2023

JANUARY NEWSLETTER

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The Hong Kong Society of Robotics and Automation

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ICACAR 2023

ICACAR 2023

2023 International Conference on Advanced Control, Automation and Robotics

APRIL 14-16 BEIJING, CHINA

SPEAKERS

- **Prof. Juyang Weng**
- **Prof. Naira Hovakimyan**
- **Dr. Bernard BROGLIATO**
- **Prof. Youfu Li**

CALL FOR PAPER

TOPICS

Change Detection Problems
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Business Process Modelling
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Mechanical, Force and Tactile Sensors
Environmental Monitoring and Control
Nonlinear Signals and Systems
Network Robotics
Genetic Algorithms
Signal Reconstruction
Soft Computing
System Identification
Control and Supervision Systems
Computer-based Manufacturing Technologies
Human-Machine Interfaces
Image Processing
Fuzzy Control ...

DEADLINE

- Full Submission: Jan. 7, 2023
- Registration: Mar. 31, 2023

SUBMISSION

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2023 International Conference on Advanced Control, Automation and Robotics

Keynote Speakers

ICACAR 2023

Prof. Juyang Weng

Speech Title: The First Conscious Learning Algorithm Avoids "Deep Learning" Misconduct

Abstract: From a fruit fly to a human, with many animal species in between, do they share a set of biological mechanisms to regulate the lifelong development of the brains? We have seen very impressive advances in understanding the principles of neuroscience. However, what is still missing is a holistic algorithm that is both broad and deep. By broad, we mean it approximates such mechanisms across a range of species. By deep, we mean that it specifies sufficient details so that the algorithm can be biologically and computationally verified and corrected across a deep hierarchy of scales, from neurotransmitters, to cells, to brain patterns, to behaviors, to intelligence, to consciousness across the time span of a life. This talk outlines such a conscious learning algorithm, the first in the categorically as far as the presenter is aware of, called Developmental Network 3 (DN-3), the generation after Cresceptron, IHDR, DN-1 and DN-2 all of which were not capable of conscious learning till DN-3. A major extension from the predecessor DN-2 to DN-3 is that the model starts from a single cell inside the skull so that brain patterning is fully automatic in a coarse to fine way. This biological model has been supported by computational experiments with real sensory data for vision, audition, natural languages, and planning, to be presented during the talk. This first ever algorithm for conscious learning is free from "deep learning" misconduct.

January Newsletter

Prof. Naira Hovakimyan

Speech Title: Speech Title: Safe Learning and Control with L1 Adaptation

Abstract: Learning-based control paradigms have seen many success stories with various robots and co-robots in recent years. However, as these robots prepare to enter the real world, operating safely in the presence of imperfect model knowledge and external disturbances is going to be vital to ensure mission success. In the first part of the talk, we present an overview of L1 adaptive control, how it enables safety in autonomous robots, and discuss some of its success stories in the aerospace industry. In the second part of the talk, we present some of our recent results that explore various architectures with L1 adaptive control while guaranteeing performance and robustness throughout the learning process. An overview of different projects at our lab that build upon this framework will be demonstrated to show different applications.

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Dr. Bernard BROGLIATO

Speech Title: Implicit Euler discretization of set-valued sliding-mode controllers and differentiators: An introduction

Abstract: Set-valued sliding-mode control and differentiation, yield algorithms which usually suffer from the well-known chattering phenomenon, which significantly deteriorates their performance and can even sometimes prevent their use. It is known that one important source of chattering (at both the output and the input, which takes a bang-bang-like shape) is an inappropriate discretization, which yields the so-called digital, or numerical chattering. The explicit Euler discretization, which is widely employed, is known to be the source of numerical chattering (see the works of Galias et al for a fine characterization in various types of SMC). Recently it has been shown that the implicit Euler discretization yields very efficient algorithms to suppress the numerical chattering, while keeping all the nice and powerful properties of the continuous-time counterparts: rigorous definition of a discrete sliding surface, finite-time convergence, robustness to matched (and some unmatched) disturbances, Lyapunov stability, insensitivity to the control gain during the sliding-motion, etc. In this talk we will introduce the implicit Euler method on several kinds of systems (linear, Lagrange mechanical, with matched or unmatched disturbances) and several kinds of SMC controllers (first-order, twisting, super-twisting, high-order) as well as various differentiators (super-twisting, arbitrary order, Slotine-Hedrick-Misawa, generalized homogeneous, quadratic, etc). Most importantly it will be shown the deep link between the implicit discretization and maximal monotone operators, the Yosida approximations of Convex Analysis and the so-called proximal algorithms, which shows that the implicit discretization is not an implementation trick, but a discretization method. Several experimental results will be presented which validate the theoretical findings.

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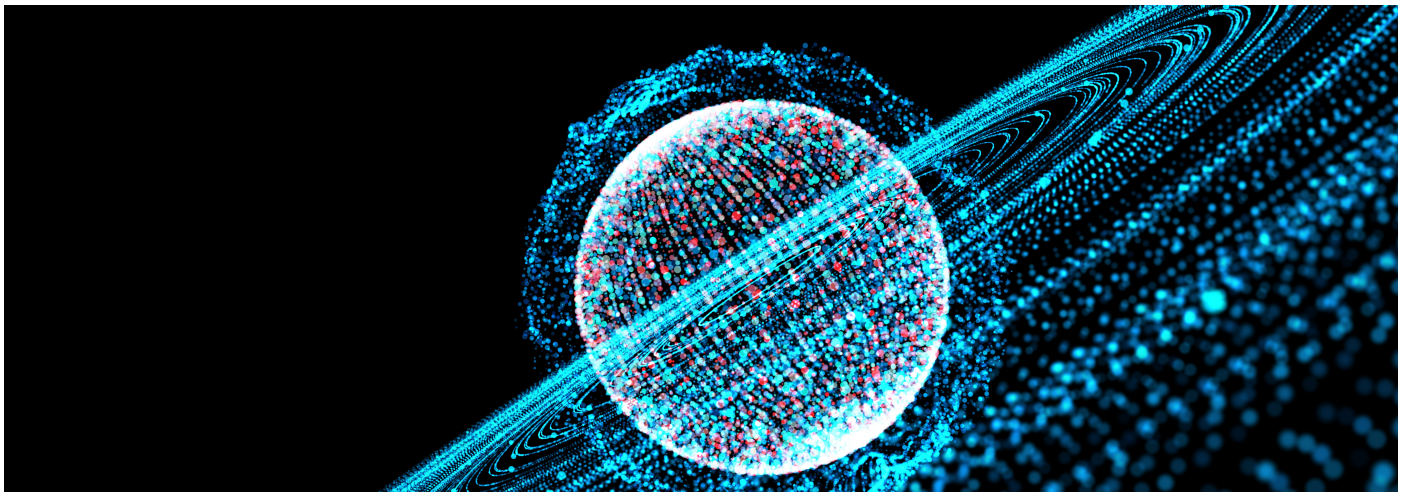

Prof. Youfu Li

Speech Title: Visual sensing and tracking for robotic applications

Abstract: Visual sensing and tracking are needed in many engineering applications including robotics. In this talk, I will present our research in visual sensing for automated 3D sensing in general and for motion tracking for robotics in particular. Different approaches in our investigation in 3D vision will be reported. These include an active vision approach to 3D visual sensing. For robotic applications, visual sensing in 3D is often needed, but the calibration remains tedious and inflexible with traditional approach. To this end, we have investigated the relevant issues for different visual sensing systems. A flexible calibration method desires the vision system parameters to be recalibrated automatically or with less operator interference whenever the configuration of the system is changed, but practically this is often hard to achieve. Various attempts were made in our previous works to enhance the flexibility in the visual sensing calibration. I will present some them including the work on omni-directional visual sensing and tracking. Another case to present is that of gaze tracking where the issues in the modeling and calibration are addressed with our new calibration method developed.