2024 6th International Conference on Control and Robotics (ICCR 2024)

WORKSHOP

2024 4th International Conference on Artificial Intelligence and Application Technologies (AIAT 2024)

Yokohama, Japan
December 5-7, 2024

Venue：

アットビジネスセンター横浜西口駅前 貸し会議室・レンタルスペース

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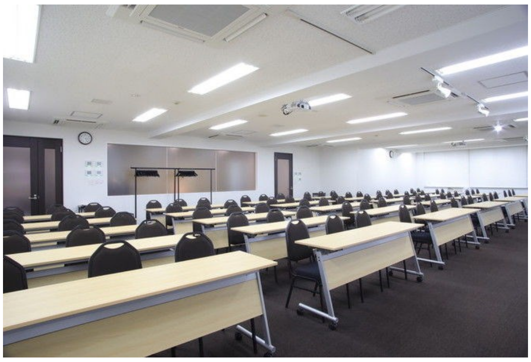

Meeting Rooms:

	Dec. 5, 2024	*Dec. 6, 2024*
ROOM 604	Sign-in & Conference Materials Collection	
ROOM 603		Keynote Speech + Session 1 + Poster Session
ROOM 504		Session 2 + Session 4
ROOM 505		Session 3 + Session 5

Conference Agenda

Thursday | Dec. 5, 2024 All schedules will process in **Japan Local Time (UTC+9)**

13:30-17:00 ▼ アットビジネスセンター横浜西口駅前 (ROOM 604 - 6F)

Sign-in & Conference Materials Collection for Onsite Participants

*Give your Paper ID to the staff.
*Sign your name in the attendance list and check meal information.
*Check your conference kit, which includes conference bag, name tag, meal voucher, conference program, USB.

14:30-16:30 ▼ ZOOM ID: 871 3543 0618

Online Participants' Test

Paper ID: LY086, LY051, LY026, LY017, LY038, LY011, LY014, LY064, LY040, LY062, LY525, LY080, LY065, LY059, LY079, LY035

Friday | Dec. 6, 2024

AM ▼ ROOM 603 - 6F

Chaired by Prof. Genci Capi, Hosei University, Japan

8:50-8:55 Opening Remarks by Prof. Genci Capi

8:55-9:40 Keynote Speech | Wei-Hsin Liao, The Chinese University of Hong Kong
Control of Robotic Exoskeletons for Motion Assistance

9:40-10:25 Keynote Speech | Chinthaka Premachandra, Shibaura Institute of Technology, Japan
Hardware and Software Developments for UAV Applications in Disaster Site Operations

10:25-10:45 Group Photo & Coffee Break & Poster Session
Paper ID: LY528-A, LY005-A, LY526-A, LY013-A, LY527-A, LY504-A

10:45-11:30 Keynote Speech | En-Bing Lin, Wentworth Institute of Technology, USA
The Dynamic Fusion of AI, Applied Mathematics, and Granular Computing

11:30-12:15 Keynote Speech | Guoqiang Hu, Nanyang Technological University, Singapore
TBA

12:15-13:20 Lunch

Friday | Dec. 6, 2024

PM ▼ ROOM 603 - 6F

13:20-15:50 Onsite Session 1 - Machine Vision and Image Processing
Paper ID: LY010, LY036, LY506, LY084, LY501, LY508, LY518, LY522, LY524, LY519

15:50-16:05 Coffee Break

PM ▼ ROOM 504 - 5F

13:20-15:50 Onsite Session 2 - Robot Motion Control and Simulation
Paper ID: LY077, LY094, LY002, LY025, LY034, LY050-A, LY029-A, LY521, LY021, LY510

15:50-16:05 Coffee Break

16:05-18:20 Onsite Session 4 - Modern Control Theory and System
Paper ID: LY008, LY003, LY023, LY028, LY042, LY018-A, LY048, LY044, LY060

PM ▼ ROOM 505 - 5F

13:20-15:50 Onsite Session 3 - Robot Motion Control and Simulation
Paper ID: LY033, LY016, LY046, LY066, LY054, LY004-A, LY001, LY085, LY503, LY092

15:50-16:05 Coffee Break

16:05-18:20 Onsite Session 5 - Intelligent Electromechanical System and Artificial Intelligence Technology
Paper ID: LY032, LY052-A, LY076, LY502, LY505, LY520, LY523, LY020, LY089

Saturday | Dec. 7, 2024

All schedules will process in **Japan Local Time (UTC+9)**

11:00-13:00 ▼ ZOOM ID: 871 3543 0618

Online Session 1 - Engineering Robot Design and Unmanned Control System I
Paper ID: LY086, LY051, LY026, LY017, LY038, LY011, LY014, LY064

14:00-16:00 ▼ ZOOM ID: 871 3543 0618

Online Session 2 - Engineering Robot Design and Unmanned Control System II
Paper ID: LY040, LY062, LY525, LY080, LY065, LY059, LY079, LY035

Poster Session

Poster Session - Next Generation Artificial Intelligence and Intelligent Robot Application Technology **Time: 10:25-10:45 Dec. 6, 2024** **Venue: ROOM 603 - 6F**	
LY528-A	Title: Machine Learning-based Flow Fields Reconstruction with Error Analysis and Prediction Error Correction for Single Inlet/outlet Configuration Author(s): Kewei Gao, Min Liang Wang, Woo Young Cho, Hyunji Ryu, Congyu Mao, Hongdi Jin, Hyun Wook Kang Presenter: Kewei Gao, Chonnam National University, South Korea Abstract: Machine learning method has revolutionized computational efficiency and nonlinear fitting capabilities, profoundly impacting fields involving fluid dynamics. Among these applications are latent feature extraction from flow fields, flow field reconstruction, and others. This study proposes an approach for the initial prediction of the flow field using a convolutional neural network (CNN) model, followed by re-predicting the flow field using a correction-based CNN model from the corrected velocity vector. The CNN model establishes the mapping relationship between geometric representation features and velocity vector fields. Additionally, it calculates the velocity prediction errors that are effectively elucidated through an analysis of the local Reynolds number distribution. Furthermore, the initially predicted velocity vectors are corrected based on correlation correction, and the flow field is re-predicted based on these corrected velocity vectors. The prediction error decreases remarkably, demonstrating the improved prediction capabilities of the proposed method.
LY005-A	Title: Helical Liquid Crystalline MoS2 Fibers for Advanced Multifunctional Wearable Sensors Author(s): Jun Hyun Park, Jang Hwan Kim and Bong Hoon Kim Presenter: Jun Hyun Park, DGIST, Republic of Korea Abstract: Next-generation wearable devices require reliable material systems that can conform to flexible and bendable parts of the human body. One-dimensional (1D) fiber-based materials offer a highly desirable platform for such devices due to their superior mechanical flexibility, deformability, breathability, and durability when woven into textiles [1]. Recent studies have focused on modifying the shape of fibers using nanotechnology [2] to enhance their functionalities for applications in soft electronics, sensors, and biomedical devices [3]. Two-dimensional (2D) materials, characterized by their atomically thick planar crystalline structures, exhibit unique properties like high structural anisotropy, a large surface-to-volume ratio, and ultralow weight. When highly exfoliated and dispersed in solvents, these materials, such as graphene oxide (GO) and MXene, can form liquid crystalline (LC) phases [4]. This property is advantageous for low-cost wet-spinning of fibers with novel functionalities derived from the highly functional 2D building blocks. Previous research on 2D material-based fibers has primarily focused on developing electroconductive fibers using metallic 2D components like graphene and MXene for lightweight textile electronics. Among various 2D materials, molybdenum disulfide (MoS2), a transition metal dichalcogenide (TMD), has garnered significant

	interest due to its semiconducting properties [5] and unique photo-reactivity over a broad wavelength range. MoS2 also exhibits nematic LC behavior in solvents such as N,N-dimethylformamide (DMF), making it an attractive 2D building block for semiconductive fiber systems [6]. In this work, we introduce multifunctional semiconductive MoS2 fibers with a helical geometric structure that can respond to various external stimuli. MoS2 fibers were successfully spun from polylactic acid (PLA)-MoS2 mixed dispersions, maintaining colloidal LC properties suitable for wet spinning. By precisely controlling the processing parameters, helical-shaped MoS2 fibers were generated. These fibers were utilized in multifunctional sensing applications, including photo-detection, pH sensing, gas sensing, and 3D strain sensing. The photo-detectivity is due to the small intrinsic bandgap of MoS2, while the ability to detect pH changes or gas molecules stems from its surface chemical reactivity. Additionally, the unique helical structure allows for significant elongation, enabling the detection of 3D mechanical deformation, supported by simulations of stress distribution along the helix direction and the magnitude of mechanical deformation.
LY526-A	Title: CNN Based Carbon Dioxide Concentration Prediction in Animal Husbandry Barn Author(s): Woo Young Cho, Min Liang Wang, Kewei Gao, Se Jong Noh, Hyun Wook Kang Presenter: Woo Young Cho, Se Jong Noh, Chonnam National University, South Korea Abstract: The animal husbandry barn environment affects animal's living conditions and growth. Since a poor animal husbandry barn environment inhibits animal growth and productivity, various methods are employed to manage the barn environment. Ventilation is widely used in animal husbandry barn, as it removes internal pollutants and supplies fresh air. Mechanical ventilation provides a stable and constant airflow and is commonly used for managing and improving the barn environment. Since mechanical ventilation consumes energy, it is necessary to analyze both the energy consumption and the effectiveness of gaseous materials reduction inside the barn. This study proposes a method for predicting gaseous materials concentrations inside the barn based on animal location, depending on the operation of the mechanical ventilation system. We set the operation modes of the system and acquired data on gaseous materials within the barn for the same animal location through numerical simulations. Based on the dataset, we modeled a convolutional neural network (CNN) to predict the concentrations of the carbon dioxide according to the operation modes of the ventilation system for the same animal location. The trained CNN uses animal location data and ventilation system operation modes as input data to predict carbon dioxide concentrations inside the barn.
LY013-A	Title: Bio-Inspired and Wirelessly Controllable Robot for Camouflage in Aquatic-Environment Author(s): Su Eon Lee, Doyoung Kim, Seung Won Seon, Minkyung Shin, Seung Ho Han, Sang Min Won and Bong Hoon Kim Presenter: Su Eon Lee, DGIST, South Korea Abstract: Achieving optimal camouflage in an aquatic environment requires the capability to adjust transmittance according to the surrounding darkness and potential threats. This adaptation involves a dynamic shift from transparency to a deep-blue color, particularly in low-light or dark conditions. This approach ensures seamless integration with the environment, allowing the absorption of searchlights and thereby reducing the risk of predator detection. Therefore, it is essential to have

	advanced mechanisms that facilitate stable and efficient transmittance control, enabling smooth transitions between transparent and deep-blue states in the aquatic environment. This study introduces a nature-inspired programmable camouflage system that combines an electrochromic display for transmittance changes with a wireless base module for power and data transmission. This technology offers a durable and flexible design, ensuring stable operation as validated through mechanical fatigue tests and quantitative simulations. A custom circuit and power-control software package enable active management of multiple electrochromic displays while submerged.
LY527-A	Title: Online machine learning method for topology optimization of heat conduction problem under various load distributions Author(s): Min Liang Wang, Hyun Wook Kang, Woo Young Cho, Kewei Gao, Seungho Lee, Hernando Leon-Rodriguez Presenter: Min Liang Wang, Chonnam National University, South Korea Abstract: Image processing-based machine learning techniques are expected to address the heavy computational burden in large-scale topology optimization processes. In this study, we present an online machine learning method that intertwines a convolutional neural network model with the conventional topology optimization process. Compared to previous methods that run the finite element derivation process in each iterative step, the proposed method autonomously switches between the finite element derivation and the machine learning prediction processes, where the dataset generated during optimization are used to continuously trained the machine learning model. To illustrate the versatility and robustness of the proposed method, heat conduction topology optimization problems under various thermal load cases are studied. The result indicates that optimization has achieved stable convergence with over 50% fewer iterative steps and 8% augmented optimization potential. The mechanism of optimization enhancement and computational saving is further discussed.
LY504-A	Title: Enhancing HSIL Detection in Colposcopic Images with CNNs Through Acetowhite Epithelium Segmentation Author(s): Jisoo Kim, Angella Cho Presenter: Jisoo Kim, Jeju National University, Republic of Korea Abstract: Colposcopy is a crucial test for detecting precancerous lesions in cervical cancer, which progresses slowly, making early intervention vital. Identifying high-grade squamous intraepithelial lesions (HSIL) that require surgical treatment is particularly important. This study explores the potential of enhancing the accuracy of convolutional neural networks (CNNs) in detecting HSIL by incorporating segmentation information of acetowhite epithelium. While previous research has utilized CNNs for classifying colposcopic images, the novel approach of adding segmentation data aims to improve detection accuracy. The results indicate that integrating segmentation information significantly enhances the CNN model's performance, emphasizing the importance of this method in early and accurate HSIL detection. This advancement holds promise for improving clinical outcomes and preventing the progression of cervical cancer.

Online machine learning method for topology optimization of heat conduction problem under various load distributions

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Abstract—Image processing-based machine learning techniques are expected to address the heavy computational burden in large-scale topology optimization processes. In this study, we present an online machine learning method that intertwines a convolutional neural network model with the conventional topology optimization process. Compared to previous methods that run the finite element derivation process in each iterative step, the proposed method autonomously switches between the finite element derivation and the machine learning prediction processes, where the dataset generated during optimization are used to continuously trained the machine learning model. To illustrate the versatility and robustness of the proposed method, heat conduction topology optimization problems under various thermal load cases are studied. The result indicates that optimization has achieved stable convergence with over 50% fewer iterative steps and 8% augmented optimization potential. The mechanism of optimization enhancement and computational saving is further discussed.

Key words: Machine learning, Online training, Topology optimization, Heat conduction.

Authors' background

Your Name	Title	Research Field	Personal website
Min Liang Wang	Ph.D candidate	Thermal-Fluid Engineering, Topology Optimization	flow.jnu.ac.kr
Woo Young Cho	Master student	Computational Fluid Dynamics, Artificial Intelligence	flow.jnu.ac.kr
Kewei Gao	Ph.D candidate	Fluid Mechanics, Topology Optimization	flow.jnu.ac.kr
Seungho Lee	Master student	Computational Fluid Dynamics	flow.jnu.ac.kr
Hernando Leon-Rodriguez	Ph.D candidate	Fluid Mechanics, Robotics	flow.jnu.ac.kr
Hyun Wook Kang	Full professor	Fluid Mechanics, Thermo-Fluid Engineering, Heat Transfer, Topology Optimization	flow.jnu.ac.kr

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