

2022 IEEE CIS Summer School on Computational Intelligence for Human-Machine Interaction in Ergonomics

August 23-25, 2022

IEEE Computational Intelligence Society

IEEE CIS Taipei Chapter

**Institute of Electrical and Control Engineering, National Yang Ming Chiao Tung University, Taiwan
Department of Biological Science and Technology, National Yang Ming Chiao Tung University,
Taiwan**

IEEE CIS High School Outreach Subcommittee

Ministry Of Education, Taiwan

Taiwan Fuzzy Systems Association (TFSA), Taiwan

Community-centric Systems Research Core, Tokyo Metropolitan University, Japan

Nojima Lab, Osaka Metropolitan University, Japan

Artificial Intelligence Industry and Academia Alliance, Taiwan

KWS Center / OASE Lab., National University of Tainan, Taiwan

**Center for Intelligent Drug Systems and Smart Bio-devices, NYCU AI-FML International
Academy, Taiwan**

Taiwanese Association for Artificial Intelligence, Taiwan

E. Sun Commercial Bank, Taiwan

1. Objectives

Computational Intelligence (CI), including fuzzy logic, neural network, and evolutionary computation, is a sub-branch of AI. It is an important core technology of AI and plays an important role in developing successful intelligent systems, including games, multilayer perceptron, and cognitive developmental systems [1-2]. The main contents in this summer school are the basics of fuzzy systems, neural networks, brain-computer interface and evolutionary computation. Fuzzy logic is suitable for computing the degree of human perception such as heat or cold. Different people have different feelings of heat and cold even at the same temperature. The neural network is one of the important models for machine learning which can compute the mathematical feature functions. Evolutionary computation is based on the observation of the animals' behavior patterns and it is one of the important machine learning models, too [1-2]. Brain-computer interfaces (BCIs) have shown great prospects as real-time bidirectional links between living brains and actuators [3], Artificial intelligence (AI), which can advance the analysis and decoding of neural activity, promoted the development of BCI in the fields of consumer, clinical, and laboratory research [4-5].

Human-Machine Interaction in Ergonomics is the scientific discipline concerned with understanding the principles underlying interactions between humans and other elements of a system, and the profession that applies these principles and understanding to designs in order to optimize human well-being and overall system performance. As human behavior is always dynamic, making it challenging to predict and access, it is worth applying fuzzy theories, control systems and neural network with intelligent computational technologies to enhance the interaction performance between humans and the systems [6-7].

In 2018 and 2019, we hold a summer school on “*Computational Intelligence for Human and Robot Co-learning*” in Kaohsiung. In 2020, owing to the COVID-19 pandemic, 2020 IEEE CIS Summer School on Computational Intelligence for Human and Robot Co-learning was held in the form of the **Virtual Seminars @ Zoom** in Japan and Taiwan. In 2021, we hold a **Summer School on Computational Intelligence for High-**

School Student Learning in the form of the **Virtual Seminars @ Zoom** in Japan and in Taiwan in a physical seminar. In 2022, we hold a **Summer School on Computational Intelligence for Human-Machine Interaction in Ergonomics** activity in a hybrid style, including a virtual (Japan/USA/Canada/ India/ Indonesia/Malaysia/Vietnam/Thailand/Guatemala/Germany/China) and a physical (Taiwan) summer school, to gather more students **to learn the Computational Intelligence knowledge on Robot Co-learning and Brain-Computer Interface in real-world applications.**

2. Venue and Dates

The basic details, including the venue, dates, duration, and a web link to the CI High School Education Program webpage are listed as follows.

- Venue: **JanFuSun Resort Hotel, Yunlin, Taiwan**
Note: This summer school held in a hybrid style, including a virtual (Japan/ USA/ Canada/ India/ Indonesia/ Malaysia/ Vietnam/ Thailand/ Guatemala/ Germany/ China) and a physical (Taiwan) summer school.
- Dates: **August 23-25, 2022**
- Duration: **3 days**
- Website:
<https://sites.google.com/asap.nutn.edu.tw/2022-ieee-cis-summer-school/home>
- Program and Abstracts:
<https://reurl.cc/m3yjN1>
- Sponsors:
IEEE Computational Intelligence Society
Institute of Electrical and Control Engineering, NYCU
Department of Biological Science and Technology, NYCU



- Co-sponsors:
IEEE CIS High School Outreach Subcommittee
Ministry Of Education
Taiwan Fuzzy Systems Association (TFSA)
Community-centric Systems Research Core, Tokyo Metropolitan University
Nojima Lab., Osaka Metropolitan University
Artificial Intelligence Industry and Academia Alliance
KWS Center / OASE Lab., National University of Tainan
Center for Intelligent Drug Systems and Smart Bio-devices, NYCU AI-FML International Academy
Taiwanese Association for Artificial Intelligence
E. Sun Commercial Bank



- **Technically Co-sponsors**

JanFunSun Fancy World



3. Lectures and Courses Program

Invited Lecture 1: Prof. Chia-Feng Juang

Affiliation: College of Electrical Engineering and Computer Science
National Chung Hsing University, Taiwan

Topic: Data-driven Interpretable Fuzzy Systems: Techniques and Applications

Invited Lecture 2: Prof. Huei-Yung Lin

Affiliation: Department of Electrical Engineering, National Chung Cheng University, Taiwan

Topic: UAV: Principles and Applications

Invited Lecture 3: Prof. Yusuke Nojima

Affiliation: Department of Core Informatics, Graduate School of Informatics, Osaka Metropolitan University, Japan

Topic: Basics and Extensions of Evolutionary Computation

Invited Lecture 4: Dr. Chun-Ren Phang

Affiliation: International Ph.D. Program in Interdisciplinary Neuroscience, National Yang Ming Chiao Tung University, Taiwan

Topic: Brain-Computer Interface for Enhancing the Post-Stroke Rehabilitation

Invited Lecture 5: Dr. Cheng-Hua Su

Affiliation: Institute of Bioinformatics and Systems Biology,
National Yang Ming Chiao Tung University, Taiwan

Topic: Machine Learning in Analysis and Improvement of Sleep Quality

Invited Lecture 6: Prof. Marek Reformat

Affiliation: Department of Electrical and Computer Engineering
University of Alberta, Canada

Topic: Introduction to Fuzzy Sets and Systems

Invited Lecture 7: Prof. Chang-Shing Lee

Affiliation: Department of Computer Science and Information Engineering
National University of Tainan, Taiwan

Topic: CI for Real-World Applications

Invited Lecture 8: Prof. Naoyuki Kubota

Affiliation: Department of Mechanical Systems Engineering
Tokyo Metropolitan University, Japan

Topic: Neural Network

Invited Lecture 9: Prof. Jin-Tsong Jeng

Affiliation: Department of Computer Science and Information Engineering, National Formosa University, Taiwan

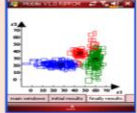
Topic: Intelligent Symbolic Data Fuzzy Clustering on Smart Phone

4. Program

2022 IEEE CIS Summer School on Computational Intelligence for Human-Machine Interaction in Ergonomics

Note: Time zone is GMT+8 (Taiwan Time).

Program

Time/Date	Day 1 Aug. 23, 2022		Day 2 Aug. 24, 2022	Day 3 Aug. 25, 2022	
09:45-10:00	Opening Address				
10:00-11:00	Lecture Title	Data-driven Interpretable Fuzzy Systems: Techniques and Applications	Introduction to Fuzzy Sets and Systems	Workshop Topic 1 : CI for Human-Machine Interaction in Real-World Applications Chair : Prof. Li-Wei Ko <i>Institute of Electrical and Control Engineering, National Yang Ming Chiao Tung University, Taiwan</i> Topic 2 : AI-FML Robotic Learning with AIoT Applications Chair : Prof. Chang-Shing Lee	
	Speaker	Prof. Chia-Feng Juang <i>Department of Electrical Engineering and Computer Science, National Chung Hsing University, Taiwan</i>	Prof. Marek Reformat <i>Department of Electrical and Computer Engineering, University of Alberta, Canada</i>		
11:00-11:10	Break				
11:10-12:10	Lecture Title	UAV : Principles and Applications	CI for Real-World Applications		
	Speaker	Prof. Huei-Yung Lin <i>Department of Electrical Engineering, National Chung Cheng University, Taiwan</i>	Prof. Chang-Shing Lee <i>Department of Computer Science and Information Engineering, National University of Tainan, Taiwan</i>		
12:10-13:00	Lunch & Break				
13:00-14:00	Lecture Title	Basics and Extensions of Evolutionary Computation	Neural Network	Demonstration Topic 1 : CI for Human-Machine Interaction in Real-World Applications Chair : Prof. Li-Wei Ko Topic 2 : AI-FML Robotic Learning with AIoT Applications Chair : Prof. Chang-Shing Lee	
	Speaker	Prof. Yusuke Nojima <i>Department of Core Informatics, Graduate School of Informatics, Osaka Metropolitan University, Japan</i>	Prof. Naoyuki Kubota <i>Department of Mechanical Systems Engineering, Tokyo Metropolitan University, Japan</i>		
14:00-14:30	Break				
14:30-15:00	Lecture Title	Brain-Computer Interface for Enhancing the Post-Stroke Rehabilitation	Intelligent Symbolic Data Fuzzy Clustering on Smart Phone		
	Speaker	Chun-Ren Phang <i>International Ph.D. Program in Interdisciplinary Neuroscience, National Yang Ming Chiao Tung University, Taiwan</i>	Prof. Jin-Tsong Jeng <i>Department of Computer Science and Information Engineering, National Formosa University, Taiwan</i>		
15:00-15:30	Lecture Title	Machine Learning in Analysis and Improvement of Sleep Quality			
	Speaker	Cheng-Hua Su <i>Institute of Bioinformatics and Systems Biology, National Yang Ming Chiao Tung University, Taiwan</i>			

5. Organizers

• General Chair

Name Prof. Li-Wei Ko
Affiliation IEEE CIS Taipei Chapter
 Institute of Electrical and Control Engineering
 Department of Biological Science and Technology
 National Yang Ming Chiao Tung University, Taiwan
Contact and Email lwko@nycu.edu.tw

• General Co-Chairs

Name Prof. Chang-Shing Lee
Affiliation Department of Computer Science and Information Engineering
 National University of Tainan, Taiwan

Contact and Email leccs@mail.nutn.edu.tw

Name Prof. Naoyuki Kubota
Affiliation Department of Mechanical Systems Engineering
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Name Prof. Yusuke Nojima
Affiliation Department of Computer Science and Intelligent Systems
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Name Prof. Jin-Tsong Jeng
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Name Prof. Hung-Duen Yang
Affiliation Department of Physics, National Sun Yat-Sen University, Taiwan
Contact and Email: yang@mail.nsysu.edu.tw

• **Organizing Committee Members**

Name Prof. Marek Reformat
Affiliation Department of Electrical and Computer Engineering, University of Albert, Canada

Name Prof. Po-Hsun Cheng
Affiliation Department of Software Engineering and Management, National Kaohsiung Normal University, Taiwan

Name Prof. Jose M. Alonso
Affiliation NCentro Singular de Investigación en TecnoloXías Intelixentes, Spain

Name Prof. Jose M. Soto Hidalgo
Affiliation Department of Electronics and Computer Engineering, University of Cordoba, Spain

Name Prof. Amir Pourabdollah
Affiliation School of Science & Technology, Nottingham Trent University, UK

Name Prof. Jiann-Shu Lee
Affiliation Department of Computer Science, National University of Tainan, Taiwan

• **Student Volunteer Chairs**

Name Cong-Ying He
Affiliation Institute of Bioinformatics and Systems Biology
National Yang Ming Chiao Tung University, Taiwan

Name I-Wen Huang
Affiliation Institute of Biomedical Engineering,
National Yang Ming Chiao Tung University, Taiwan

6. Poster, Banner, and T-shirt

● **T-shirt**



● Poster

2022 IEEE CIS Summer School on Computational Intelligence for Human-Machine Interaction in Ergonomics

2022/August 23-25

Venue: Janfusun Resort Hotel, Yunlin, Taiwan

Website





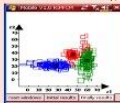
Registration



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In 2022, we hold a Summer School on Computational Intelligence for Human-Machine Interaction in Ergonomics in Taiwan and in Japan to gather more students to learn the Computational Intelligence knowledge on Robot Co-learning and Brain-Computer Interface in real-world applications.

Lectures and Courses Program Note: Time zone is GMT+8 (Taiwan Time).

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	Speaker	Prof. Chia-Feng Juang <i>Department of Electrical Engineering and Computer Science, National Chung Hsing University, Taiwan</i>	Prof. Marek Reformat <i>Department of Electrical and Computer Engineering, University of Alberta, Canada</i>			
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11:10-12:10	Lecture Title	UAV : Principles and Applications	CI for Real-World Applications		Demonstration Topic 1 : CI for Human-Machine Interaction in Real-World Applications Chair : Prof. Li-Wei Ko Topic 2 : AI-FML Robotic Learning with IoT Applications Chair : Prof. Chang-Shing Lee	
	Speaker	Prof. Hwei-Yung Lin <i>Department of Electrical Engineering, National Chung Cheng University, Taiwan</i>	Prof. Chang-Shing Lee <i>Department of Computer Science and Information Engineering, National University of Tainan, Taiwan</i>			
12:10-13:00 Lunch & Break						
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	Speaker	Prof. Yusuke Nojima <i>Department of Core Informatics, Graduate School of Informatics, Osaka Metropolitan University, Japan</i>	Prof. Naoyuki Kubota <i>Department of Mechanical Systems Engineering, Tokyo Metropolitan University, Japan</i>			
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	Speaker	Chun-Ren Phang <i>International Ph.D. Program in Interdisciplinary Neuroscience, National Yang Ming Chiao Tung University, Taiwan</i>	Prof. Jin-Tsong Jeng <i>Department of Computer Science and Information Engineering, National Formosa University, Taiwan</i>			
15:00-15:30	Lecture Title	Machine Learning in Analysis and Improvement of Sleep Quality				
	Speaker	Cheng-Hua Su <i>Institute of Bioinformatics and Systems Biology, National Yang Ming Chiao Tung University, Taiwan</i>				

Organizers:

General Chair: Li-Wei Ko, IEEE CIS Taipei Chapter, Institute of Electrical and Control Engineering/Department of Biological Science and Technology, National Yang Ming Chiao Tung University, Taiwan. Email: lwko@nycu.edu.tw

General Co-Chairs: Chang-Shing Lee, Department of Computer Science and Information Engineering, National University of Tainan, Taiwan. Email: leccs@mail.nutn.edu.tw



● Website Banner












Website Banner

● Lecture Materials

- Lecture Materials on the website can download:

<https://sites.google.com/asap.nutn.edu.tw/2022-ieee-cis-summer-school/invited-lectures?authuser=0>

Invited Lectures		
 <p>Speaker: Prof. Chia-Feng Juang Lecture Title: Data-driven Interpretable Fuzzy Systems: Techniques and Applications Department of Electrical Engineering and Computer Science, National Chung Hsing University, Taiwan Download Lecture Materials</p>	 <p>Speaker: Chun-Ren Phang Lecture Title: Brain-Computer Interface for Enhancing the Post-Stroke Rehabilitation International Ph.D. Program in Interdisciplinary Neuroscience, National Yang Ming Chiao Tung University, Taiwan Download Lecture Materials</p>	 <p>Speaker: Prof. Chang-Shing Lee Lecture Title: CI for Real-World Applications Workshop/Demonstration: AI-FML Robotic Learning with AIoT Applications Department of Computer Science and Information Engineering, National University of Tainan, Taiwan Download Lecture Materials</p>
 <p>Speaker: Prof. Huei-Yung Lin Lecture Title: UAV - Principles and Applications Department of Electrical Engineering, National Chung Cheng University, Taiwan Download Lecture Materials</p>	 <p>Speaker: Cheng-Hua Su Lecture Title: Machine Learning in Analysis and Improvement of Sleep Quality Institute of Bioinformatics and Systems Biology, National Yang Ming Chiao Tung University, Taiwan Download Lecture Materials</p>	 <p>Speaker: Prof. Naoyuki Kubota Lecture Title: Neural Network Department of Mechanical Systems Engineering, Tokyo Metropolitan University, Japan Download Lecture Materials</p>
 <p>Speaker: Prof. Yuzuke Nojima Lecture Title: Basics and Extensions of Evolutionary Computation Department of Core Informatics, Graduate School of Informatics, Osaka Metropolitan University, Japan Download Lecture Materials</p>	 <p>Speaker: Prof. Marek Reformat Lecture Title: Introduction to Fuzzy Sets and Systems Department of Electrical and Computer Engineering, University of Alberta, Canada Download Lecture Materials</p>	 <p>Speaker: Prof. Jin-Tsong Jeng Lecture Title: Intelligent Symbolic Data Fuzzy Clustering on Smart Phone Department of Computer Science and Information Engineering, National Formosa University, Taiwan Download Lecture Materials</p>

7. Activity Photos

- Summer School Environment Setup and Testing in Taiwan on August 22, 2022



Device Testing @ JanFuSun Room 202



Virtual Environment Testing @ JanFuSun Room 202



Signage Setup @ JanFuSun 2F



Device Setup @ JanFuSun Room 203

- Day 1 on August 23, 2022



Group Photo After Opening Address



Prof. Chia-Feng Juang @ Lecture 1



Prof. Yusuke Nojima @ Lecture 3



Dr. Chun-Ren Phang @ Lecture 4



Dr. Cheng-Hua Su @ Lecture 5



Day1 Lecture Status @ JanFuSun Room 202



Group Photo After Day1 Lectures



Sign in @ JanFuSun 2F

● **Day 2 on August 24, 2022**



Group photo Before Day2 Lectures



Prof. Marek Reformat @ Lecture 6



Prof. Chang-Shing Lee @ Lecture 7



Prof. Chang-Shing Lee @ Lecture 7



Prof. Naoyuki Kubota @ Lecture 8



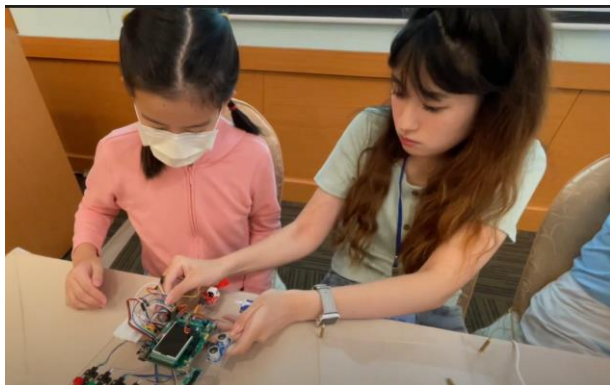
Prof. Jin-Tsong Jeng @ Lecture 9



Prof. Jin-Tsong Jeng @ Lecture 9



Day 2 Lecture Status@JanFuSun Room 202



Testing AIoT @ JanFuSun Room 203



Testing EEG Control Drone @ JanFuSun Room 203

● Day 3 on August 25, 2022



Sign in Status @ JanFuSun 2F



Workshop on BCI Drone



Workshop on AIoT



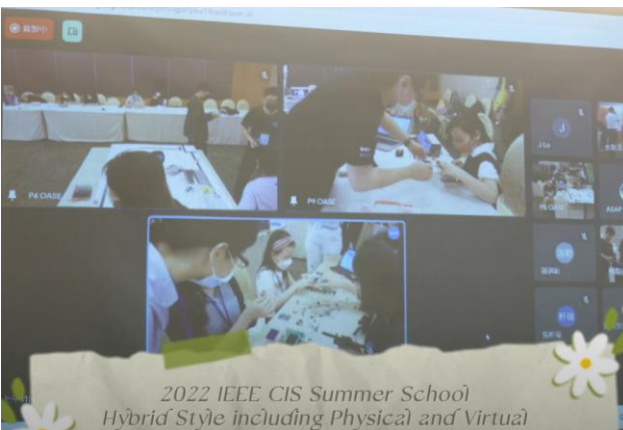
Workshop on AIoT



Workshop on BCI Rehab



Prof. Li-Wei Ko Teaching

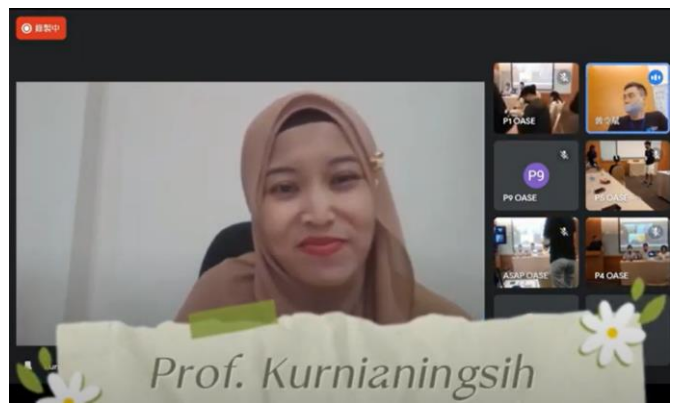




Prepare English Report



Group Photo 1



Janhusun Fancyworld CEO

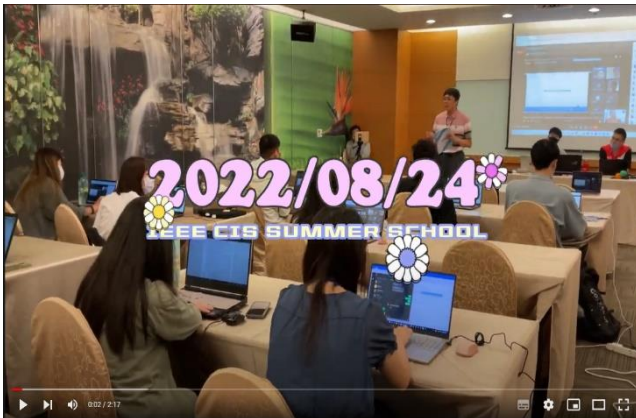


Group Photo 2

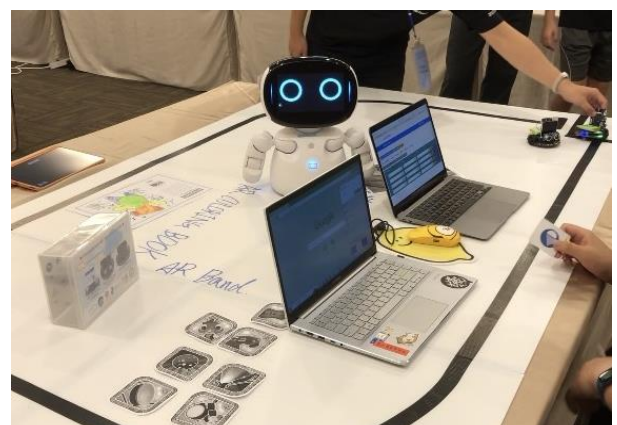
8. Activity Videos



2022/08/23 Day 1: <https://youtu.be/ctQ-dVvQP50>



2022/08/24 Day 2: <https://youtu.be/hhl0WDIjK0E>



2022/08/25 Day 3 morning: <https://youtu.be/3xZYO-LkADs>

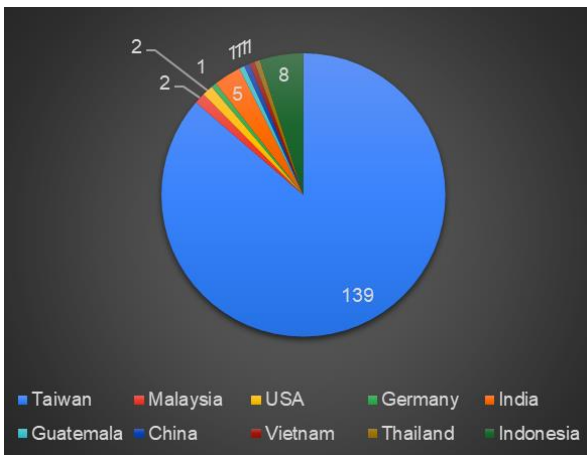


2022/08/25 Day 3 afternoon: <https://youtu.be/cLOuGpsOFQk>

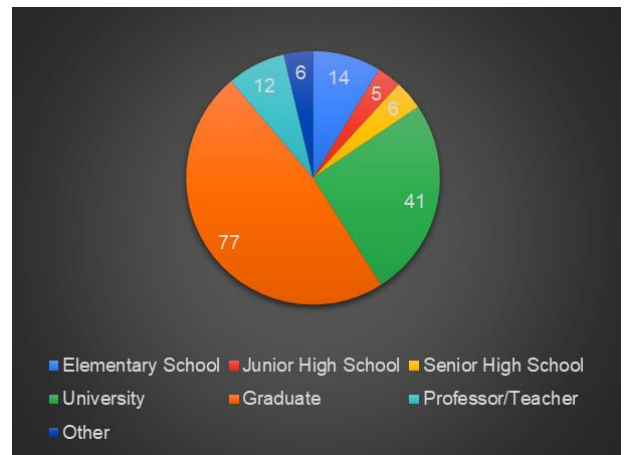
9. Information of Participants

- **Basic information of participants**

Total number of people who registered for 2022 IEEE CIS Summer School is 161, including 139, 8, 5, and 9 from Taiwan, Indonesia, India, and the other countries, respectively. There are 77 graduates, 41 undergraduates, 6 senior high school students, 5 junior high school students, 14 elementary school students, and 18 non-students.



Number of Participants from different countries

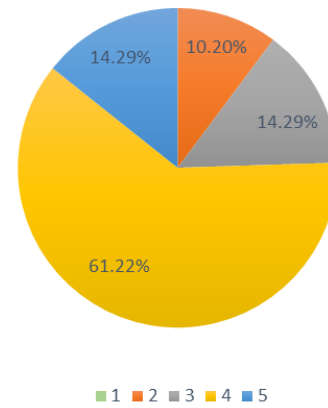
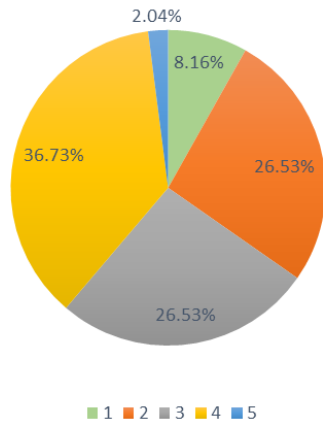


Number of Participants from different Groups of Students

10. Feedback Survey

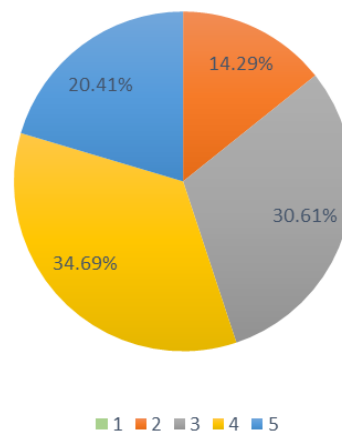
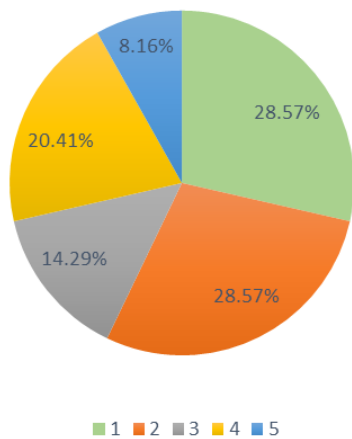
- The total number of people who attended at least two-thirds of the lectures and CI for Human-Machine Interaction in Real-world Applications and AI-FML Robotic Learning with AIoT Applications workshops is 61, including 58, 1, and 2 from Taiwan, the U.S.A., and Indonesia, respectively.
- The ratio of people who were awarded a certificate of participation is 0.417, 0.5, and 0.25 from Taiwan, the U.S.A. and Indonesia, respectively. The total number of people who submitted feedback survey is 60.

- Results of feedback survey:** From the pie chart of the feedback survey, most people have briefly understood computational intelligence, fuzzy logic, and human-machine interaction much more than before. And about 95% of people would like to join IEEE CIS summer school next time.



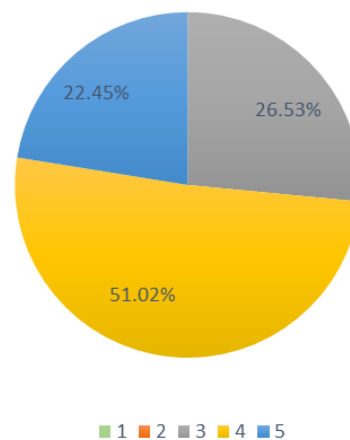
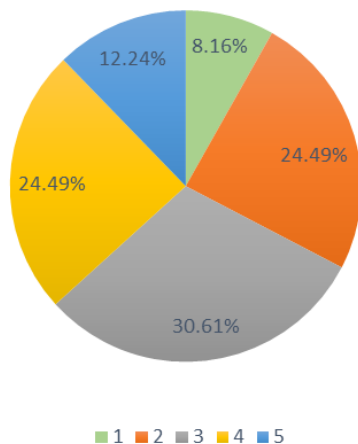
Q1. How much had you known computational intelligence in general before this summer school?

Q2. How much did you understand computational intelligence in general in this summer school?



Q3. How much had you known fuzzy logic in general before this summer school?

Q4. How much did you understand fuzzy logic in general in this summer school?



Q5. How much had you known human-machine interaction in general before this summer school?

Q6. How much did you understand human-machine interaction in general in this summer school?

11. Impacts and Discussions

Our summer school expects the impact on Computational Intelligence education to senior undergraduate, graduate students, post-doc, and young researchers who are willingly to deepen their skills in Computer Science, Mathematics, Electrical Engineering, Robotics, Brain-computer interface, and related areas. Meanwhile, it is disseminated by having CIS co-funding the summer school. The scientific goal of the summer school is to better understand how innovative Computational Intelligence developments relate to and enhance human-machine interaction in real-world settings. It includes the participation of national and internationally leading researchers in the area of CI, members, and senior members of the IEEE. The **Summer School on Computational Intelligence for Human-Machine Interaction in Ergonomics** has promoted the the Computational Intelligence knowledge from elementary-school, high-school, university students to graduates, as well as the **Workshop** are good for students to learn the **CI for Human-Machine Interaction in Real-World Applications** and **AI-FML Robotic Learning with AIoT Applications**.

This activity has more than 150 registrants from 10 countries or regions around the world, covered from 77 graduates, 41 undergraduates, 6 senior high school students, 5 junior high school students, 14 elementary school students, and 18 non-students. The first two days of the course are more suitable for students above high school, and the last day of the workshop is more suitable for children. This activity was divided into several levels to meet the learning needs of more students.

The organizers of this summer school really work hard to promote computational intelligence to more students. For students and lectures, we will provide appropriate content to them in the future. We think this event is a well-organized summer school, as well as are very happy to join this event and see many participants, both students & teachers, from 12 countries including Japan, Canada, India, USA, and Indonesia.

Finally, we summarize some feedback after the summer school as follows. This first day is suitable for university students related to EE or CSIE. The second day is suitable for senior high school students and university students. The third day is suitable for all the students who are interested in CI, BCI, and AI-FML Metaverse. The third-day event of the workshop needs to be improved for online participants. This summer school organizes very well and thank you very much for the main organizers. Hopefully, all of the local participants can go to the venue to join together.

12. Acknowledgement

The organizers would like to express many thanks for the support of the IEEE Computational Intelligence Society, Institute of Electrical and Control Engineering from NYCU, department of Biological Science and Technology from NYCU, IEEE CIS High School Outreach Subcommittee members, the Ministry of Science and Technology (MOST) in Taiwan, KWS Center / OASE Lab. From National University of Tainan, JanFuSun Resort Hotel, E. Sun Commercial Bank and Taiwan Fuzzy Systems Association.

Reference

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- [6] Lee, C. S., Wang, M. H., Ko, L. W., Lee, Y. H., Ohashi, H., Kubota, N., ... & Su, S. F. (2020). Human intelligence meets smart machine: a special event at the IEEE international conference on systems, man, and cybernetics 2018. *IEEE Systems, Man, and Cybernetics Magazine*, 6(1), 23-31.
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