Workshop on **Computational Intelligence for Adaptive Learning in Human-Machine Interaction**

IEEE 2023 Congress on Evolutionary Computation
July 2-5, 2023
Swissôtel Chicago

Duration: Half-Day

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 scope of this workshop is to apply the CI technologies from the basics of fuzzy systems, neural networks, and evolutionary computation for the adaptive learning in Human-Machine Interaction. **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. **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. All of them are the important machine learning models [1-2].

Human-Machine Interaction in real world 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 [3-5].

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 [6-7].

This workshop 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 workshop is to better understand how innovative Computational Intelligence developments relate to and enhance human-machine interaction in real-world settings. 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 internationally leading researchers in the area of CI, members, and senior members of the IEEE.

Organizers:

Li-Wei Ko, Institute of Electrical and Control Engineering / Department of Electronics and Electrical Engineering, National Yang Ming Chiao Tung University Hsinchu campus, Taiwan

I-Fang Chung, Institute of Biomedical Informatics, National Yang Ming Chiao Tung University, Taipei campus, Taiwan

Giovanni Acampora, Department of Physics Ettore Pancini, University of Naples Federico II, Naples, Italy

Tzyy-Ping Jung, Swartz Center for Computational Neuroscience, University of California San Diego

Reference

[1] Lee, C. S., Wang, M. H., Ciou, Z. H., Chang, R. P., Tsai, C. H., Chen, S. C., ... & Yamaguchi, T. (2021, July). Robotic assistant agent for student and machine co-learning on AI-FML practice with AIoT application. In 2021 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE) (pp. 1-6). IEEE.

[2] Lee, C. S., Wang, M. H., Nojima, Y., Reformat, M., & Guo, L. (2021). AI-Fuzzy Markup Language with Computational Intelligence for High-School Student Learning. arXiv preprint arXiv:2112.01228.

[3] Chang, Y., He, C., Tsai, B. Y., & Ko, L. W. (2021). Multi-Parameter Physiological State Monitoring in Target Detection Under Real-World Settings. Frontiers in human neuroscience, 793.

[4] 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.

[5] Ko, L. W. (2021). Editorial Message: Special Issue on Innovative Fuzzy Systems for Ergonomics in Real-World Settings. International Journal of Fuzzy Systems, 23(8), 2369-2370.

[6] Ko, L. W., Stevenson, C., Chang, W. C., Yu, K. H., Chi, K. C., Chen, Y. J., & Chen, C. H. (2021). Integrated Gait Triggered Mixed Reality and Neurophysiological Monitoring as a Framework for Next-Generation Ambulatory Stroke Rehabilitation. IEEE Transactions on Neural Systems and Rehabilitation Engineering, 29, 2435-2444.

[7] C. Stevenson, Y. Chang, C. He, C.-R. Phang, C.-H. Su, R.-W. Lin, L.-W. Ko. "Emerging Non-invasive Brain Computer Interface Technologies and their Clinical Applications" in Emerging IT/ICT and AI Technologies (Lecture Notes in Networks and Systems Series). Springer. 2022 (pre-print)