaction with two humanoid robots using a neural-gaseous autonomous agent. The trained model is capable of generating decoupled visual and neural signals without explicit energy consumption.
- The model adapts to the environment to maintain neural activity, even when faced with visual disturbances.

ThPMA1.4  ID: 0045  14:45 - 15:00
Exploring Gender Differences in EEG-based Emotion Recognition with Haptic Vibration
Xin Wang1, Baoqun Xu1, Jiaxin Wang1, Wenbin Zhang2 and Aguio Song1
1School of Instrument Science and Engineering, Southwestern University of Science and Technology, China
2College of Computer and Information, Hohai University, China

- We applied visual-auditory-haptic fusion stimuli to induce emotions, and the EEG signals were recorded simultaneously.
- Females generally had lower brain activation changes than males across all frequency bands.
- Haptic stimuli improved in subject emotion classification accuracy, especially for females (83.5% vs. 70% for 0.5-2.56 Hz).
- Females showed greater inter-subject differences than males, haptic stimuli reduced these differences, particularly in males.

ThPMA1.5  ID: 0046  15:00 - 15:15
Leveraging Empowerment to Model Tool Use in Reinforcement Learning
Faizan Rashdi, Daniel Polani and Niccolò Catapano
Volpi Adaptive Systems Research Group, University of Hertfordshire, UK

- We introduce the intrinsic motivation “object empowerment” to measure the influence a RL agent has on the object of the environment.
- Object empowerment can be leveraged to compare different tools and determine their relative impact on a given object.
- We employ object empowerment as a regularizer to guide the reinforcement learning agent towards states beneficial for learning how to master tasks for efficient task completion.

ThPMA1.6  ID: 0054  15:15 - 15:30
QM-Cube – A Tactile Cube to Explore Hand Interaction
Zhong Li, Jie Zhang

- The proposed QM-Cube is designed to help users understand the tactile interaction between their hands and the cube. It consists of a series of tactile points, each representing a specific interaction point.
- The cube’s design allows for intuitive exploration of various tactile interactions and provides a practical tool for teaching and learning about hand movements and grip forces.
- The QM-Cube has been tested in various scenarios, demonstrating its effectiveness in enhancing tactile perception and interaction skills.
ThPMA2: Award Session II

Sheraton Grand Macao Hotel, Hamadan 6-2, 14:00 - 16:00, Thursday, Nov. 9, 2023

**ThPMA2.1 ID: 0056  14:00 - 14:15**

**Automated Parameters Prediction for Microwave Thermal Ablation of Liver Tumor with Ultrasound Image**
Lihli Jia and Yifan Hao and Qinghua Huang
School of Artificial Intelligence, Optics and Electronics (SPIOE), Northwestern Polytechnical University, China
Wenzhang Ding and Ping Liang and Jie Yu
Department of Interventional Ultrasound, Chinese PLA General Hospital Fifth Medical Center, China

- The first attempt to predict the MTA parameters of HCC with good results.
- Propose a multimodal feature fusion method guided by ablation energy.
- Use clustering and nearest neighbor search (NNS) to predict the ablation parameters.

**ThPMA2.2 ID: 0069  14:15 - 14:30**

**Intelligent Magnetic Control and Surgical Planning of a Multi-Segment Robotic Catheter for Endovascular Intervention**
Zhengyang Li and Qinggong Xu
Department of Electromechanical Engineering, Faculty of Science and Technology, University of Macau, China

- An intelligent magnetic control of a multi-segment robotic catheter is proposed.
- It is remotely actuated by an external mobile magnet system.
- Surgical planning in the coronary arteries is analyzed in four different steering scenarios.
- The effectiveness is verified by an ex vivo steering experiment within a humanized arterial phantom.

**ThPMA2.3 ID: 0075  14:30 - 14:45**

**Environmental recognition and multimode continuous-phase control for a powered transfemoral prosthesis**
ShuCong Yin1, XinXing Chen1, Teng Ma2, YuXuan Wang1, YuXuan Guo1, YuQuan Long1 and ChengLong Fu1
1. Mechanical and Energy Engineering, Southern University of Science and Technology, China
2. Biomedical Engineering, National University of Singapore, Singapore

- Propose a vision sensor and continuous-phase fusion control method.
- Model the desired joint trajectories as functions of gait phase and environmental features.
- Provide powered transfemoral prostheses with adaptive capacity to the environment.
- Involve an amputee to evaluate the performance of the proposed method.

**ThPMA2.4 ID: 0082  14:45 - 15:00**

**Visual Explanations: Activation-based Acute Lymphoblastic Leukemia Cell Classification**
Muhammad umair Raza, Adil Nawaz, Xintong Liu, Zhuanghaohuang Chen, Victor C.M. Leung, Jie Chen, and Jianggeng Li
College of Computer Science and Software Engineering, Shenzhen University, China

- Visualization of CNN feature maps for locating the pathological area.
- White blood cells (leukemia cell classification).
- Activation-based visual explanations.
- Empirically overcomes the trade-off between interpretability and accuracy.

**ThPMA2.5 ID: 0095  15:00 - 15:15**

**Caregiver Talk Shaping Toddler Vision: A Computational Study of Dyadic Play**
Timothy Schaufelle1, Gemma Roig2
1. Department of Computer Science, Goethe University, Germany
2. Frankfurt Institute for Advanced Studies, Germany

- Computational model of toddlers during dyadic play session.
- Time- and cross-mode contrastive learning.
- Outlier of ego-centric object manipulations + caregivers utterances.
- Robust appearance statistics improve semantic visual representations.

**ThPMA2.6 ID: 0097  15:15 - 15:30**

**Robust Model Predictive Control of a Lower Limb Exoskeleton Robot with Suspension Gravity-Assist using Deep Neural Network**
Guosin Li, Hasheng Xia, Liangui Xu, Pengbo Huang
Department of Automation, University of Science and Technology of China, China
Min Zeng
AIHUA AI Joint Laboratory, Archai University.
Institute of Artificial Intelligence, Henan Comprehensive National Science Center
Yongzheng He
Henan Xiangyu Medical Equipment Co., LTD.

- We propose a model-based control strategy using deep learning for the lower limb exoskeleton with suspension gravity-assist systems in gait neurorehabilitation.
- We developed a deep neural network to estimate the unknown dynamic parameters and a robust model predictive control to stably track the desired trajectory.
IEEE ICDL 2023 Conference Digest

**ThPMR1: Regular Session (Machine Learning Methods for Robot Development)**

Sheraton Grand Macao Hotel, Hamadan 6-16, 14:00 - 16:00, Thursday, Nov. 9, 2023

**ThPMR1.1**  
**ID:** 0015  
**14:00 - 14:15**  
**An Ethological Analysis of Developmental Behavior in Machines**  
Saturnu Isaka  
Vision Dot Net, LLC, USA.

- Why and how could machines learn autonomously and develop new behavior?
- Value systems are central but what are they and how do they emerge?
- Apply an ethological approach to deriving ultimate-proximate explanations.
- Demonstrate the idea in a simple mobile robot.

**ThPMR1.2**  
**ID:** 0022  
**14:15 - 14:30**  
**Novel Methods Inspired by Reinforcement Learning**  
**Actor-Critic Mechanism for Eye-in-Hand Calibration in Robotics**  
Chenming Li, Fabien Schreier and Shahram Esfandi  
Department of Computer Science, University of Tübingen, Germany  
Jan Seyler  
Advanced Development Analytics and Control, Festo SE and Co. KG, Germany  
Yinlong Liu  
HUI Cloud Intelligent Technology Co., Ltd., Ningbo, China  
Yingbao Hu  
Multi-Scale Medical Robotics Centre and the China-Vari Krakow Technology Centre for Innovative Medicine, The Chinese University of Hong Kong, China

- Manifold sampling is implemented in RL.
- A new reward mechanism is designed based on the uniqueness of the calibration solution.
- A novel modified Actor-Critic learning method is proposed to improve the calibration performance.

**ThPMR1.3**  
**ID:** 0031  
**14:30 - 14:45**  
**State Representation Learning for Task and Motion Planning in Robot Manipulation**  
Qu Weiming, Wei Yiyang, Luo Dingliang  
National Key Laboratory of General Artificial Intelligence, Key Laboratory of Machine Perception (IMI), School of Intelligence Science and Technology, Peking University, Beijing 100871, China.

- A state representation learning method based on a variational autoencoder network and prior knowledge for robot arm manipulation.
- A joint learning strategy for both the state representation model and the environment model to enhance the performance of the environment model.
- A planning method based on greedy search of the value function and a replanning method based on model predictive control to improve the efficiency and success rate of the robot arm in completing complex manipulation tasks.

**ThPMR1.4**  
**ID:** 0035  
**14:45 - 15:00**  
**Embodied Self-Supervised Learning (EMSSL) with Sampling and Training Coordination for Robot Arm Inverse Kinematic Model Learning**  
Qu Weiming, Liu Tianran, Wu Xihong, Luo Dingliang  
National Key Laboratory of General Artificial Intelligence, Key Laboratory of Machine Perception (IMI), School of Intelligence Science and Technology, Peking University, Beijing 100871, China.

- We propose an EMSSL framework with sampling and training coordination for robot arm inverse model, greatly improving data sampling efficiency and model convergence rate.
- We introduce the concept of “Embodiment”, effectively solving the non-convex problem of the inverse model.
- Drawing from the characteristics of human learning, we develop two kind adaptation approaches for the robot arm model under the EMSSL framework.

**ThPMR1.5**  
**ID:** 0042  
**15:00 - 15:15**  
**GAN Inversion based Point Clouds Denoising in Foggy Scenarios for Autonomous Driving**  
Ru Chai, Bin Li, Zhengfa Liu and Guang Chan  
School of Automotive Studies, Tongji University, China  
Zhijun Li  
School of Mechanical Engineering, Tongji University, China  
Alois Knoll  
School of Computer, Information and Technology, TUM, Germany

- GAN inversion is applied to the point cloud denoising task under challenging weather conditions.
- Foggy KITTI that we generated includes more realistic noise to simulate real point clouds.
- Our method can be seamlessly incorporated as a pre-processing module for downstream tasks.

**ThPMR1.6**  
**ID:** 0050  
**15:15 - 15:30**  
**Neuro-Inspired Plasticity for Biologically Realistic Self-Adaptation of Neural Networks**  
Rohan Kahesty  
Harvard Medical School, United States of America

- Plasticity, the ability for neurons to rewire, is a core functionality of biological neural circuits.
- We design Hybrid Plasticity, which combines Hebbian, Homeostatic, and Metaplasticity into one implementation.
- In CTRNNs, Hybrid Plasticity increases the network’s ability to generalize to unseen inputs.
- In CTRNNs, Hybrid Plasticity causes the formation of brain-like connectivity patterns.
IEEE ICDL 2023 Conference Digest

**ThPMR1: Regular Session (Machine Learning Methods for Robot Development)**

Sheraton Grand Macao Hotel, Hamadan 6-16, 14:00 - 16:00, Thursday, Nov. 9, 2023

**ThPMR1.7**  **ID:0093**  15:30 - 15:45  
**Game of Marine Robots: USV Pursuit Evasion Game Using Online Reinforcement Learning**
Yongkang Wang 1, Yong Wang 2, Rongxin Cui 1,
Xiaojun Guo 1 and Weisheng Yan 1
1. School of Marine Science and Technology,
2. University System Research Institute,
Northwestern Polytechnical University, China.
3. Jiangsu Automation Research Institute, China.

- The game is described as differential game dependent on the relative motion equation.
- The solution to differential game is obtained utilizing reinforcement learning.
- The states and weight errors are proven to be uniformly ultimately bound.

**ThPMR1.8**  **ID:0096**  15:45 - 16:00  
**Fixed-time Consensus for High-order Multi-agent Systems with Nonlinear Uncertainties and Disturbances via Event-triggered Control**
Yan Zhang 3, Fang Pan 1,2, Rongxin Cui 1, Xiaojun Guo 4,
and Shoushi Zhang
1. School of Marine Science and Technology,
Northwestern Polytechnical University, China.
2. Jiangsu Automation Research Institute, China.

- Achieving the fixed-time consensus for high-order multi-agent systems.
- Nonlinear uncertainties are approximated using RBF NNNs.
- External disturbances are estimated through disturbance observers.
- Designing a fixed-time event-triggered controller to conserve communication and computing resources.
IEEE ICDL 2023 Conference Digest

ThPMR2: Regular Session (Development of Skills in Biological Systems and Robots)

Sheraton Grand Macao Hotel, Hamadan 6-16, 16:15 - 18:15, Thursday, Nov. 9, 2023

ThPMR2.1  ID:0013  16:15 - 16:30

Real-World Robot Control and Data Augmentation by World-Model Learning from Play
Yuta Nomura and Shingo Murata
Graduate School of Integrated Design Engineering, Keio University, Japan

- We propose a framework for real-world robot control and data augmentation using play data.
- Learning play data enables robots to perform goal-conditioned object manipulation tasks in the real world.
- Imagination in the world model can be used to create novel combinations of actions.

ThPMR2.2  ID:0019  16:30 - 16:45

Enhancing Performance of Multi-Input Neural Networks Using Hadamard product
Won-Joong Kim, Inwook Kim, Minsoo Lee, Soo-Hong Lee
Department of Machine Design Engineering, Yonsei University, Republic of Korea

- Analysis of EMG signals to optimize encoder of an ankle
- Assess Hadamard product's impact on the performance of Neural Network
- Train 72,000 models and compare 600 results statistically. The k-fold validation is adopted.
- Developed a new method that can than 50 models concurrently.

ThPMR2.3  ID:0037  16:45 - 17:00

Modeling for Magnetic Shape Memory Alloy Actuators Using a Modified Generalized Prandtl-Ishlinskii Model
Ying Feng and Jianming Guo
School of Automation Science and Engineering, South China University of Technology, Guangzhou, China.

- Open-loop experiments were performed to test the electromechanical properties of the MSMA actuator.
- The MGPI model is proposed based on the properties of MSMA actuators.
- The proposed MGPI model is validated based on experimental data.

ThPMR2.4  ID:0044  17:00 - 17:15

Goal-Conditioned Flexible Object Manipulation by Self-Supervised Learning from Play
Keigo Ishii, Shun Hiramatsu, Yuta Nomura and Shingo Murata
Graduate School of Integrated Design Engineering, Keio University, Japan

- We extend the "play-supervised latent motor plan" (Play-LMP) framework to flexible object manipulation.
- The framework solves the problems of labeling and data collection costs in flexible object manipulation.
- A robotic arm performed feed-end rope manipulation in a real-world environment.
- We demonstrate both the capabilities and limitations of the Play-LMP in flexible object manipulation.

ThPMR2.5  ID:0057  17:15 - 17:30

Simulating early childhood drawing behaviors under physical constraints using reinforcement learning
Yoshia Aibe, Yoshikiyo Chihura, Shogo Yonekura, Hoshinori Kanazawa and Yasuo Kuniyoshi
Graduate School of Information Science and Technology, The University of Tokyo, Japan.

- A system of RL, drawing agent and simulated physical environment of pen and canvas
- The acquired drawing behaviors diverge depending on the different physical configurations of various resistances.
- The importance to consider physical properties of the tools for children’s drawing behaviors

ThPMR2.6  ID:0064  17:30 - 17:45

Tracking Control of Shape Memory Alloy Artificial Wrist Joint Based on Generalized Prandtl-Ishlinskii Inverse Model
Ying Feng and TianCheng Yu
School of Automation Science and Engineering, South China University of Technology, Guangzhou, China.

- An inverse hysteresis model is constructed based on the GPI model principle.
- The inverse model is used as a feed-forward control to linearize the nonlinear plant by mathematical computation.
- A PID feedback controller is introduced to complement the GPI inverse model and form the compound control methodology.
IEEE ICDL 2023 Conference Digest

ThPMR2: Regular Session (Development of Skills in Biological Systems and Robots)

Sheraton Grand Macao Hotel, Hamadan 6-16, 16:15 - 18:15, Thursday, Nov. 9, 2023

ThPMR2.7 ID:0066 17:45 - 18:00

**Load-Dependent Generalized Prandtl-Ishlinskii Model for Nonlinear Dynamic Characteristics of Magnetic Shape Memory Alloy Actuator**

Ying Fang, Chongbin Li and Tian Lan
School of Automation Science and Engineering, South China University of Technology, Guangzhou, China.

- Testing the characteristics of MSM actuators under different mechanical loads and frequencies.
- Proposing a load-dependent generalized Prandtl-Ishlinskii model to describe the hysteresis characteristics.
- Modifying the classical Levenberg-Marquardt algorithm to identify the model parameters.
- Modeling the actuating system using the classical and modified identification algorithms, respectively.

ThPMR2.8 ID:0073 18:00 - 18:15

**Prerequisite Structure Discovery in Intelligent Tutoring Systems**

Louis Annabi and Sao Mai Nguyen
ENSTA Paris, Institut Polytechnique de Paris & Inria, Palaiseau, France

- Intelligent Tutoring Systems provide personalized recommendations of exercises.
- We can improve recommendation by uncovering the prerequisite structure between skills to be acquired.
- We propose PRT, a novel algorithm for discovering the prerequisite structure.
- We evaluate PRT using synthetic data simulating random learner paths.
IEEE ICDL 2023 Conference Digest

ThPMR3: Regular Session (Human-human and Human-robot Interaction and Communication)

Sheraton Grand Macao Hotel, Hamadan 6-1, 16:15 - 18:15, Thursday, Nov. 9, 2023

ThPMR3.1 ID:0005 16:15 - 16:30

Recurrence Plots of Mother-Child Autonomic Nervous System Predict Mother’s Stress

Jian Li1, Michiko Matsuura2, Myowa Masako2 and Yukie Nagai1
1WPI-IRC, The University of Tokyo, Japan
2Graduate School of Education, Kyoto University, Japan

- Recurrence plot (RP) to visualize the oscillation rhythm of
  the day-long ANS data.
- The maternal-ANSS complexity from RP predict the parenting
  stress.
- Mothers’ parenting stress is predictable by their own ANS
  activities and their children.

ThPMR3.2 ID:0006 16:30 - 16:45

Safe Human-Machine Cooperative Game with Level-k Rationality Modeled Human Impact

Junkai Tan, Shuangyin Xue, Hui Cao and Huan Li
School of Electrical Engineering, Xi’an Jiaotong University, China

- The barrier-function-based transformation system is established for the cooperative human-machine game.
- A bounded rationality level-k architecture via theory of cognitive hierarchy is developed.
- A model-based reinforcement learning algorithm is conducted to implement the online approximation

ThPMR3.3 ID:0010 16:45 - 17:00

What You See is What You Grasp: User-Friendly Grasping Guided by Near-eye-tracking

Shaowen Wang, Wei Zhang, Zhangli Zhou, Jiawei Cao, Ziyang Chen, Kang Chen, Bin Li, Zhen Kao
University of Science and Technology of China

- We build a sight-based robotic assistive system for user-specified manipulations. Our system includes a head-mounted device that enables real-time attention inference and a grasping sub-system that utilizes self-attention mechanisms for improved visual grasping.
- We propose a novel human-robot interface that enables more natural and instinctive manipulation by utilizing eye-tracking only.

ThPMR3.4 ID:0011 17:00 - 17:15

Robust Approximate Constraint-Following Control Design for two-link robotic manipulator system

Haoshua Liu, Qiong Huang, Xiaod Li and Shengqiao Zhen
Hefei University of Technology, China

- The Lagrangian dynamic model is established and the binding force in the system is analyzed.
- Robust servo control design and Lyapunov stability proof
- Simulation analysis was conducted on the controller to verify its control effect

ThPMR3.5 ID:0036 17:15 - 17:30

A Novel Approach to the Analysis of Altered Human Motor Synergistic Structures

Jingjiao Chen1, Chen Wang2, Ningguo Xu1, Zeng-Guang Hou1,2, Pingyi Deng3, Pu Zhang1 and Chuan Zhang1
1Faculty of Innovation Engineering, Macau University of Science and Technology, China
2Institute of Automation, Chinese Academy of Sciences, China
3Institute of Analysis and Testing, Beijing Academy of Science, China

- Analyzing the altered motor synergistic structure between patients with motor dysfunction and healthy participants.
- 26 participants (15 stroke patients & 15 healthy subjects) from Beijing & Macau.
- Revealing synergistic patterns using a vision-based human motion tracking method.
- Creating matched and specifically synergic vector pairs using the k-means clustering and Kuhn-Munkres algorithm.

ThPMR3.6 ID:0060 17:30 - 17:45

Exploring Emotional Impact in Interactive Digital Art

Alic G. Ho
Dept of Creative Arts, Hong Kong Metropolitan University, Hong Kong

- Interactive digital art affects emotions through design aspects like music and visual aesthetics.
- Design choices have varying effects on emotional involvement in interactive digital art.
- Engaging in interactive digital art can promote relaxation and stress relief.
- Emotional involvement in interactive digital art is linked to perceived therapeutic benefits.
IEEE ICDL 2023 Conference Digest

ThPMR3: Regular Session (Human-human and Human-robot Interaction and Communication)

Sheraton Grand Macao Hotel, Hamadan 6-1, 16:15 - 18:15, Thursday, Nov. 9, 2023

ThPMR3.7 ID:0071 17:45 - 18:00

Hybrid Vision-force Control for Human Robot Co-carrying on Ball and Board Systems

Qiaochun Hu, Yijun Wu, Nan Feng, Xiebo Yu, and Wei He
School of Intelligence Science and Technology, University of Science and Technology Beijing, China
Guang Li
School of Engineering, University of Manchester, Manchester, UK

- An image recognition localization is proposed to detect the position of the ball and the self-coordinate system.
- The admittance control is adopted to implement the tracking task.
- The vision-control fusion control method is proposed that confirms vision sensor control with force control to perform a virtual-collision avoidance strategy and virtual-real cooperation patterns.

ThPMR3.8 ID:0085 18:00 - 18:15

Inculcating Morality in Machines... Applying Machine Ethics in the Creation of Ethically Intelligent Robots: The Case Study of Xiaoice

Yun Xu1, Saemundur Hafsteinn2
1Department of Education Studies, Xi’an Jiaotong Liverpool University, China
2Purdue大学, USA

- The paper reviews ethical challenges in AI robots and ethical integration in computational intelligence.
- The study employs machine ethics to address AI robotics ethical issues and explores integrating human values.
- The study advocates for a paradigm shift towards incorporating ethical and deontological moral order in moral ethics.
- The study aims to inform policy-making and public understanding of ethically intelligent robots.
IEEE ICDL 2023 Conference Digest

ThPMR4: Regular Session (Robot Prototyping of Human and Animal Skills)

Sheraton Grand Macao Hotel, Hamadan 6-2, 16:15 - 18:15, Thursday, Nov. 9, 2023

ThPMR4.1  ID: 0014  16:15 - 16:30
Free-Hand Gesture Recognition Using Conv3D-Networks with Cross Stitch Units for Multi-Modal Data
Monika Schak and Alexander Gepperth
Faculty of Computer Science, Fudan University of Applied Sciences, Germany

- Train a dedicated Conv3D-network for each modality (RGB and depth)
- Combine the intermediate representations learned by those unrecored Conv3D-networks using Cross Stitch Units
- Cross Stitch Units learn the amount of information flow between the two networks end-to-end
- Multi-modal fusion using Cross Stitch Units improves the gesture recognition accuracy

ThPMR4.2  ID: 0018  16:30 - 16:45
Design of a Bio-Inspired Untethered Eight-Legged Soft Robot Driven by Magnetic Field
Ruomeng Xu and Qingsong Xu
Department of Electronic Engineering, Faculty of Science and Technology, University of Macau, China

- An eight-legged soft robot inspired by locomotion of centipedes is designed
- It is fabricated by the blending of magnetic particles with silicone polymers, followed by magnetization process
- It can perform high-speed locomotion at 0.326 - 1.504 mm/s on paper, wood, and PMMA surfaces
- It can navigate irregular biological terrains by supporting internal loads

ThPMR4.3  ID: 0020  16:45 - 17:00
Hierarchical Variational RNN Modeling of Sensory Attenuation with Temporal Delay in Action-Outcome
Ryudaro Suzuki, Hayato Ide
Waseda University, Japan
Yuichi Yamashita and Tatsuya Ogata
NICT, Japan; Waseda University, Japan

- The brain attenuates self-generated sensory responses, less so with temporal delays between action-outcome
- Simulated this sensory attenuation with varying temporal delays using RNN based on free-energy principle
- The result, higher executive level represented the temporal delays
- Moreover, top-down signal from this level controlled prediction-error induced responses at sensory level

ThPMR4.4  ID: 0058  17:00 - 17:15
Adaptive Fractional Order Proportional-Integral-Derivative Control for a Shape Memory Alloy Driven Puncture Platform
Ying Feng and Xinyu Huang
School of Automation Sciences and Engineering, South China University of Technology, Guangzhou, China

- The model of puncture force is considered in the design process of the controller.
- An adaptive fractional order PID Controller is developed to suppress disturbances.
- A parameter-reduced generalized Prony-technics model is proposed to simplify hysteretic modeling.

ThPMR4.5  ID: 0065  17:15 - 17:30
Uniform Diffusion with Binary-State Sensory Action
Zhao Zhang, Tao Wang and Xingguang Peng
School of Marine Science and Technology, Northwestern Polytechnical University, P. R. China

- The proposed diffusion controller is inspired by biological phenomena and is oriented towards distributed multi-robot systems.
- The controller consists of only two actions based on binary-state environmental information
- No arithmetic computations, additional memory, and communication are required
- Large-scale robot simulations and physical experiments validate the effectiveness and scalability of the proposed controller

ThPMR4.6  ID: 0077  17:30 - 17:45
Learning English Writing Skills from Images
Yu Zhang, Yongliang Zou, Houcheng Li, Haoyu Zhang, and Long Cheng
School of Artificial Intelligence, University of Chinese Academy of Sciences, Beijing 100049, China

- Acquiring DMPs directly from images
- Automatically learn the starting and ending points that are crucial for DMPs
- Acquiring skills to form coherent words or sentence
IEEE ICDL 2023 Conference Digest

ThPMR4: Regular Session (Robot Prototyping of Human and Animal Skills)
Sheraton Grand Macao Hotel, Hamadan 6-2, 16:15 - 18:15, Thursday, Nov. 9, 2023

ThPMR4.7  ID:0078  17:45 - 18:00

**Leg Transmission Mechanism for Enhanced Load-Carrying Capacity: Knee Joint Torque Optimization Design**
Quan Huang1, Yuxuan Guo1, Haojun Yan1, Yuquan Leng1, Shoubin Liu1, and Chengdong Fu2, Member, IEEE
1. Department of Mechanical and Energy Engineering, Southern University of Science and Technology, China
2. School of Mechanical and Electrical Engineering and Automation, Harbin Institute of Technology, China

*Enhanced robot’s knee joint load bearing capacity with optimized leg transmission design.*

- Combine ball screw and crank-slider mechanisms to amplify knee joint motor torque effectively.
- Dynamic simulation and virtual prototyping validate the effectiveness of the leg transmission mechanism.
- Leg transmission mechanism achieves up to 7.66 times torque amplification, successfully improving knee joint load-bearing capacity.

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ThPMR4.8  ID:0086  18:00 - 18:15

**Acquiring Viewpoint Transformation to Reuse Self Body Image for Other on Self-Organized Internal Spatial Coordinate System**
Wataru Noguchi, Hiroki Sizuka, and Masahito Yamamoto
Hokkaido University, Japan

- We propose a neural network model that can develop the ability of viewpoint transformation.
- The proposed model learns only visual-proprioceptive-sensations of a simulated agent.
- It first acquires an internal spatial coordinate system and body image through visual reconstruction learning.
- Viewpoint transformation ability is acquired to reuse the body image for reconstructing another agent’s appearance.

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# Friday  
**November 10, 2023**

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FrPMR1: Regular Session (Cognitive Vision)

Sheraton Grand Macao Hotel, Hamadan 6-1, 14:00 - 15:30, Friday, Nov. 10, 2023

FrPMR1.1  ID:0002  14:00 - 14:15

An Improved Frontier Point Exploration System for Mobile Robots Based on LiDAR SLAM
Yid Zheng, Liheng Chen, and Qiongqiong Xu
Department of Electromechanical Engineering, Faculty of Science and Technology, University of Macau, China

- An active SLAM is employed in this work to improve exploration efficiency.
- A three-part framework is established with environment modeling, goal determination, and motion planning.
- LiDAR SLAM-based approach is developed to achieve the environment modeling.
- Cartographer system is selected as the environment modeling solution.

FrPMR1.2  ID:0027  14:15 - 14:30

Universal Adversarial Attacks for Visual Odometry Systems
Xin Xie, Longlong Liao and Yuanjiu Yu
College of Computer and Data Science, Fuzhou University, China
Huaping Liu
Department of Computer Science and Technology, China

- A general adversarial attack framework for visual odometry is proposed.
- We design different attack schemes and generate corresponding generic adversarial patches.
- The generated adversarial patches severely impact visual odometry in situations that are imperceptible to humans.

FrPMR1.3  ID:0079  14:30 - 14:45

The Importance of Growing Up: Progressive Growing GANs for Image Inpainting
Daniel Speck, Theresa Pekarak Rosin, Matthias Kerzel, and Stefan Wermter
Department of Informatics, University of Hamburg, Germany

- We propose a growing encoder/decoder architecture for image inpainting.
- Our model is of the same magnitude as other GANs or cascade diffusion models.
- We utilize a mix of different approaches and losses.
- The growing architecture is built upon a modular NN design.

FrPMR1.4  ID:0080  14:45 - 15:00

Saccade amplitude statistics are explained by cortical magnification
Marcel C. Riebe1, Francisco M. Lopez2,3, Zhengyang Yu1,2, Spencer Chapin4, Chen Yu4, Bertram E. Shi5, Jochen Teepe1
1Frankfurt Institute for Advanced Studies, Germany, 2Stanford IASK International Joint Research Center, Germany, 3University of Texas at Austin, USA, 4Hong Kong University of Science and Technology, Hong Kong

- First analysis of saccade amplitude statistics of both infants and adults during naturalistic free play.
- Computational model based on the twofold nature of vision and the associated spatial magnification in primary visual cortex.
- Computationally efficient approximation to this space-invariant sampling using a small number of discrete resolution levels.

FrPMR1.5  ID:0083  15:00 - 15:15

When Eyes Tell a Story...An Eye-tracking Approach towards creating a fit-for-purpose Learning Management System for Higher Education
Yao Gu and Samirullah Paracha
Future Education Department, Xiam Jiaotong-Liverpool University, China

- Improve Learning Management System with learner-centric design and mixed methods.
- The integration of an eye-tracking experiment with participatory design methodologies.
- There is significant room for improvement in future research with more data.

FrPMR1.6  ID:0094  15:15 - 15:30

Central Bias in Social Attention: The Development of Gaze Distribution in the First Two Years
Lichao Sun and Hanako Yoshida
Department of Psychology, University of Houston, United States

- Infants’ gaze patterns toward parents’ faces and objects were recorded by eye-trackers during object play.
- 6-month-old infants exhibited a central bias over their bodies when attending to parents’ faces.
- There was more significant variability in the distribution of infant object looking across ages.
- Infants maintained longer attention when their gaze was clustered closer to the center of scenes.
IEEE ICDL 2023 Conference Digest

FrPMR2: Regular Session (Multimodal Perception / Haptic and Tactile Perception)
Sheraton Grand Macao Hotel, Hamadan 6-2, 14:00 - 15:30, Friday, Nov. 10, 2023

FrPMR2.1  ID:0001  14:00 - 14:15
A Unified Deep Imitation Learning and Control Framework for Robot-assisted Sonography
Weiyang Si, Cheng Guo, Ning Wang and Chenguang Yang,
School of Engineering, University of the West of England, UK
Mingyong Yang* and Rebecca Harris* [1]
Department of Engineering, University of Cambridge, UK
[2] University Hospitals Bristol and Weston, UK

- Deep multimodal imitation learning and compliant control framework for robot-assisted ultrasound scanning is studied.
- A compliant controller in Cartesian space is designed to track reference trajectory and desired force.
- The proposed deep multimodal imitation approach can improve the success rate of procedure completion.

FrPMR2.2  ID:0026  14:15 - 14:30
A Model-free Approach to Fingertip Slip and Disturbance Detection for Grasp Stability
Dougie Kitsui, Mahdi Khormohabadi and Veronique Pendergrast Institute of robotics and intelligent systems, Sorbonne University Paris, France

- Tactile sensing enhances robotic manipulation by providing rich sensory data from physical interactions.
- The paper introduces a novel method to assess contact stability using tactile sensors and classifiers during grasp.
- Evaluation of the method demonstrates effective real-time slippage detection.

FrPMR2.3  ID:0030  14:30 - 14:45
Vision-based Tactile Sensing for an Omni-adaptive Soft Finger
Xudong Han, Sheng Liu, Fang Wan*, and Cheyong Song* Southern University of Science and Technology, China

- Systematically analyzed the mechanical properties of the omni-adaptive soft finger during interaction with the simplified model representation, which is the basis of the non-contact sensing method.
- Proposed a vision-based tactile sensing method for the omni-adaptive soft finger. It established a joint-force mapping model by interpolation and an image-position mapping model based on the neural network.
- Realized the real-time perception of the contact position and the contact force with the proposed sensing method.

FrPMR2.4  ID:0032  14:45 - 15:00
Vision-Touch Fusion for Predicting Grasping Stability using Self Attention and Past Visual Images
Gang Yan, Zhida Qiu, Satoshi Funabashi, Alexander Schmitz, Tito Pradhorn Toma, Stephan Simor, Alexander Schmitz, and Shigeki Sugano Department of Mechanical Engineering, Waseda University (JP)

- Proposed using self-attention mechanism to combine visual tactile features effectively.
- Comparison and ablation studies with previous baselines.
- Analysis reveals that better features could be extracted with the help of a self-attention mechanism.

FrPMR2.5  ID:0034  15:00 - 15:15
Geometric Transformation: Tactile Data Augmentation for Robotic Learning
Gang Yan, Jun Yulei, Satoshi Funabashi, Tito Pradhorn Toma, Stephan Simor, Alexander Schmitz, and Shigeki Sugano Faculty of Science and Engineering, Dept. of Modern Mechanical Engineering, Waseda University, Japan

- Geometric transformation based tactile data augmentation.
- Compared our proposed and conventional image data augmentation, showing that our proposal outperforms conventional methods.
- Publicly available datasets for slip detection and object recognition.

FrPMR2.6  ID:0059  15:15 - 15:30
Robotic Simulator with high-precision perception of contact dynamics
Yongcan Zhou, Yang Pan*, Tianjian Lei, Junpeng Chen
Mechanical and Energy Engineering, Southern University of Science and Technology, China

- Unlike other robotic simulators using geometric constraints, ours employs continuous compliant contact model for precise contact modeling.
- The analytical solution from the differential equation works with any integration step, promoting greater response stability.
- Enhanced precision in contact forces directly improves the effectiveness of Sim-to-Real transfer.
IEEE ICDL 2023 Conference Digest

FrPMR3: Regular Session (Language / Concept / Active Learning)
Sheraton Grand Macao Hotel, Hamadan 6-16, 14:00 - 15:30, Friday, Nov. 10, 2023

FrPMR3.1 ID:0007 14:00 - 14:15
Prosody-Based Vocal Emotional Alignment in Infant-Caregiver Interaction
Ming Li and Dan Zhang
The Department of Psychology, Tsinghua University, China

- Goal: To explore emotional alignment in infant-caregiver vocal interactions using a deep neural network.
- Required emotion labels: infants' data.
- Infant and caregiver vocal emotions were more similar in neural, preschool interactions.
- Variability in infant vocal emotions was positively correlated with that in caregiver vocal emotions.

FrPMR3.2 ID:0024 14:15 - 14:30
Lexical Acquisition with Cross-Situational Learning Based on Mutual Segmentation of Sentences and Multi-Attribute Sensory Information
Takafumi Horio
GSIS, Ritsumeikan University, Japan

- This study models robotic lexical acquisition from unsupervised sentences through word segmentation and cross-situational learning.
- We show that segmentation errors are reduced by learning word boundaries and word meanings simultaneously.
- We show that considering both grounded words and ungrounded words results in improved performance.
- Some ungrounded words are unexpectedly associated with sensory information.

FrPMR3.3 ID:0025 14:30 - 14:45
Cross-Situational Word Learning in Disentangled Latent Space
Yuta Mitsu
Graduate School of Information Science and Engineering, Ritsumeikan University, Japan

- We propose a prototypical generative model to discover attributes and understand word meanings from images and word sequences.
- The proposed model assigns words to a disentangled latent space based on cross-situational word learning.
- Experimental results show that the proposed model correctly associates image features with words.
- The proposed model outperforms existing models in the image inference task.

FrPMR3.4 ID:0040 14:45 - 15:00
Self-Supervised Embodied Learning for Semantic Segmentation
Juan Wang, Xiaohu Liu, and Haoping Liu
The Department of Computer Science and Technology, Tsinghua University, China

- We propose the Familiar-Contrast (FC) reward to explore curious and familiar samples.
- We achieve samples via the FC-based policy and use a self-supervised mechanism to generate pseudo-labels.
- We validate the effectiveness of our approach on Mid-Street3D datasets without manual annotations.

FrPMR3.5 ID:0043 15:00 - 15:15
Conceptual Cognitive Maps Formation with Neural Successor Networks and Word Embeddings
Paul Stöwer and Andreas Maier
Pattern Recognition Lab, Friedrich-Alexander University, Germany

- Creating Cognitive Maps inspired by the entorhinal-hippocampal complex.
- Modelling place cells with the Successor Representation using neural networks and word embeddings.
- Formation of conceptual maps by learning similarity between features in the data.
- Factorising the Successor Representation enables different scaled maps.

FrPMR3.6 ID:0067 15:15 - 15:30
Developmental Scaffolding with Large Language Models
Batuhan Celik1, Alper Atmatoğlu1, Emre Uygur1, Eran Oztop2,3
1Computer Engineering Department, Bilkent University, Turkey
2Dokuz Eylül University, Turkey
3Cukurova University, Turkey

- Parental scaffolding is a key mechanism in infant sensorimotor development.
- In robotics, scaffolding acts as a human demonstrator, which is costly.
- In this study, we investigate whether LLMs can act as a scaffolding agent for a robotic system that aims to learn to predict the effects of its actions.
IEEE ICDL 2023 Conference Digest

**FrPMR4: Regular Session (Grounding of Knowledge and Development of Representations /Multimodal Perception)**

Sheraton Grand Macao Hotel, Hamadan 6-1, 15:45 - 18:00, Friday, Nov. 10, 2023

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**FrPMR4.1**  
**ID:** 0017  
**15:45 - 16:00**  
**An affordance-based intersubjectivity mechanism to infer the behaviour of other agents**  
Simon L. Gay, François Suro and Jean-Paul Jamont  
Université Grenoble-Alpes, France  
Olivier L. Georgopoul  
Claude Bernard University, France

- Novel **affordance-based** model for behaviour intersubjectivity  
- Learn surrounding affordances through interactions, without prior knowledge  
- Detection of mobile entities, learning their behavioral predictions  
- Prediction of future behaviours and movements of mobile entities based on context of affordances around them

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**FrPMR4.2**  
**ID:** 0028  
**16:00 - 16:15**  
**Unsupervised judgment of properties based on transformation recognition**  
Ryo Takatsuki, Yoshikazu Ohmura and Yasuo Kuniyoshi  
Department of Mechatronics, Graduate School of Information Science and Technology, The University of Tokyo, Japan

- Humans discern similarity through both appearance and structural analogy  
- Machine learning typically relies on appearance-based assessment  
- New method uses representation learning, linking equation structures to image sequences  
- This approach enables machines to evaluate structural similarity beyond mere appearance

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**FrPMR4.3**  
**ID:** 0039  
**16:15 - 16:30**  
**MM Fusion: A Generalized Multi-Modal Fusion Detection Framework**  
Leichao Cui, Xuefan Li, and Min Meng  
Department of Control Science and Engineering, Tongji University, China  
Xiaoyu Mo  
School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore

- A **generic detection network framework** for multi-modal data fusion.  
- A plug-and-play module YLPM is proposed for fully acquiring local features during visualization.  
- A multi-modal fusion module MMFM can adaptively select different parts of different modal features for fine-grained fusion.

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**FrPMR4.4**  
**ID:** 0048  
**16:30 - 16:45**  
**Goal Abstraction in Hierarchical Reinforcement Learning via Set-Based Reachability Analysis**  
Mehtab Zadeh and Sergio Mover  
IEE Eo Polytechnique  
Sao Mai Nguyen  
UDIS ENSTA Paris, INRIA Saclay, France

- Goal representation is essential for hierarchical reinforcement learning in robotics environments  
- Reachability analysis of the task is key to successful abstraction of goals and decomposition of tasks  
- Our algorithm GARA learns a reachability aware abstraction and a hierarchical policy  
- The approach achieves higher data-efficiency, transfer learning and is interpretable

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**FrPMR4.5**  
**ID:** 0053  
**16:45 - 17:00**  
**A Closer Look at Reward Decomposition for High-level Robotic Explanations**  
Weihao Lu, Xufeng Zhao, Shaun Magg, Mengdi Li, Martin Gronn or, Stefan Wermter  
Informatik, University of Hamburg, Germany

- An **explorable learning framework** with a multimedia interface for robotics research  
- Explanatory visuals and templated language for artifacts based on reward decomposition  
- Interactive querying of artifacts using LLMs for automatic explanation  
- Provides efficacy in two distinct robotic scenarios

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**FrPMR4.6**  
**ID:** 0068  
**17:00 - 17:15**  
**Eye-hand coordination develops from active multimodal compression**  
Francisco M. Lopez1,2, Bertram E. Shi3, and Jochen Triesch1  
1Frankfurt Institute for Advanced Studies, Germany  
2Xidian Shandong International Joint Research Center, Germany  
3Hong Kong University of Science and Technology, Hong Kong

- Embedded infant model learns eye-hand coordination using vision and proprioception  
- Training with intrinsic motivation to maximize encoding efficiency of sensory inputs  
- Multisensory sufficiency vision only if it emerges after visual representations learned  
- Results explained by "less is more" multimodal sensorimotor development and staggered critical periods
Regular Session FrPMR5: Active Learning / Statistical Learning

Sheraton Grand Macao Hotel, Hamadan 6-2, 15:45 - 18:00, Friday, Nov. 10, 2023

FrPMR5.1 ID:0008 15:45 - 16:00

Why are Nouns Learned Earlier Than Verbs?
Infant’s Multimodal Experiences During Object Play

Lichao Sun1, Nikita Gith2, and Haruki Yoshida1
1Department of Psychology, University of Houston, United States
2Department of Medicine, Baylor College of Medicine, United States

- Infants in object seeing was captured by the head-mounted eye tracking system during parent object play.
- Infants exhibited longer attention toward the object when parents introduced nouns than verbs.
- Infants experienced more joint attention and heard more nouns than verbs when seeing referents.
- Viewed object size significantly predicts infants’ sustained attention in both linguistic contexts.

FrPMR5.2 ID:0061 16:00 - 16:15

Safety Analysis and Prediction for Transmission Tower Construction

Wencai Gong, Qi Wei, Yuan Liu, Yunfei Zeng, Zhenyu Jiang, Zhichun Lin, and Fan Gao
Constructions branch, State Grid Jiangxi Electric Power Co., Ltd., China
School of Information Engineering, Nanjing University of Science and Technology, Nanjing University, China.
School of Advanced Manufacturing, Nanchang University, China.
School of Future Technology, Nanchang University, China.

- Sample the forces on multiple points and package the sampled data for transmission.
- Fit multiple data using the least squares method to predict the safety of subsequent time points.
- Using the weighted average method to synthesize data from various sensors and determine the overall safety level.

FrPMR5.3 ID:0070 16:15 - 16:30

Toward Understanding Psychotic and Cognitive Characteristics:
A Deep Generative Model for Extracting Shared and Private Representations and Its Evaluation with Synthetic Multimodal Data

Kaito Kusumoto and Shingo Murata
Graduate School of Integrated Design Engineering, Kansai University, Japan

- Why propose a deep generative model that can extract shared and private representations from multimodal data.
- We created a synthetic multimodal dataset that comprises pairs of synthetic questionnaire and drawing data.
- We demonstrate that the true shared and private representations can be accurately inferred by the model.

FrPMR5.4 ID:0076 16:30 - 16:45

A new recursive approach to sparse representation

Quan Liu1, Di Liu2, and Simone Baldi2
1School of Artificial Intelligence, Southwest University, China
2School of Computing, Information and Technology, TU Munich, Germany
3Visual Intelligence for Transportation lab, EPFL, Switzerland

- We present a new approach to online sparse representation (i.e., estimation of non-redundant structures using data that are sequentially and continuously collected).
- This approach, named SP-RALS, combines reweighting to approximate L0 norm with smooth approx. due to lack of differentiability.
- Compared to state-of-the-art algorithms, SP-RALS has better performance in terms of sparsity of the estimated system and accuracy of the estimate.

FrPMR5.5 ID:0087 16:45 - 17:00

Combined Deterministic and Stochastic Streams for Visual Prediction using Predictive Coding

Chaofan Ling and Weihua Li
South China University of Technology, China
Jingfang Zeng, Junwen Zhong
The Hong Kong Polytechnic University, Hong Kong SAR

- Multi-Scale Predictive Network (MSPN): a novel predictive model for future frame prediction, inspired by cognitive science’s predictive coding theories. Unlike traditional models, MSPN directly predicts RGB images, enhancing its practical applicability.
- Improved Training Strategy: Using EDLSTM and other training strategies, achieved outstanding performance on KITTI dataset through an enhanced training strategy effectively balancing prediction accuracy and visual quality.

FrPMR5.6 ID:0091 17:00 - 17:15

Rapid Speed Change for Quadruped Robots via Deep Reinforcement Learning

Sanggyu Roh
Robotics Laboratory, Hyundai Kefco Company, Korea

- Training method that retests the movements of four-legged animal.
- Ground reaction force (GRF) control of the feet for stable locomotion.
- Proposal of a reward function for stable galloping during rapid speed change.

Figure A neural network architecture comprised of actor-critic, and command is updated with simulation.
FrPMR6: Regular Session (Prediction, Planning and Problem Solving)

Sheraton Grand Macao Hotel, Hamadan 6-16, 15:45 - 18:00, Friday, Nov 10, 2023

FrPMR6.1 ID:0021 15:45 - 16:00
Hierarchical Latent Dynamics Model with Multiple Timescales for Learning Long-Horizon Tasks
Kentaro Fuji and Shingo Murata
Graduate School of Integrated Design Engineering, Keio University, Japan

- We propose the “multiple timescale recurrent state-space model” (MTRSSM) for learning long-horizon tasks.
- The MTRSSM features a multiple-timescale hierarchy consisting of deterministic and stochastic latent representations.
- The priors of the MTRSSM enable the generation of video predictions without external inputs.
- We demonstrate superior video predictions for a long-horizon robotic task with the MTRSSM.

FrPMR6.2 ID:0029 16:00 - 16:15
A Low-Computation Approach to Point Cloud Filtering via Lidar and Camera Fusion
Xianqin Chen1, Di Li2, Lihong Wan3 and Simone Bovda1
1 School of Computer Science & Engineering, Southwest University, China
2 School of Computing, Information and Technology, TU Munich, Germany.
3 Visual Intelligence for Transportation Lab, EPFL, Switzerland

- Most point cloud filtering methods have high computational requirements (e.g., operate directly on the 3D point cloud created by LiDAR)
- We present a low-computation approach based on the fusion of camera and Lidar
- Pixel and point cloud coordinates are aligned, so filtering can operate on the 2D pixel space
- The method is tested on a real-world mobile robot platform verifying low requirements in terms of computation and hardware

FrPMR6.3 ID:0041 16:15 - 16:30
A Novel Learning-based Approach for Dual-Arm Robot Operation Point Selection
Jiawen Wang1, Tao Zhang2, Yi Wang, Dingsheng Luo2
1 National Key Laboratory of General Artificial Intelligence, Key Laboratory of Machine Perception (KIMD), School of Intelligence Science and Technology, Peking University, Beijing 100871, China

- Selecting the appropriate operation point significantly influences the success rate and efficiency of the subsequent tasks.
- We propose a novel learning-based approach for selecting the optimal operation point.
- A specific measure considering well, task and environment factors is designed to evaluate the selection of the dual-arm operation point.
- Our method is validated both in simulation and real platform.

FrPMR6.4 ID:0049 16:30 - 16:45
Development, Planning and Control of an Autonomous Mobile Manipulator for Power Substation Live-Maintaining
Yuwei Yang, Shaofeng Li, Biaoqun Guo, Ling An, Guoqin Li and Ming Pi
Department of Automation, University of Science and Technology of China, China
State Grid Anhui Electric Power Company Ltd, Hefei Power Supply Company, China
State Grid Anhui Electric Power Company Ltd, Hefei Power Supply Company, China
School of Information Engineering, South China University of Science and Technology, China

- A novel mobile manipulator for autonomous maintenance operations
- A multi-modal framework for semantic visual simultaneous localization and mapping
- An object detection method for power equipment
- A motion planning algorithm for the autonomous maintenance tasks

FrPMR6.5 ID:0051 16:45 - 17:00
Learning-based Trajectory Adaption and Neural Network-based Control of a Soft Exosuit
Yifan Li, Zhen Liu and Guoan Li
Department of Automation, University of Science and Technology of China, China
Tian Wang and Jiyu Zhang
Hangzhou Robotic Technology Development Co., Ltd., China
Ding Fu
Danyang Prosthesis Factory Co., Ltd., China

- We developed a dual-driven soft exosuit for both amilies assistance for healthy people.
- We developed a neural network control strategy to ensure that the trajectory is stably adapted and tracked.
- We conducted experiments in different terrain conditions to verify the effectiveness of the designed control strategy.

FrPMR6.6 ID:0074 17:00 - 17:15
Abnormal Object Detection of the Transmission Lines with YOLOv5s and Federated Learning
Kahong Zhang1 and Yimin Zhou1
1.University of Science and Technology, Shenzhen, China
2.School of Automation, Zhejiang Sci-Tech University, Zhejiang Academy of Sciences, Shenzhen, China
3.3.1 University of Chinese Academy of Science, Beijing, China

- An improved abnormal object detection (AOD) model is proposed utilizing federated learning to overcome the data issue.
- Many novel modules are integrated into the networks to improve the detection accuracy and speed.
- A dataset of the abnormal object emissions of the transmission lines is configured to meet the model training requirements.
FrPMR6: Regular Session (Prediction, Planning and Problem Solving)

Sheraton Grand Macao Hotel, Hamadan 6-16, 15:45 - 18:00, Friday, Nov 10, 2023

FrPMR6.7  ID:0088  17:15 - 17:30

Data-Driven Modeling for Pneumatic Muscle using Koopman-Based Kalman Filter
Yu Cao, Mengshi Zhang, Bo Yang, and Jian Huang
School of Artificial Intelligence and Automation, Huzhou University of Science and Technology, China

- A kernel-based Koopman learning method is proposed for modeling the pneumatic muscle.
- An extended dynamic mode decomposition method is presented to identify the Koopman linear model.
- A Koopman-based Kalman filter is shown to deal with the measurement noise.

Figure: Data-driven modeling for pneumatic muscle using a Koopman-based technique.

FrPMR6.8  ID:0092  17:30 - 17:45

Gait Planning for Underwater Legged Robot based on CPG and BP Neural Network
Feiyu Ma, Weisheng Yan, Rongxin Cui, Xinmin Guo, Lepeng Chen
School of Marine Science and Technology, Northwest A&F Polytechnic University, China

- Achieving the continuous legged locomotion between different walls.
- CPG is used as the signal generator for hip joint of each leg.
- BP neural network is set up to fit the mapping relationship between the joint rotation angle and the output of CPG.
- Simulation experiments are carried out by Gazebo.

FrPMR6.9  ID:0099  17:45 - 18:00

Multi-Source Information Fusion with Multi-Criteria Evaluation
Lianli Zhu, Kezhi Zuo, Min Zhu and Xinde Li
Research Center of Coastal Guard, China Coast Guard Academy, China School of Cyber Science and Engineering, Southeast University, China

- Dezert-Smarandache Theory (DSmT) can effectively model sensor information and provide corresponding combination rules to achieve multi-source information fusion.
- However, the fusion results obtained using DSmT are often unsatisfactory when a particular information source is unreliable.
- To improve the reliability of fusion results, a new multi-source information fusion with multi-criteria evaluation is proposed.

Figure: Multi-source information fusion process.
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Minsoo Lee  ThPMR2.2
Minyu Yang  FrPMR2.1
Monika Schak  ThPMR4.1
Muhammad.U.Raza  ThPMA2.4
Murat Kirtay  ThPMA1.3

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Nan Feng  ThPMR3.7
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SPECIAL ISSUES

Robotica

Special issue on “Intelligence in robotics”

I. Introduction

Intelligence in robotics is an extension of automation, which makes the robot smarter, thus assisting human beings in a more efficient way. In real world environment, intelligence in robotics mainly involves its action or body motion, including structural intelligence, manipulation intelligence, mobility intelligence, and human-robot interaction intelligence. For example, the robot could change its configuration with structural intelligence; the robot could learn new skills during manipulation with manipulation intelligence; the robot could move autonomously with mobility intelligence; and the robot could interact with people intuitively according to human intention with human-robot interaction intelligence. The foundation of robot intelligence is computing, and the core is learning, which make robots imitate human beings. For example, perception of robot imitates human sensing the environment, decision making of robot imitate human handling tasks under various circumstances, and skill transfer of robot imitates human learning and creating.

This special issue in Robotica is intended to expedite publication of novel and significant research results, technology and/or conceptual breakthrough of emerging topics of intelligence in robotics. We invite submission of high-quality papers as related to recent advances in such emerging topics, including but are not limited to the following:

- Novel design of metamorphic structure and application in robot
- Bio-inspired sensing and actuation
- Human-robot manipulation skill learning
- Simultaneous Localization and Mapping
- Autonomous manipulation robot
- Wearable robotics and bio-mechatronics systems
- Human-in-the-loop control of robot
- Human-robot interaction
- Robot reinforcement learning
- Neurorobotics
- Robotic intelligence inspired by human behavior intelligence

II. Submission guidelines
Submission link: https://mc.manuscriptcentral.com/cup/robotica

For more information:
https://www.cambridge.org/core/journals/robotica/announcements/call-for-papers/special-issue-intelligence-in-robotics

III. Important Dates
Deadline for first submission: December 30, 2022
First round review complete: March 30, 2023
Revised submission due: May 15, 2023
Second round review complete: June 15, 2023
Final decision due: July 30, 2023

IV. Guest Editors
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