

## IEEE CIS Distinguished Lecturer Program

IEEE CIS Malaysia Chapter invites you to a Distinguished Lecture by **Prof Chia-Feng Juang** from National Chung Hsing University, Taiwan.



Chia-Feng Juang received the B.S. and Ph.D. degrees in Control Engineering from the National Chiao-Tung University, Hsinchu, Taiwan, in 1993 and 1997, respectively. Since 2001, he has been with the Department of Electrical Engineering, National Chung Hsing University, Taichung, Taiwan, where he became a Full Professor in 2007 and has been a Distinguished Professor since 2009. He served as the Chapter Chair of IEEE Computational Intelligence, Taipei Chapter, in 2017-2018, during which the chapter won the Outstanding Chapter Award from IEEE Taipei Session. Dr. Juang has authored or coauthored over 110 journal papers (including over 60 IEEE journal papers), ten book chapters, and over 130 conference papers. His current research interests include computational intelligence, intelligent control, computer vision, and intelligent robots.

Dr. Juang received the Outstanding Automatic Control Engineering Award from Chinese Automatic Control Society, Taiwan, in 2014; the Outstanding Electrical Engineering Professor Award from Chinese Institute of Electrical Engineering, Taiwan, in 2019; and the Outstanding Research Award from Ministry of Science and Technology, Taiwan, in 2021. He was elevated to IEEE Fellow in 2019 and IFSA Fellow in 2023. He is a Distinguished Lecture of IEEE Computational Intelligence Society. He is an Associate Editor of the IEEE TRANSACTIONS ON FUZZY SYSTEMS, the IEEE TRANSACTIONS ON CYBERNETICS, and the Asian Journal of Control and an Area Editor of the International Journal of Fuzzy Systems.

## Evolutionary Mobile Robots using Computational Intelligence Techniques

Evolutionary robots, like autonomous artificial organisms, automatically develop their own skills by interaction with the environment. This talk will focus on evolutionary locomotion control of mobile robots using computational intelligence techniques, including fuzzy systems and evolutionary computation. First, the basic concept of evolutionary fuzzy systems (EFSs) will be introduced. Next, for wheeled robots, an obstacle boundary following behavior learned through EFSs will be introduced. Evolutionary fuzzy control of a single wheeled robot and multiple wheeled robots cooperatively carrying an object through multi-objective evolutionary computation algorithms for obstacle boundary following will be introduced. Then, to boost the learning efficiency of multi-objective EFSs in this application, the technique of reinforcement neural fuzzy surrogate-assisted learning will be given. Finally, navigation of a single and multiple cooperative wheeled robots in unknown environments will be presented.

**Save the date and  
please register [here](#).**

**Thursday, 14<sup>th</sup> September 2023  
10 – 11.30 am  
Google Meet**

## IEEE CIS Distinguished Lecture Program

By Prof Chia-Feng Juang, National Chung Hsing University

---

---

Date of Event: 14<sup>th</sup> September 2023  
Time: 10 AM – 11.30 AM (GMT+8)  
Event Platform: Virtual (GoogleMeet)

Hosted by: IEEE Computer Intelligence (CIS) Malaysia Chapter  
Coordinator: Dr Veronica Lestari Jauw  
([Veronica.Jauw@nottingham.edu.my](mailto:Veronica.Jauw@nottingham.edu.my))  
Executive Committee, IEEE CIS Malaysia Chapter

Attendance: 48 (Registered)  
DLP Title: Evolutionary Mobile Robots using Computational Intelligence  
Techniques

**Abstract**

Evolutionary robots, like autonomous artificial organisms, automatically develop their own skills by interaction with the environment. This talk will focus on evolutionary locomotion control of mobile robots using computational intelligence techniques, including fuzzy systems and evolutionary computation. First, the basic concept of evolutionary fuzzy systems (EFSs) will be introduced. Next, for wheeled robots, an obstacle boundary following behavior learned through EFSs will be introduced. Evolutionary fuzzy control of a single wheeled robot and multiple wheeled robots cooperatively carrying an object through multi-objective evolutionary computation algorithms for obstacle boundary following will be introduced. Then, to boost the learning efficiency of multi-objective EFSs in this application, the technique of reinforcement neural fuzzy surrogate-assisted learning will be given. Finally, navigation of a single and multiple cooperative wheeled robots in unknown environments will be presented.

**Bibliography**

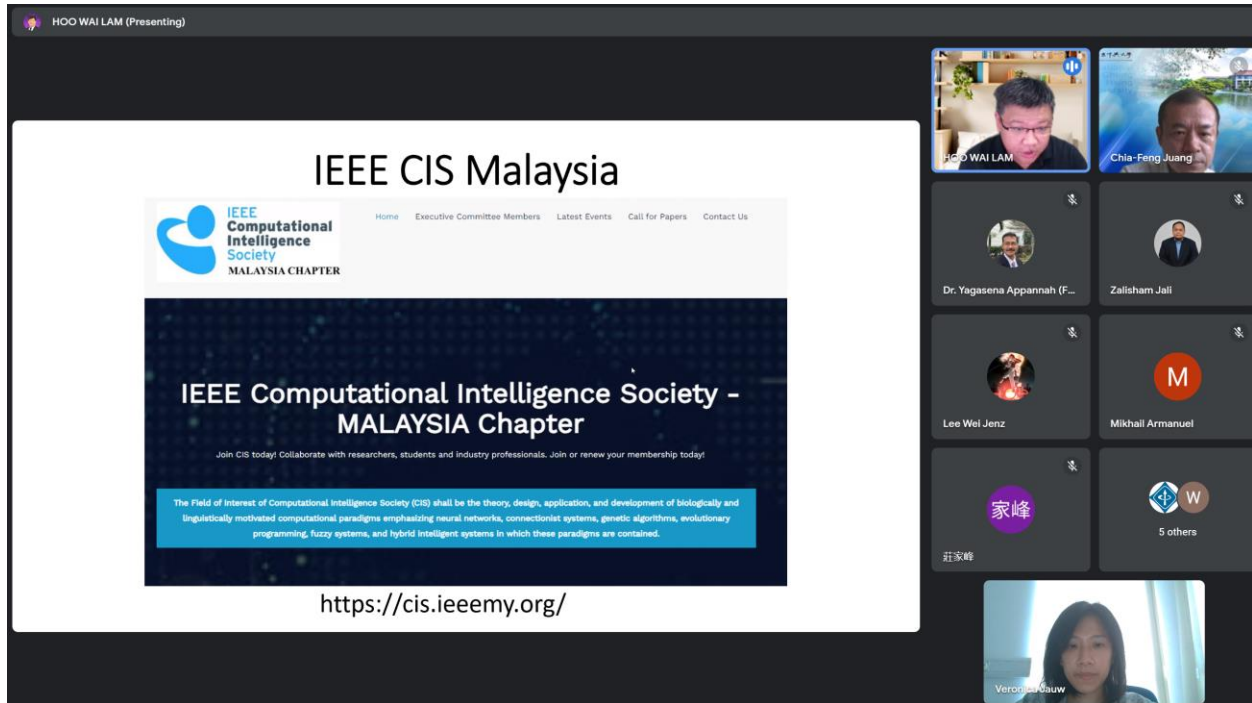
Chia-Feng Juang received the B.S. and Ph.D. degrees in Control Engineering from the National Chiao-Tung University, Hsinchu, Taiwan, in 1993 and 1997, respectively. Since 2001, he has been with the Department of Electrical Engineering, National Chung Hsing University, Taichung, Taiwan, where he

became a Full Professor in 2007 and has been a Distinguished Professor since 2009. He served as the Chapter Chair of IEEE Computational Intelligence, Taipei Chapter, in 2017-2018, during which the chapter won the Outstanding Chapter Award from IEEE Taipei Session. Dr. Juang has authored or coauthored over 110 journal papers (including over 60 IEEE journal papers), ten book chapters, and over 130 conference papers. His current research interests include computational intelligence, intelligent control, computer vision, and intelligent robots.

Dr. Juang received the Outstanding Automatic Control Engineering Award from Chinese Automatic Control Society, Taiwan, in 2014; the Outstanding Electrical Engineering Professor Award from Chinese Institute of Electrical Engineering, Taiwan, in 2019; and the Outstanding Research Award from Ministry of Science and Technology, Taiwan, in 2021. He was elevated to IEEE Fellow in 2019 and IFSA Fellow in 2023. He is a Distinguished Lecture of IEEE Computational Intelligence Society. He is an Associate Editor of the IEEE TRANSACTIONS ON FUZZY SYSTEMS, the IEEE TRANSACTIONS ON CYBERNETICS, and the Asian Journal of Control and an Area Editor of the International Journal of Fuzzy Systems.

## Events

Our event started off with an introduction of IEEE Computational Intelligence Society Malaysia Chapter by the chair of IEEE CIS, Dr Hoo Wai Lam.



The event was then proceed with the DLP talk by Prof Chiu-Feng Juang



Chia-Feng Juang (Presenting)

Information Intelligence Lab., EE, NCHU, Taiwan

## Outline

- Evolutionary robots
- Evolutionary recurrent neural networks for walking robot gait generation
- Evolutionary fuzzy control of wall-following mobile robots
- Evolutionary surrogate-assisted learning
- Conclusions

<http://iil.ee.nchu.edu.tw/>

Chia-Feng Juang, HOO WAI LAM, Dr. Yagasena Appannah (F..., Chuan Wool Cheah, Zalisham Jali, Lee Wei Jenz, FITRI YAKUB MJIIT, 7 others, Veronica Jauw

Chia-Feng Juang (Presenting)

Information Intelligence Lab., EE, NCHU, Taiwan

## Evolutionary Computation (Cont'd)

Evolutionary Computation

Genetic algorithm (GA)

SWARM LEARNING

Particle swarm optimization (PSO)

Ant colony optimization (ACO)

<https://kalamimedium.com/ypea-a-toolbox-for-evolutionary-algorithms-in-matlab-6610d61a0a9c>

<http://iil.ee.nchu.edu.tw/>

Chia-Feng Juang, HOO WAI LAM, Dr. Yagasena Appannah (F..., Chuan Wool Cheah, Zalisham Jali, Lee Wei Jenz, FITRI YAKUB MJIIT, 8 others, Veronica Jauw

Chia-Feng Juang (Presenting)

Information Intelligence Lab., EE, NCHU, Taiwan

## Evolutionary hexapod robot (cont'd)

Multiple FCRNNs

- Objective: fast forward walking

<http://iilee.nchu.edu.tw/>

II Lab, EE, NCHU

Chia-Feng Juang, HOO WAI LAM, Dr. Yagasena Appannah (F..., Chuan Wool Cheah, Zalisham Jali, Lee Wei Jenz, FITRI YAKUB MUJIT, 8 others, Veronica Jauw

Chia-Feng Juang (Presenting)

Information Intelligence Lab., EE, NCHU, Taiwan

## Multiobjective functions for performance evaluation

- Objective 1 ( $f_1$ ): walk fast
- Objective 2 ( $f_2$ ): walk straightforward
- Objective 3 ( $f_3$ ): minimal body oscillations in the roll direction.
- Objective 4 ( $f_4$ ): minimal body oscillations in the yaw direction
- Objective 5 ( $f_5$ ): desired walking posture

<http://iilee.nchu.edu.tw/>

People

- Presentation
- Chuan Wool Cheah
- Dr. Yagasena Appannah ...
- FITRI YAKUB MUJIT
- HOO WAI LAM
- Jocelyn Tan
- K W Ng
- Lee Wei Jenz
- MAS RINA MUSTAFFA / ...
- Menn Tatt Lai
- Mikhail Armanuel
- rosli abdul hamid
- Wong Soon Hiik
- Zalisham Jali
- 莊家峰

Feng Juang, HOO WAI LAM, Dr. Yagasena ..., Chuan Wool C..., Zalisham Jali, Lee Wei Jenz, FITRI YAKUB ..., 8 others, Veronica Jauw

Chia-Feng Juang (Presenting)

Information Intelligence Lab., EE, NCHU, Taiwan

## Evolution control strategies

Evolve population of solutions based on robot controls

Evolve population of solutions based on RNFS estimations

One iteration

M iterations

<http://iil.ee.nchu.edu.tw/>

Chia-Feng Juang

HOO WAI LAM

Dr. Yagasena Appannah (F...)

Chuan Wool Cheah

Zalisham Jali

David Chieng

Nur Nabillah Abu Mangshor

12 others

Veronica Jauw

Chia-Feng Juang (Presenting)

Information Intelligence Lab., EE, NCHU, Taiwan

## Simulations: training result

(a) best-location FS (minimum  $f_1$ : robot-wall distance)

(b) best-speed FS (minimum  $f_2$ : speed)

<http://iil.ee.nchu.edu.tw/>

Chia-Feng Juang

HOO WAI LAM

Dr. Yagasena ...

Chuan Wool C...

Zalisham Jali

yinlou soon

David Chieng

12 others

Veronica Jauw

People

- Chuan Wool Cheah
- David Chieng
- Dr. Yagasena Appannah ...
- FITRI YAKUB MUJIT
- HOO WAI LAM
- Jocelyn Tan
- K.W Ng
- Kah Weng Ng
- Lee Wei Jenz
- MAS RINA MUSTAFFA / ...
- Menn Tatt Lai
- Mikhail Armanuel
- rosli abdul hamid
- Shadia
- Wong Soon Hlik

## List of Participants

Full Name	Affiliations	IEEE Member (Y/N)
Eddy Lim Yee Yang	University of Nottingham Malaysia	No
Chhatresh Sehgal	University of Nottingham	No
Mohd Zaki Ayob	UniKL	Yes
Nicholas Tiong Foo Kuok		Yes
Ts Ng Kah Weng	IEEE Penang	Yes
Narendran Ramasenderan	Asia pacific university	Yes
Md Mozasser Rahman		Yes
Alfian Abdul Halin	UNIVERSITI PUTRA MALAYSIA	Yes
Shadia Baroud	UNIMY University	Yes
Cheah Chuan Wooi	IEEE Malaysia ED/MTT/SSC Penang Joint Chapter	Yes
Lee Nung Kion	Universiti Malaysia Sarawak	No
Lai Menn Tatt	IEEE Malaysia ED/MTT/SSC Penang Joint Chapter	Yes
Mahfuza Sultana	IIUM	Yes
Attaullah Khidrani	Unversity technology Malaysia	Yes
WSeng Kin Lai	Tunku Abdul Rahman University of Management and Technology	Yes
Mohd Zalisham B Jali	SENIOR LECTURER	Yes
Ang Chee Huei	Inti International College Subang	Yes
Lee Poh Foong	University Tunku Abdul Rahman	Yes
Ts Dr Lam Wai Leong	KFHM	Yes
Tan Jian An	NTU	No
Fitri Yakub	Researcher	Yes
Wong Soon Hiik	SMIEEE	Yes
Maram B. R. Seyam	hfyms5@nottingham.edu.my	No
Syamsiah Mashohor	Universiti Putra Malaysia	No
Navientharan Balasubramaniam	University of Nottingham malaysia	No
Nur Nabilah binti Abu Mangshor	Universiti Teknologi MARA	No
Ng Kok Weng	University of Nottingham Malaysia	No
Tan Szu Jean	MMU Melaka	No
Tew Yiqi	Tunku Abdul Rahman University Management and Technology (TAR UMT)	Yes
Lee Wei Jenz	University of Nottingham Malaysia	No
Wong Chee Harng, Reuben	University of Nottingham Malaysia	No
Mikhail Armanuel	University of Nottingham	No
David Chieng	University of Nottingham Ningbo China	Yes
Thong Tian Xiang	N/A	No
Fong Kee Joe	University of Nottingham Malaysia	No
Mas Rina Mustaffa	UPM	Yes
Rosli bin Abd Hamid	Jaringan Semangat sdn bhd	Yes
Dr. Yagasena Appannah	Assoc Professor	Yes



Ahmed Ali Ahmed Bahashwan	Lecturer in Electronic and communication Engineering Faculty of Engineering and Petroleum Hadhramaut University Yemen	Yes
Leong Ying Mei	Quest International University	Yes
Christopher Lazarus	Tunku Abdul Rahman University of Management and Information Technology	No
Saiful Azrin bin Mohd Zulkifli	Universiti Teknologi PETRONAS	Yes
Sarah Yasmin Mohamad	IIUM	Yes
Teng Howe Cheng	Tunku Abdul Rahman University of Management and Technology	No
Lau Bee Theng	Swinburne University of Technology Sarawak Campus	Yes
Nicholas Tiong Foo Kuok	IEEE Malaysia	Yes
Chong Chee Soon	Tunku Abdul Rahman University of Management and Technology (TARUMT)	Yes
Tan Ee Hung	Kolej Laila Taib	Yes