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 held 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 held 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](https://sites.google.com/asap.nutn.edu.tw/2022-ieee-cis-summer-school/home)
- **Program and Abstracts:** [https://reurl.cc/m3yjN1](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
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).

<table>
<thead>
<tr>
<th>Time/Date</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
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<tbody>
<tr>
<td>09:45-10:00</td>
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<tr>
<td>10:00-11:00</td>
<td>Lecture Title</td>
<td>Lecture Title</td>
<td>Workshop</td>
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<tr>
<td></td>
<td>Speaker: Prof. Chia-Feng Juang</td>
<td>Speaker: Prof. Marek Reformat</td>
<td>Chair: Prof. Li-Wei Ko</td>
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<tr>
<td></td>
<td>Department of Electrical Engineering and Computer Science, Nation Taiwan University, Taiwan</td>
<td>Department of Electrical and Computer Engineering, University of Alberta, Canada</td>
<td>Institute of Electrical and Control Engineering, National Yang Ming Chiao Tung University, Taiwan</td>
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<tr>
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<td>Department of Mechanical Systems Engineering, Tokyo Metropolitan University, Japan</td>
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<tr>
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<tr>
<td></td>
<td>Brain-Computer Interface for Enhancing the Post-Stroke Rehabilitation</td>
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<tr>
<td></td>
<td>International M.Sc. Program in Multidisciplinary Neuroscience, National Yang Ming Chiao Tung University, Taiwan</td>
<td>Department of Computer Science and Information Engineering, National University of Tainan, Taiwan</td>
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</tbody>
</table>

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 Tokyo Metropolitan University, Japan  
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  **Name**  Prof. Yusuke Nojima  
  **Affiliation**  Department of Computer Science and Intelligent Systems Osaka Prefecture University, Japan  
  **Contact and Email** nojima@cs.osakafu-u.ac.jp
Name: Prof. Jin-Tsong Jeng  
Affiliation: College of Electrical and Computer Engineering  
National Formosa University, Taiwan  
Contact and Email: tsong@nfu.edu.tw

Name: Prof. Chen-Chia Chuang  
Affiliation: Department of Electrical Engineering, Ilan County, Taiwan  
Contact and Email: ccchuang@niu.edu.tw

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 Alberta, 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 Tecnologías 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
# 2022 IEEE CIS Summer School on Computational Intelligence for Human-Machine Interaction in Ergonomics

**2022/August 23-25**

**Venue:** Janfusun Resort Hotel, Yunlin, Taiwan

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, multiplayer perceptron, and cognitive developmental systems. The main contents in this summer school are the basics of fuzzy systems, neural networks, brain-computer interface and evolutionary computation.

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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<td>Institute of Bioinformatics and Systems Biology, National Yang Ming Chung Hsing University, Taiwan</td>
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**Workshop**

**Topic 1:** CI for Human-Machine Interaction in Real-World Applications

Chair: Prof. Li-Wei Ko

Institute of Electrical and Control Engineering, National Yang Ming Chung Hsing University, Taiwan

**Topic 2:** AI-FML: Robotic Learning with AI Applications

Chair: Prof. Chang-Shing Lee

**Demonstration**

**Topic 1:** CI for Human-Machine Interaction in Real-World Applications

Chair: Prof. Li-Wei Ko

**Topic 2:** AI-FML: Robotic Learning with AI Applications

Chair: Prof. Chang-Shing Lee

**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: wkko@nycu.edu.tw

**General Co-Chairs:** Chang-Shing Lee, Department of Computer Science and Information Engineering, National University of Tainan, Taiwan. Email: lecss@mail.nutn.edu.tw
Lecture Materials on the website can download: https://sites.google.com/asap.nutn.edu.tw/2022-ieee-cis-summer-school/invited-lectures?authuser=0
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
Day 2 on August 24, 2022
Prof. Chang-Shing Lee @ Lecture 7

Prof. Naoyuki Kubota @ Lecture 8

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
8. Activity Videos

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

2022/08/24 Day 2: https://youtu.be/hhl0WDljK0E

2022/08/25 Day 3 morning: https://youtu.be/3ZYO-LkADs
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.

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 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


