

The 14th International Conference on Frontier Computing

Final Program

July 10 - 14, 2024 Singapore



The 14th International Conference on Frontier Computing (FC 2024)

- Theory, Technologies, and Applications

Co-Located Event

The International Workshop on Smart Information Technology (SmartIT 2024)

2024 International Conference on Machine Learning on FinTech, Security and Privacy (MLFSP 2024)

FC 2024 Final Program

Singapore & Online Event July 10-14, 2024

Organized by

Frontier Computing Conference Group

Sponsors

IET



IET Taipei Local Network



National Taichung University of Science and Technology





Message from Organizing Committees

The inception of the International Conference on Frontier Computing – Theory, Technologies, and Applications (FC) can be traced back to an IET executive meeting in early 2010. This esteemed conference series serves as a platform for facilitating an expansive exchange of ideas and understanding the latest advancements in information technology, science, and engineering. The thematic focus includes Communication Technology and Applications, Computer Science, Business Intelligence and Knowledge Management, Artificial Intelligence, and other pertinent domains fostering the progression of information technology.

Marking its 14th iteration, this forthcoming event epitomizes the culmination of an enduring tradition. Noteworthy contributions and notable findings from previous conferences, namely FC 2010 (Taichung, Taiwan), FC 2012 (Xining, China), FC 2013 (Gwangju, Korea), FC 2015 (Bangkok, Thailand), FC 2016 (Tokyo, Japan), FC 2017 (Osaka, Japan), FC 2018 (Kuala Lumpur, Malaysia), FC ABH 2019 (Taichung, Taiwan), FC 2019 (Kitakyushu, Japan), FC 2020 (Singapore, Online), FC 2021 (Online), FC 2022 (Tokyo, Japan), and FC 2023 (Tokyo, Japan), are prominently preserved within the digital library and conference proceedings.

By bringing together researchers from around the globe, this scholarly gathering aims to cultivate a stimulating and intellectually enriching environment. This year, FC2024 marks the 14th anniversary of the esteemed FC conference series. Despite the persistent challenges posed by the pandemic over the course of three years, our conference will host a hybrid event, with both an onsite presence in Singapore and online participation. Each presentation will be thoughtfully planned as a video stream accessible through the conference website.

The conference proceedings will include a collection of accepted papers focusing on the current frontiers of computing. FC2024 will also feature workshops and special sessions, offering a comprehensive overview of the latest advancements in frontier computing. We extend our heartfelt gratitude to the authors for their invaluable contributions and to all participants who have played a pivotal role in making this conference a success.

Furthermore, we express our sincere appreciation to the multitude of experts whose expertise and dedication have contributed to the triumph of this conference. As we look towards the future, we fervently hope that our next FC event, FC2025, can be held in a fully onsite format, marking the 15th anniversary of this illustrious conference series. Anticipation runs high, as we envisage it to be yet another remarkable milestone in the history of FC conferences.

FC Organizing Committees FC Conference Group July 2024

Organizing Committees

* Sort by first alphabet of last name

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Schedule

Day 1 - July 10, 2024 (Wednesday)

Executive Committee Meeting

Day 2 - July 11, 2024 (Thursday)				
	Room 1 (Big Room)	Room 2 (Small room)		
Morning Session				
9:30~10:00	Registration			
10:00~10:20	Opening Ceremony			
10 : 20 ~ 10 : 30	Coffee break			
10:30 ~ 12:00	Session 2 – 1 MLFSP 2024	Session 2 – 2 MLFSP 2024		
Afternoon Session				
13:00 ~ 14:00	Keynote Speaker: Dr. Jia-Wei Chang			
14:00 ~ 14:20	Coffee break			
14 : 20 ~ 15 : 50	Session 2 - 3	Session 2 - 4 Fi – Award 2024		
15 : 50 ~ 18 : 00	Meeting Time			
18:00~	Banquet			

Day 3 - July 12, 2024 (Friday)				
	Room 1	Room 2		
Morning Session				
9:30~11:00	Session 3 - 1	Session 3 - 2		
11:00 ~ 12:30	Session 3 - 3	Session 3 - 4		
Afternoon Session				
13 : 30 ~ 15 : 00	Session 3 - 5	Session 3 - 6		
15 : 00 ~ 15 : 20	Coffee break			
15 : 20 ~ 16 : 50	Session 3 - 7	Session 3 - 8		

Day 4 - July 13, 2024 (Saturday)		
Morning Session		
10:30 ~ 12:00	Session 4-1	
Afternoon Session		
13 : 30 ~ 15 : 00	Session 4 - 2	

Day 5 - July 14, 2024 (Sunday)		
Morning Session		
10:30 ~ 12:00	Session 5 -1	
Afternoon Session		
13 : 30 ~ 15 : 00	Executive Committee Meeting	

Keynote Speaker



Dr. Jia-Wei Chang

Associate Professor in the Department of Computer Science and Information Engineering, National Taichung University of Science and Technology, Taiwan

Title of talk

Exploring Multimodal Learning and Generative Al from the Experiences of Natural Language, Image, and Audio Tasks

Dr. Jia-Wei Chang is an Associate Professor in the Department of Computer Science and Information Engineering at the National Taichung University of Science and Technology. He holds several prestigious positions, including Young Professionals Chair and Director of the Institution of Engineering and Technology (IET) - Taipei Network. Additionally, Dr. Chang has been a consultant at the NEXCOM Industry 4.0 Innovation Center since 2017 and at Mobagel Inc. since 2023, and an adjunct professor in the Department of Engineering Science at National Cheng Kung University since 2018.

Before his academic career, Dr. Chang worked as a data scientist and project manager at IoT BU, Nexcom, from 2016 to 2017. He obtained his Ph.D. from the Department of Engineering Science at National Cheng Kung University in 2017. His research interests encompass natural language processing, the Internet of Things, artificial intelligence, data mining, and e-learning technologies.

Dr. Chang has made significant contributions to the academic community, serving as a Guest Editor for several prestigious SCIE/SSCI journals, including Computer Science and Information Systems, Sensors, Sustainability, and the Journal of Internet Technology. Since 2023, he has held the position of Associate Editor at the International Journal of System Assurance Engineering and Management, which is indexed by ESCI. Additionally, he won the Outstanding Reviewer Award from Engineering Applications of Artificial Intelligence in 2018.

In recent years, he has also served as a reviewer for many prestigious journals, such as Applied Soft Computing, Computer Communications, and Engineering Applications of Artificial Intelligence.

Abstract of Talk

In the rapidly advancing field of artificial intelligence, multimodal learning, and generative Al have emerged as pivotal research and application areas. These technologies leverage multiple data modalities, such as text, images, and audio, to enhance Al's capabilities in recognition and generation tasks.

Multimodal learning emphasizes AI systems' ability to recognize and understand information from various sources. For instance, in movies, AI can interpret the storyline by analyzing visual scenes, audio tracks, and textual subtitles. This capability enables comprehensive understanding and detailed explanations of video content. Integrating these data types enhances applications such as automated video summarization, content recommendation, and accessibility features. The core of multimodal learning lies in combining natural language processing (NLP) and computer vision (CV) and utilizing powerful encoder and decoder models.

Generative AI focuses on creating new content from given prompts, such as text, images, or audio. This involves generating coherent narratives, realistic images, or meaningful audio clips based on input data. Generative AI models, like those based on Generative Adversarial Networks (GANs) and Variational Autoencoders (VAEs), have shown remarkable success in various creative and practical applications. By leveraging these generative models, AI can produce high-quality content that mimics human creativity, opening new possibilities in content creation, design, and data augmentation.

Advancements in multimodal learning and generative AI are driven by integrating NLP and CV, primarily through encoder-decoder architectures. These frameworks enable the seamless processing and synthesis of diverse data types. Notable models such as Transformers and Diffusion Models have been instrumental in this progress.

Finally, we will cover deep learning models' sustainability and ethical implications in multimodal learning and generative AI. This keynote provides a thorough overview of multimodal learning and generative AI, highlighting their current capabilities and future potential. By understanding the principles and applications of these technologies, attendees will be better equipped to leverage AI to create intelligent, versatile systems that can transform various industries.

-Day 2-July 11, 2024

Opening Ceremony

Session 2 – 1 MLFSP 2024

Chair: Dr. Hao-Shang Ma, National Taichung University of Science and Technology, Taiwan

1. Research on the Construction Path of Teaching Workshops from the Perspective of Structural-Functionalism Theory

Jun Wu, Xiujuan Huang and Hsiao-Fen Liu

- 2. Research on the Application of Generative Artificial Intelligence in the Field of Design Teaching at a Taiwan University of Science and Technology Hsiao-Ping Chang
- 3. An Action Research on Learning Communities -An Example of a Learning Community Organization
 Fei-Lung Lin
- 4. Forward-Stepwise Regression Analysis to Establish the Optimal Combination of Trends in Renewable Energy Development in Taiwan
 Shu-Kuei Lin, Fu-Hsiang Kuo

Session 2 – 2 MLFSP 2024

Chair: Dr. Yu-Wei Chan, National Taichung University of Science and Technology, Taiwan

 Zero Trust Maturity Dual Assessment Model: Incorporating Technical and Organizational Insights

Yu-Chih Wei, Tak Wai Yu, Wei-Chen Wu

2. Investigating the Development of an Al-Based Classification System for Detecting Sarcopenia in the Elderly through Gait and Posture Analysis

Jui-Hung Kao, Yu-Yu, Yen, Wei-Chen, Wu

3. The Application of Generative Artificial Intelligence Technology in Conversational Robots

Yu-Yu, Yen, Chen-Yu, Tsai, Jui-Hung Kao

4. Perception of Musical Intervals through Mobile Learning Model Based on the Scaffolding Strategy with Separating Single Note Building
Yu Ting Huang, Chi Nung Chu

Session 2 – 3

Chair: Dr. Chuan-Feng Chiu, Minghsin University of Science and Technology, Taiwan

1. Enhanced Click Fraud Detection in Digital Advertising through Ensemble Deep Learning

Amreen Batool, Jisoo Kim and Yung-Cheol Byun

2. Implementation on the Price Prediction and Analysis of Chicken Breast with Deep Learning Techniques

Chao-Hung Liu, Yu-Wei Chan, Po-Yen Lin, Chih-Hung Chang and Chao-Tung Yang

3. Design and Implementation of the ADDIE Instructional Design Model Integrated with Al Technology for the Development of an ACS and PPM for IPOTA Yung-Hui Chen, Chun-Hsiung Tseng, Huang-Wen Huang, Lin Hui, Jian-Yu Chen, Tsang-Yu

Lin, Jeffrey Kurniawan Chandra and Tzu-Yu Wei

- **4.** A Novel Bi-Phase LSTM Architecture for Dynamic Social Network Prediction Lin Hui, Yi-Cheng Chen, Yung-Hui Chen and Yu-Chen Chang
- 5. The Efficiency Enhancement for Continual Learning on Cluster-Based Gradient Episodic Cache Memory

Yi-Cheng Chen, Lin Hui, Ying-Hong Wang and Tsang-Yu Lin

Session 2 – 4 Fi-Award 2024

Chair: Dr. Jason C. Hung, National Taichung University of Science and Technology, Taiwan Neil Y. Yen, University of Aizu, Japan

- 1. Bicycle hazard detection application based on optical radar detection module Yung-Hui Chen, Lin Hui2, Zong-Hung Hsieh, Yi-Yang He, Huai-Ming Chang, Yu-Chen Chang, Chia Chun Chang
- 2. News Analyzer: A System for Combating Fake News on Facebook Tsang-Yu Lin, Lin Hui, Yung-Hui Chen, Pei-Teng Tsai, Yu-Chen Chang
- 3. Portfolio Optimization Using No-Regret Online Learning: A Case Study on US Stocks

Shuo-Ting Hung, Pin-Hua Wei, Yu-Chuan Huang, Nan-Tien Chen, Han-Siang Lan, Chuang-Chieh Lin, and Chih-Chieh Hung

- **4.** Using Large Language Models as Non Player Character in Role Playing Games Yun-Ru Lin, You-Shin Lin, Yi-Han Chen, Pei-Yu Su and Jia-Wei Chang
- 5. Game Content Generation of Super Mario Bros. Using Interactive Evolutionary Computation

Yu-Cheng Cheng, Yanan Wang, and Yan Pei

6. Dream Bunny Wonderland

Guan-Lin Huang, Shu-Jun Huang, Jie-Ying Yang, Ci-Ying Lin, Yun-Xuan Xu, Mei-Ling Cai, Shu-Wei Chang and Yi-Chun Liao

-Day 3-July 12, 2024

Session 3 – 1

Chair: Dr. Hsuan-Che Yang, Chihlee University of Technology, Taiwan

 Efficient Road Situation Classification using Long-Term Recurrent Convolutional Network

Cyreneo Jr Dofitas, Joon-Min Gil and Yung-Cheol Byun

2. Leveraging Data Augmentation to Improve Deep Transfer Learning Models for Diabetic Retinopathy Severity Classification

Kinza Nazir, Jisoo Kim and Yung-Cheol Byun

3. Federated Learning Optimization Algorithm Based on Bhattacharyya Regularization

Xiaowen Duan, Rui Zhao, Hongtao Nie, Qingguo Zhou and Xin Liu

- 4. Fall Detection with Smart Devices for the Elderly Using Machine Learning
 Hsuan-Che Yang, Wen-Chih Chang, Wei-Han Huang, Chia-Hao Hsu, Yen-Chen Lin, Jie-Syuan
 Li, Yun-Cheng Lee and Zeng-Sheng Luo
- 5. A Study on the Application of Deep Learning-based Gesture Recognition Technology in VR Magic Games

Yi-Chun Liao, Shu-Wei Chang

Session 3 – 2

Chair: Dr. Chuan-Feng Chiu, Minghsin University of Science and Technology, Taiwan

1. Enhancing Tomato Leaf Disease Classification with Augmentation Techniques in Deep Learning

Anik Debnath, Joon-Min Gil and Yung-Cheol Byun

- 2. Proposing the Assemblage Actor-Network Theory Systems (AANTS) to Secure Philosophically Robust and Sustainable Al-Driven Algorithmic Management Systems (AAMS) in the context of Gig Economy Platforms

 Kun Chang Lee
- 3. Tourist Attraction Recommendation Using a Word2Vec-based Approach Enhanced by XGBoost Classifier

Jiyoung Ko, Jisoo Kim and Yung-Cheol Byun

4. Enhancing Augmented Reality Interactions: Dynamic Control of Virtual Characters via SLAM and Motion Matching

Tsun-Hung Tsai and Yi-Wei Chiang

Session 3 - 3

Chair: Dr. Hao-Shang Ma, National Taichung University of Science and Technology, Taiwan

1. Design and Evaluation of Emotional Prompts for Generating Videos with High Emotion Consistency

Chao-Ting Chu, You-Yu Chen, Jia-Wei Chang and Jason C. Hung

2. ESO-PVT: Esophageal Lesion Segmentation with Color Space Fusion Attentionquided Pyramid Vision Transformers

Huimin Guo, Yin Gu, Wu Du, Boyang Chen, Yu Miao and He Ma

3. Next-k Items Recommendation with Item Novelty Hao-Shang Ma

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4. Liver Tumor Classification and Segmentation from CT Images with a Trans RU-Net and EfficientNet Hybrid System

Yih-Ruey Huang and Chen-Han Huang

Session 3 - 4

Chair: Dr. Chun-Hong Huang. Lunghwa University of Science and Technology, Taiwan

- The Design of Portrait Photography Guiding System using VGG16 Model Chuan-Feng Chiu, Chun-Hong Huang, Hsiang-Chieh Tseng, Pei-Jung Wu, Wei-Sheng Lin and Hsiang-Min Peng
- 2. Multi-Mode Inflow Prediction for Urban Transportation Systems
 Chih-Chieh Hung, Min-Hsien Hung and Jia-Wei Chang
- 3. Comments on a Key Agreement Scheme for the V2G System Ya-Fen Chang, Wen-Ting Chang and Wei-Liang Tai
- 4. A Time Series Prediction Method for Debris Flow Hazards Based on Improved LSTM

Hongtao Zhang and Qingguo Zhou

Session 3-7

Chair: Dr. Yan Pei, University of Aizu, Japan

1. Lung Cancer Diagnosis Based on Object Detection Technology
Jia-Lang Xu, Tzu-Hsuan Huang, Ying-Lin Hsu, Kuo-Yang Huang and Mu-Yen Chen

2. Implementation Matters of Continuous-Time Deep Reinforcement Learning: A Case Study of HJDQN Algorithm

Jin-Qiang Wang, Yuanbo Jiang, Lirong Song, Lan Guo, Binbin Yong, Rui Zhou, Xin Liu and Qingguo Zhou

3. Mental Status Identification for Infertile Patients Using Artificial Intelligence Models

Hao-Siang Hsu, Jong-Yi Wang, Hai-Chi Chiou, Fu-Hsing Wu, Chuen-Horng Lin and Yung-Kuan Chan

Session 3 – 8

Chair: Dr. Jui-Hung Kao, Shih Hsin University, Taiwan

1. Review Rating Prediction using BiLSTM

Yongjun Kim, Sang-Joon Lee and Yung-Cheol Byun

2. Multi-Fault Classification Method for Wind Turbine with Class Imbalance Data Subhajit Chatterjee, Joon-Min Gil and Yung-Cheol Byun

3. GDN: Generative Decoupling Network for Digital Subtraction Angiography Generation

Ruibo Liu, Ronghui Tian, Zhenzhou Li, Ligang Chen, Xinyu Yang, Wei Qian, Guobiao Liang, Guangxin Chu, Hai Jin and He Ma

4. Image Annotation with Abstract and Location Keywords

Huei-Hua Tsao, Chien-Lung Hsu and Wei-Chao Lin

5. An E3sCNN-BiLSTM Model for Stock Price Prediction

Yi-Xue Yang and Kuo-Chan Huang

Session 3 - 5

Chair: Dr. Yan Pei, University of Aizu, Japan

1. Using Local Gradient Compensation in Federated Learning for Improving Privacy and Performance

Jia-Wei Chang, Wei-Cheng Chen and Chih-Chieh Hung

2. Investigating the Influence of Color on Various Perceptions Using Eye-Tracking Technology

Min-Feng Lee and Jian-Zhi Chen

3. A Hybrid Artificial Intelligence-based Model for Corporate Sustainability Evaluation and Forecasting

Te-Min Chang, Ching-Chiang Yeh, Guo-Hsin Hu, Sin-Jin Lin, Ming-Fu Hsu and Hsin-Hui Hung

4. Continuous-Time Double Actors and Regularized Critics in Reinforcement Learning

Shuhao Li, Shengjie Zhang, Han Zhang and Rui Zhou

Session 3 – 6

Chair: Dr. Lin Hui, Tamkang University, Taiwan

- 1. Creation of a Special-purpose Drone Industrial Ecosystem and Testing Facilities Sung-Phil Heo, Bong-Seok Kang, Jeong-Min Kim and Jeong-Hyun Cho
- 2. A Study on Security Countermeasures Against Autonomous Driving Hacks Soojin Oh and Cheolhee Yoon
- 3. Edge Al Robot Technology Application with YOLOv8, MQTT and MQ-5 Sensors for Realtime Fire and Smoke Detection

Anggi Andriyadi, Chandra Wijaya, Sh-Yan Chen, Ding-Hsiang Huang and Chao-Tung Yang

4. An improved Cryptocurrency Predictive Method by using Bi-Long Short-Term Memory based on News Technical Indicators

Mao-Lun Chiang, Hui-Ching Hsieh and Hsiang-Wei Kung

5. Developing an Esports Assistant System for First Person Shooting Game based on Multimodal Learning

Wei-Hsiang Chiu, Jason C. Hung, Hao-Shang Ma and Chun-Hong Huang

-Day 4-July 13, 2024

Session 4 - 1

 Design of Semiconductor Laser Power Supply Operating System Based on Digital Integrated Circuit

Jiarui Pan and Zhouxing Wang

2. Application of Computer Vision Technology in the Field of Automatic Target Reporting

Rui Zhu and Jie Yu

3. Machine Learning Algorithms for Artificial Intelligence Technology Development Online Communication Platform

Nancao Ma

4. Multimedia Digital Al painting System based on Machine Vision Algorithm
Han Li

Session 4-2

 Intelligent Decision Optimization of Big Data in the Digital Economy under Deep Reinforcement Learning

Liang Zhu

- 2. Development of Virtual Maintenance Training Platform for Electric Motors Zhao Yao, Qian Zhang, and Hejia Li
- 3. Design of Automatic Driving and Parking System for New Energy Vehicles Based on Artificial Intelligence
 Bin Ma
- 4. Application of Machine Learning Algorithms to Mental Health Data Processing for College Students

Xiaoying Liang and Yuran Liu

-Day 5-July 14, 2024

Session 5 - 1

1. On the Translation Strategy of "Intangible Cultural Heritage" Based on Visual Multimodality

Yanjun Zhou and Shuling Zhou

2. Research on the Improvement of Human-Machine Collaborative Machine Translation Model Based on Internet

Wei Sun and Man Yao

3. Research on Subway Station Space Design from the Perspective of Regional Culture

Ziru Zhang

4. Application of Intelligent Algorithm in Image Recognition under the Vision of Artificial Intelligence

Lei Xu

PM: Organizing Committee Meeting

Information For Paper Presenters

The FC 2024 will be held in Singapore during 10-14 July 2024.

Oral Presentation

- Papers will be presented during about 90 minutes of parallel sessions of the conference, each with about 4 - 5 papers. Each paper will be allocated to 15 minutes of presentation time and 5 minutes for Q&A.
- Your punctual arrival and active involvement in each session will be highly appreciated.
- Do not forget to prepare and backe up your presentation slides or PDF files.

Video Presentation

For authors who are unable to attend the event in Singapore, it is required to submit a 15-minute video. The video will be made publicly available on YouTube after the session through private links.

Note

- Take Care of Your Personal Belongings. The conference organizers do not assume any responsibility for lost personal belongings.
- Wear Your Badge: Always wear your participation badge throughout the conference.
 Access will be denied to individuals without a badge. Do not discard your badge.
- Please take your badge and meal coupons to Banquet restaurant.

Conference Venue

The 14th International Conference on Frontier Computing (FC 2024) will be held in **RNN Conference Center Cecil Building**, Singapore.



Address: 137 Cecil Street, Cecil Building #04-01, Singapore 069537

Access

- By MRT (via Telok Ayer MRT): Take the MRT from Changi Airport (CG2) to Expo (CG1), transfer to the Downtown Line towards Bukit Panjang, alight at Telok Ayer (DT18), and walk 8 minutes to 137 Cecil Street.
- By MRT (via Tanjong Pagar MRT): Take the MRT from Changi Airport (CG2) to Tanah Merah (EW4), transfer to the East West Line towards Tuas Link, alight at Tanjong Pagar (EW15), and walk 10 minutes to 137 Cecil Street.
- By Taxi: Take a taxi from Changi Airport to 137 Cecil Street, which takes about 20-30 minutes and costs SGD 20-30.
- By Bus: Take Bus 36 from Changi Airport to Suntec City, transfer to Bus 70 or 700, alight at Opposite The Amara (Bus Stop 03151), and walk 5 minutes to 137 Cecil Street.

For more detail, please visit to RNN conference center website: [Access Information]

Banquet

The FC2024 Banquet will be held at **Lime Restaurant** in the PARKROYAL COLLECTION Pickering hotel at **Ground floor** on July 11, 2024. The banquet will start at **18:00**.



Address: 3 Upper Pickering Street, Singapore 058289

Access

- By MRT: Board the train from Changi and alight at the Tanah Merah Station. Transfer to the Green Line heading towards Outram MRT Station. Alight at Outram, then take the Purple Line to Chinatown, exiting via Exit E (towards Chinatown Point Shopping Centre). The hotel is just a one-minute walk from this station. Estimated travel time from Changi Airport is one hour.
- By Taxi: The journey from Changi International Airport should take approximately 20 minutes and will cost between SGD 20 to SGD 30

Access from Venue to Banquet

- By Taxi: The fastest and most convenient option. It will take approximately 5-10 minutes depending on traffic.
- By Bus: Take Bus 186 from Prudential Tower (Stop 03021) to Chinatown Point (Stop 05049). From there, it's a short walk to the restaurant.
- By Walking: It's a 15–20-minute walk from FC2024 Venue. Head west on Cecil Street towards Boon Tat Street, continue Boon Tat Street, then turn right onto Upper Pickering Street.

