

2021 IEEE CIS Summer School on Computational Intelligence for High-School Student Learning

Physical Venue: JanFuSun Resort Hotel, Yunlin, Taiwan

Date: August 10-12, 2021

IEEE CIS High School Outreach Subcommittee
Taiwan AI Academy, Taiwan
KWS Center, National University of Tainan, Taiwan
Information Education Center, National Kaohsiung Normal University, Taiwan
Artificial Intelligence Industry and Academia Alliance, Taiwan
E. Sun Commercial Bank, Taiwan
Taiwanese AI Association, Taiwan
Community-centric Systems Research Core, Tokyo Metropolitan University, Japan
Nojima Lab, Osaka Prefecture University, Japan
AI-FML International Academy

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]. The main contents in this summer school are the basics of fuzzy systems, neural networks, and evolutionary computation. Fuzzy logic is suitable for computing the degree of human perception such as hot or cold. Different people have different feelings of hot 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.

Learning has become a very popular approach for cybernetics systems. This topic has always been considered a research in the Computational Intelligence (CI) area. Human-in-the-loop (*Hit-Loop*) is a branch of artificial intelligence that uses human intelligence and machine learning to jointly create the model of machine learning. In a *Hit-Loop*, a human operator is a crucial component of an automated control process, handling challenging tasks of supervision, exception control, optimization, and maintenance. *Hit-Loop* AI puts human learning and machine learning in a good circle. Humans can train, adjust, and test specific algorithms or training processes in this circle to allow them to independently participate in human behavior simulations to label training data for machine learning. Human-centered AI learns from human input and collaboration, as well as its goal is to bridge the gap between machine and human beings by developing machine intelligence to understand human language, emotion, and behavior.

In 2018 and 2019, we hold a summer school on “*Computational Intelligence for Human and Robot Co-learning*” in Kaohsiung, Taiwan. 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. Additionally, 2020 CI High School Education Program on Computational Intelligence for AI-FML Robotic Learning was held in Taiwan in a physical seminar together with *2020 IEEE CIS Summer School on Computational Intelligence for Human and Robot Co-learning* to promote the Computational Intelligence concept and knowledge to Junior High School students and Elementary School students in Japan and Taiwan. Hence, in 2021, we proposed a *Summer School on Computational Intelligence for High-School Student Learning* proposal in Japan and in Taiwan to gather more students from high-school students **to teach the students to learn the Computational Intelligence knowledge and CI tools for 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.

- Physical Venue: **JanFuSun Resort Hotel**, Yunlin, Taiwan

Note: This summer school was held in a hybrid style, including a virtual (Japan, Taiwan and Indonesia) and a physical (Taiwan) summer school.

- Dates: August 10-12, 2021
- Duration: 3 days
- Website:

<https://sites.google.com/asap.nutn.edu.tw/2021-ieee-cis-summer-school/home>

- **Co-sponsors**

IEEE CIS High School Outreach Subcommittee

E. Sun Commercial Bank, Taiwan

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

Nojima Lab., Osaka Prefecture University, Japan

KWS Center, National University of Tainan, Taiwan (<http://kws.nutn.edu.tw>)

Taiwan AI Academy, Taiwan (<https://aiacademy.tw/>)

Artificial Intelligence Industry and Academia Alliance, Taiwan (<https://aiiaa.narlabs.org.tw/>)

Taiwanese AI Association, Taiwan

Information Education Center, National Kaohsiung Normal University, Taiwan

AI-FML International Academy

3. Lectures and Courses Program

Invited Lecture 1: Chang-Shing Lee and Leo Guo

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

Topic: CI for Real-World Applications (I)

Invited Lecture 2: Naoyuki Kubota

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

Topic: Neural Network (I)

Invited Lecture 3: Amir Pourabdollah

Affiliation: School of Science & Technology
Nottingham Trent University, UK

Topic: Neural Network (II)

Invited Lecture 4: Keeley Crockett

Affiliation: Department of Computing and Mathematics
Manchester Metropolitan University, UK

Topic: Fuzzy Logic (I)

Invited Lecture 5: Marek Reformat

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

Topic: CI for Real-World Applications (II)

- Invited Lecture 6: José María Alonso Moral & José Manuel Soto Hidalgo**
 Affiliation: Centro Singular de Investigación en Tecnoloxías Intelixentes (CITIUS)
 University of Santiago de Compostela, Spain
 Department of Computer Architecture and Technology
 University of Granada, Spain
 Topic: Fuzzy Logic (II)
- Invited Lecture 7: Marie-Jeanne Lesot**
 Affiliation: Department of Computer Science
 Sorbonne Université, France
 Topic: Fuzzy Logic (III)
- Invited Lecture 8: Giovanni Acampora**
 Affiliation: Department of physics “ettore pancini”
 University of Naples Federico II, Italy
 Topic: Evolutionary Computation (I)
- Invited Lecture 9: Yusuke Nojima**
 Affiliation: Department of Computer Science and Intelligent Systems
 Osaka Prefecture University, Japan
 Topic: Evolutionary Computation (II)

4. Program

2021 IEEE CIS Summer School on Computational Intelligence for High-School Student Learning Program

Japan (GMT+9)	Taiwan (GMT+8)	Indonesia (GMT+7)	Day 1 (Aug. 10, 2021)	Day 2 (Aug. 11, 2021)	Day 3 (Aug. 12, 2021)
10:45-11:00	09:45-10:00	08:45-09:00	Opening Address	Hung-Duen Yang, Pau-Choo (Julia) Chung Toru Yagaguchi, Richi Tsai, Po-Hsun Cheng, Hong-Yu Kao Nia Kurnianingsih Representative of Education Bureau of Kaohsiung City Government Representative of Education Bureau of Tainan City Government	
11:00-12:00	10:00-11:00	09:00-10:00	Lecture 1 Chang-Shing Lee / Leo Guo Taiwan CI for Real-World Applications (I) Chair: Naoyuki Kubota	Lecture 5 Marek Reformat, Canada CI for Real-World Applications (II) Chair: Po-Hsun Cheng	Workshop on AIoT (II) Chairs Chang-Shing Lee/Yusuke Nojima
12:00-14:30	11:00-13:30	10:00-12:30	Lunch & Break		
14:30-15:30	13:30-14:30	12:30-13:30	Lecture 2 Naoyuki Kubota, Japan Neural Network (I) Chair: Toru Yamaguchi	Workshop on AIoT (I) Chairs Chang-Shing Lee Yusuke Nojima	Workshop on AIoT (III) Chair: Hung-Duen Yang
15:30-16:00	14:30-15:00	13:30-14:00	Break		
16:00-17:00	15:00-16:00	14:00-15:00	Lecture 3 Amir Pourabdollah, UK Neural Network (II) Chair: Yusuke Nojima	Lecture 6 José María Alonso Moral Jose Manuel Soto Hidalgo Spain Fuzzy Logic (II) Chair: Yusuke Nojima	Lecture 8 Giovanni Acampora, Italy Evolutionary Computation (I) Chair: Yusuke Nojima
17:00-17:30	16:00-16:30	15:00-15:30	Break		
17:30-18:30	16:30-17:30	15:30-16:30	Lecture 4 Keeley Crockett, UK Fuzzy Logic (I) Chair: Yusuke Nojima	Lecture 7 Marie-Jeanne Lesot, France Fuzzy Logic (III) Chair: Chang-Shing Lee	Lecture 9 Yusuke Nojima, Japan Evolutionary Computation (II) Chair: Giovanni Acampora

5. Organizers

- **General Chair**

Name **Chang-Shing Lee**
Affiliation Department of Computer Science and Information Engineering
National University of Tainan, Taiwan
Contact and Email leccs@mail.nutn.edu.tw

- **General Co-Chairs**

Name **Toru Yamaguchi**
Affiliation Department of Computer Science and Information Engineering
Tokyo Metropolitan University, Japan

Contact and Email yamachan@tmu.ac.jp

Name **Naoyuki Kubota**
Affiliation Department of Mechanical Systems Engineering
Tokyo Metropolitan University, Japan

Contact and Email kubota@tmu.ac.jp

Name **Yusuke Nojima**
Affiliation Department of Computer Science and Intelligent Systems
Osaka Prefecture University, Japan

Contact and Email nojima@cs.osakafu-u.ac.jp

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Affiliation Department of Physics, National Sun Yat-Sen University, Taiwan

Contact and Email: yang@mail.nsysu.edu.tw

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

- **Organizing Committee Members**

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

Name **Giovanni Acampora**
Affiliation Department of physics “ettore pancini”, University of Naples Federico II, Italy

Name **José María Alonso Moral**
Affiliation Centro Singular de Investigación en Tecnoloxías Intelixentes,
University of Santiago de Compostela, Spain

Name **José M. Soto Hidalgo**
Affiliation Department of Computer Architecture and Technology, University of Granada, Spain

Name **Marie-Jeanne Lesot**
Affiliation Department of Computer Science, Sorbonne Université, France

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

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

Name **Richie Tsai**
Affiliation Taiwan AI Academy, Taiwan

Name **Hung-Yu Kao**
Affiliation Department of Computer Science, National Cheng Kung University, Taiwan

6. Posters, Banner, and Logos

- Poster

2021 IEEE CIS Summer School
on Computational Intelligence for High-School Student Learning
August 10-12, 2021

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

Time/Date	Day 1 Aug. 10, 2021	Day 2 Aug. 11, 2021	Day 3 Aug. 12, 2021
09:45-10:00	Opening Address		
10:00-11:00	Lecture 1 Chang-Shing Lee, Taiwan CI for Real-World Applications (I)	Lecture 5 Marek Reformat, Canada CI for Real-World Applications (II)	Workshop on AIoT (II)
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14:30-15:00	Break		
15:00-16:00	Lecture 3 Amir Pourabdollah, UK Neural Network (II)	Lecture 6 Jose Manuel Soto Hidalgo, Spain Fuzzy Logic (II)	Lecture 8 Giovanni Acampora, Italy Evolutionary Computation (I)
16:00-16:30	Break		
16:30-17:30	Lecture 4 Keeley Crockett, UK Fuzzy Logic (I)	Lecture 7 Marie-Jeanne Lesot, France Fuzzy Logic (III)	Lecture 9 Yusuke Nojima, Japan Evolutionary Computation (II)

Note:
Japan is 1 hour ahead of Taiwan.
Taiwan is 7 hours ahead of UK.
Taiwan is 6 hours ahead of Italy, Spain and France.
Taiwan is 14 hours ahead of Alberta, Canada.

2021 IEEE CIS Summer School

Try CI-
High School Outreach @ IEEE CIS

Computational Intelligence (CI)
Fuzzy Logic
Neural Network
Evolutionary Computation
Real-World Applications

High School Outreach Sub-Committee Chair:
Chang-shing Lee

High School Outreach Sub-Committee Members:
Marek Reformat, Giovanni Acampora, Jose M. Alonso, Jose M. Soto-Hidalgo, Jinhua Shi, Yusuke Nojima, Youssef Fofani, Marie-Jeanne Lesot, Amir Pourabdollah, Yoshio Tanaka, Keeley Crockett, Hsiang-Hsiung Ho

Hardware images: IEEE 1855 @ KeblAir, IEEE 1855 @ AI-FML-LTV1.0, IEEE 1855 @ AI-FML-LTV2.0, IEEE 1855 @ AI-FML-LTV3.0, AI-FML-MoonCar @ Weidiana, AI-FML-MoonCar @ Cirrus F1, IEEE 1855 @ Microsoft.

Try CI-High School Outreach @ IEEE CIS

- Website Banner and Logos



Home



Banner



IEEE Summer School Logo



Try CI Logo



AI-FML Int'l Academy Logo

- Lecture Materials

- Day 1

Lecture 1
CI for Real-World Applications (I)

Lecture 2
Neural Network (I)

Lecture 3
Neural Network (II)

Lecture 4
Fuzzy Logic (I)

- Day 2

Lecture 5
CI for Real-World Applications (II)

Workshop on AIoT (I)

Lecture 6
Fuzzy Logic (II)

Lecture 7
Fuzzy Logic (III)

- Day 3

Workshop on AIoT (II)

Workshop on AIoT (III)

Lecture 8
Evolutionary Computation (I)

Lecture 9
Evolutionary Computation (II)

— Slide and Recorded Videos

<https://sites.google.com/asap.nutn.edu.tw/2021-ieee-cis-summer-school/lecture-materials>

— Onsite Recorded Videos

<https://sites.google.com/asap.nutn.edu.tw/2021-ieee-cis-summer-school/videos/recorded-videos>

— Fast-Forward Videos

<https://sites.google.com/asap.nutn.edu.tw/2021-ieee-cis-summer-school/videos/fast-forward-videos>

7. Activity Photos

- Summer School Environment Setup and Testing in Taiwan on August 9, 2021**



AIoT devices @ JanFuSun Room 202



AIoT devices @ JanFuSun Room 202



AIoT devices @ JanFuSun Room 203



Group photo



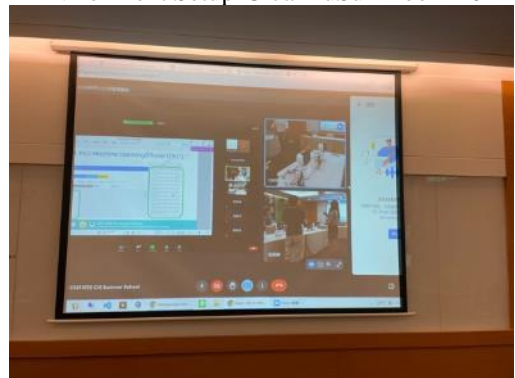
Environment Setup @ JanFuSun Room 202



Environment Setup @ JanFuSun Room 202



Environment Testing @ JanFuSun Room 202



Environment Testing @ JanFuSun Room 202

- Day 1 on August 10, 2021**



Chang-Shing Lee (General Chair) @ Opening address



Yusuke Nojima (General Chair) @ Opening address



Naoyuki Kubota (General Chair) @ Opening address



Nia Kurnianingsih @ Opening address



I-Hsien Yu (President of JanFuSun) @ Opening address



Group photo after opening address



Chang-Shing Lee @ Lecture 1



Chang-Shing Lee @ Lecture 1



Chang-Shing Lee @ Lecture 1



AIoT devices @ JanFuSun Room 202



Leo Guo (CEO of NUWA Robotics) @ Lecture 1



Naoyuki Kubota @ Lecture 2

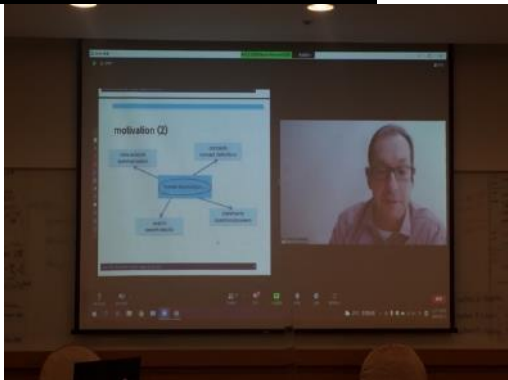


Naoyuki Kubota @ Lecture 3



Keeley Crockett @ Lecture 4

• **Day 2 on August 11, 2021**



Marek Reformat @ Lecture 5



Marek Reformat @ Lecture 5



Group photo



Workshop on AIoT (I)



Workshop on AIoT (I)



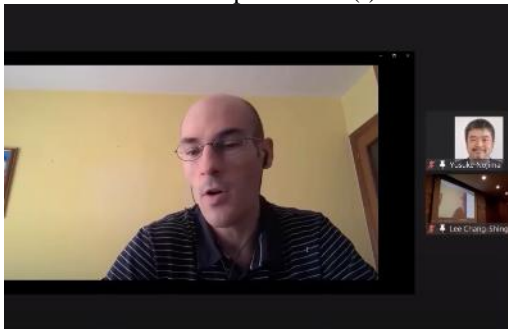
Workshop on AIoT (I)



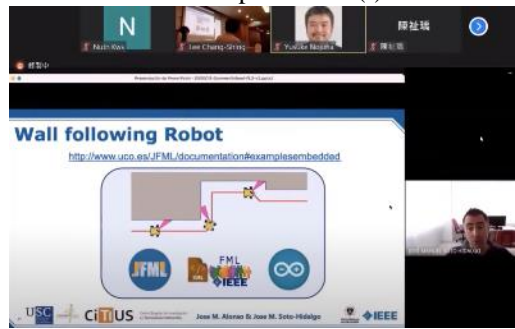
Workshop on AIoT (I)



Workshop on AIoT (I)



José María Alonso Moral @ Lecture 6



José Manuel Soto Hidalgo @ Lecture 6



Students and Marie-Jeanne Lesot @ Lecture 7



Marie-Jeanne Lesot @ Lecture 7



Group photo



Group photo

• Day 3 on August 12, 2021



Workshop on AIoT (II)



Workshop on AIoT (II)



Workshop on AIoT (II)



Workshop on AIoT (II)



Workshop on AIoT (II)



Workshop on AIoT (II)



Workshop on AIoT (III)



Workshop on AIoT (III)



Workshop on AIoT (III)



Workshop on AIoT (III)



Workshop on AIoT (III)



Workshop on AIoT (III)



Group photo



FUZZ-IEEE 2021 FML-based competitoin award



Group photo



Group photo



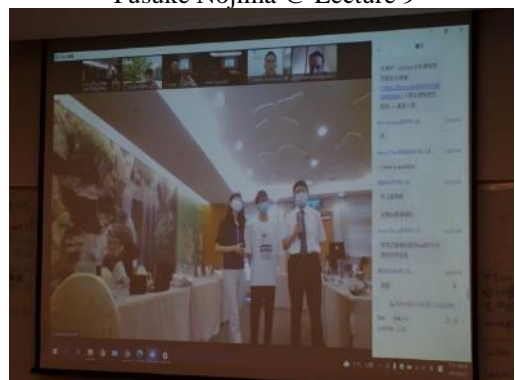
Giovanni Acampora @ Lecture 8



Yusuke Nojima @ Lecture 9



Q&A @ Lecture 8



Q&A @ Lecture 8

8. Activity Videos



Day 1: <https://youtu.be/0c-byuR4U-Q>



Day 2: <https://youtu.be/bQWPbdJOPrk>



Day 3: <https://youtu.be/mctCERsoOTA>



FUZZ-IEEE 2021 FML-based Machine Learning Competition Award Ceremony

<https://youtu.be/ungw4WuLReU>



Day 1: <https://youtu.be/xmN9tF9Y1RM>



Day 2: <https://youtu.be/vejibWF4Mh8>



Day 3: <https://youtu.be/9u4LOINFafo>



Workshops on AIoT (I)(II)(III)

<https://youtu.be/Q0-6FYt1394>

Note: For activity videos, visit: <https://sites.google.com/asap.nutn.edu.tw/2021-ieee-cis-summer-school/videos/activity-videos>

9. Information of Participants

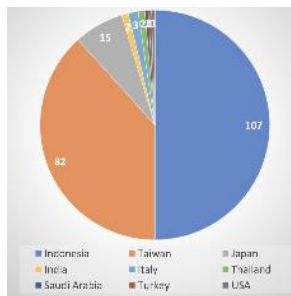
- **Basic information of participants**

— Total number of people who registered for 2021 IEEE CIS Summer School is 214, including 82, 15, 107, and 10 from Taiwan, Japan, Indonesia, and the other countries, respectively. There are 13 graduates, 93 undergraduates, 31 senior high school students, 16 junior high school students, 21 elementary school students, and 7 non-students.

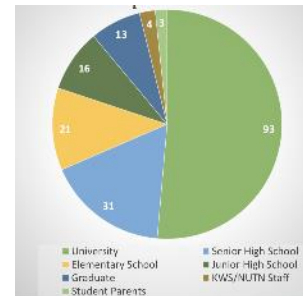
— Information

Country	Graduate	University	Senior High School	Junior High School	Elementary School	KWS/NUTN Staff	Student Parents	Total
Taiwan	9	15	7	13	20	4	3	82
Japan	0	1	14	0	0	0	0	15
Indonesia	4	75	7	0	1	0	0	107
India	0	0	0	1	0	0	0	2
Italy	0	1	1	1	0	0	0	3
Thailand	0	1	0	1	0	0	0	2
Saudi Arabia	0	0	1	0	0	0	0	1
Turkey	0	0	0	0	0	0	0	1
USA	0	0	1	0	0	0	0	1
Total	13	93	31	16	21	4	3	214

Basic Information of Participants



Number of Participants from different countries



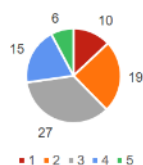
Number of Participants from different Groups of Students

10. Short Report and Feedback Survey

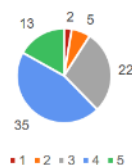
- Total number of people who attended at least two thirds of lectures and workshops on AIoT is 78, including 48, 9, and 21 from Taiwan, Japan, and Indonesia, respectively. The ratio of people who were awarded a certificate of participation is 0.585, 0.6, and 0.196 from Taiwan, Japan, and Indonesia, respectively. Total number of people who submitted short report and feedback survey is 80 and 77, respectively.

- **Results of feedback survey:** From the pie chart of the feedback survey, most people *have briefly understood computational intelligence, neural network, fuzzy logic, and evolutionary computation much more than before.*

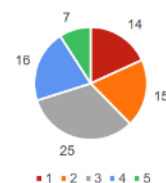
1. How much had you known computational intelligence in general before this summer school?



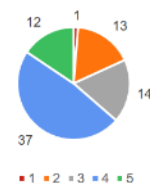
2. How much did you understand computational intelligence in general in this summer school?



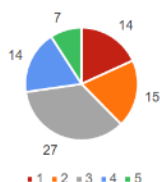
3. How much had you known neural networks before this summer school?



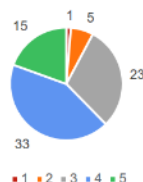
4. How much did you understand neural networks in this summer school?



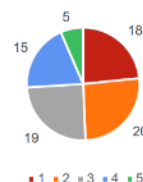
5. How much had you known fuzzy logic before this summer school?



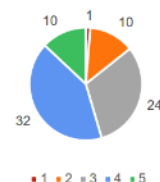
6. How much did you understand fuzzy logic in this summer school?



7. How much had you known evolutionary computation before this summer school?



8. How much did you understand evolutionary computation in this summer school?



11. Impacts and Discussions

Our summer school has some impacts on Computational Intelligence education to high-school students or undergraduate students of Computer Science, Mathematics, Electrical Engineering, Robotics, and related areas. Meanwhile, it is disseminated by having CIS co-funding the summer school. The scientific goal of the summer school is to promote CI and expands the attendee from college and graduate students to high-school students or elementary school students. Further, such an expansion is also interacting with the policy of Taiwan and Japan to push the new course outline of computational thinking concepts in fundamental education in Taiwan and Japan. It includes the participation of national and international leading researchers in the area of CI, members and senior members of the IEEE. The *Summer School on Computational Intelligence for High-School Student Learning* has promoted the Computational Intelligence concept and knowledge from elementary-school, high-school, university students to graduates in Taiwan and Japan, as well as the AIoT Workshop are good for **students to learn the AI-FML Robotic knowledge and CI tools for real-world applications.**

However, the main target of this summer school was high school students. But, the registered people covered from **13 graduates, 93 undergraduates, 31 senior high school students, 16 junior high school students, 21 elementary school students, and 7 non-students.** It will be better to distinguish “Senior” and “Junior” High School students next time. Elementary school students were out of focus. In addition, there are some elementary school students joined this summer school, but the lecturers did not prepare their lectures for elementary school students. No Japanese high school students also expect elementary school students attend the same event.

We had to care of elementary school students during the event. For example, we received a comment from audience *"It is too difficult for elementary school students to understand."* after one lecture. Yes. It is true because the lecture was for high school students. For example, one elementary school student continued drawing lines and rectangular on Zoom screen and Jamboard during two Evolutionary Computation lectures. Of course, we understand elementary school students in general feel boring for some lectures because of lack of fun for them. But this event was for high school students, ***we will focus on the main target and divide the event into several levels in the future.*** We should check the eligibility if someone from different age categories want to attend the event next time. ***The organizers of this summer school really work hard to promote computational intelligence to young students. For students and lectures, we will provide appropriate contents 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 Taiwan, Japan, Europe, and Indonesia.

Finally, we summarize some feedbacks after the summer school as follows. This is a great event to introduce students to computational intelligence at a young age, stimulate them to be involved in rapidly evolving fields, and foster participation in future research adventures. In addition, *it is in line with IEEE's mission to advance technology for humanity. Moreover, IEEE offers STEM education opportunities for pre-university students & teachers across the globe. After joining this event, hope they have a big passion & feel motivated to be involved in global issues & trends.*

12. Acknowledgement

The organizers would like to express many thanks for the support of the IEEE CIS High School Outreach Subcommittee members, the Ministry of Science and Technology (MOST) in Taiwan, JanFuSun Resort Hotel, E. Sun Commercial Bank, Zsystem Technology Company, NUWA Robotics, Tainan City Government, and Kaohsiung City Government in Taiwan.