



Jiansak Tongyung
Photographer
copyright © by Jiansak

The 28th International Computer Science and Engineering Conference (ICSEC2024)

“AI and Sustainable Computing”

**November 6-8, 2024
Khon Kaen, Thailand**

ABSTRACT BOOKLET

Table of Contents

Welcome Message from the General Chair	3
Keynote Speakers	4
Professor Dusit Niyato, SCSE, Nanyang Technological University, Singapore	4
Professor Thomas Bäck, LIACS, Leiden University, The Netherlands	5
Professor Gitta Kutyniok, Ludwig-Maximilians-Universität München, Germany	6
Mr. Thanapop Juthavantana, Huawei Thailand	7
Day 1 — Tutorials and Workshops	8
Tutorial 1: Quantum Intelligence	8
Tutorial 2: Generative AI in Data Science and Analysis	8
Tutorial 3: An Introduction to Training and Optimizing Large Language Models	9
Workshop 1: Digital Security Engineered for Digital-Age Education	9
Workshop 2: Smart City Digital Data Platform	9
Workshop 3: Deepzoom Platform	10
Session 11: Internet of Things, Wireless Networks and Communications, and Cloud	10
Day 2 — Invited Talks and Presentations	12
Invited Talk 1: Real-Time AI-Based Video Analytics: Theory and Applications	12
Invited Talk 2: Nature-Inspired Robot Intelligence: From Nature to Advanced Robotics Technology	12
Invited Talk 3: Revolutionizing Healthcare with Digital Twins: The Power of Generative AI Integration	13
Session 1: Applied AI, Generative AI, and Machine Learning	13
Session 2: Big Data, Data Science, and Applications	15
Session 3: Natural Language Processing	17
Session 4: Computer Educational Technology	20
Session 5: Computer Vision and Image Processing	22
Session 6: Computer Simulation and Modeling	25
Session 7: Geo-informatics and Remote Sensing	27
Special Session: HPC, Data Lakes, and Computing Continuum (HPC-ComCon 2024)	29
Day 3 — Invited Talk and Presentations	31
Invited Talk 4: TBA	31
Special Session: AI in Medical and Healthcare (AIMedHealth 2024)	31
Session 8: Applied AI and Machine Learning	33
Session 9: Business Intelligence	35
Session 10: Cyber Security, Embedded Systems, and Robotics	37
Session 12: HCI, Software Engineering, and Software Development	39
About ICSEC2024	41
Committee	42
Technical Program Committee	44
Sponsors	45

Welcome to the 28th International Computer Science and Engineering Conference (ICSEC2024)



On behalf of the organizing committee, I would like to extend a welcome to the 28th International Computer Science and Engineering Conference (ICSEC2024) participants, which take place from November 6-8, 2024, in Khon Kaen, Thailand. With the generous support and cooperation among our partners - IEEE Thailand Section (IEEE Computer Society Thailand Chapter), ECTI association, CITT, and AIAT - this conference is co-organized by the College of Computing, Khon Kaen University, in collaboration with the Faculty of Engineering and Faculty of Interdisciplinary Studies.

The International Computer Science and Engineering Conference (ICSEC) serves as the leading platform for researchers, practitioners, and educators to present and discuss the most recent innovations, research findings, experiences, trends, and challenges in the field of Computer Science, Computer Engineering, Software Engineering, and Information Technology. This year's theme, "AI and Sustainable Computing," explores the critical intersection of artificial intelligence and sustainable technologies, with a special focus on how these innovations can drive future societal and environmental progress.

As a reflection of the continued importance of this conference, we have received 113 submissions from authors across 15 countries, and 66 papers have been accepted, representing an acceptance rate of 58.4%. Accepted and presented papers will be considered for inclusion in IEEE Xplore, and selected papers may have the opportunity to extend their research for submission to SCOPUS-indexed journals, further enhancing the academic impact of ICSEC2024.

ICSEC2024 would not be possible without the dedicated efforts of our local organizing committees, the invaluable contributions of our research partners, authors, reviewers, and session chairs, who have worked tirelessly to support every aspect of this conference, and the support of our sponsors. We sincerely thank them for their invaluable contributions and look forward to enriching discussions, knowledge-sharing, and fruitful networking.

A handwritten signature in blue ink that reads "Sirapat C."

**Assoc. Prof. Sirapat Chiewchanwattana, Ph.D.,
IEEE member**

**General Chair, ICSEC 2024
Dean of College of Computing
Khon Kaen University, Thailand**

Large Language Models (LLMs) with Retrieval-Augmented Generation for Next Generation Networking



Keynote: Professor Dusit (Tao) Niyato, Ph.D., IEEE Fellow, IET Fellow

**President's Chair Professor in Computer Science and Engineering
School of Computer Science and Engineering (SCSE), Nanyang Technological University, Singapore**

Abstract

With the advance of artificial intelligence (AI), the emergence of Google Gemini and OpenAI Q* marks the direction towards artificial general intelligence (AGI). To implement AGI, the concept of interactive AI (IAI) with large language models (LLMs) has been introduced, which can interactively understand and respond not only to human user input but also to dynamic system and network conditions. In this presentation, we explore an integration and enhancement of LLMs in networking. We first comprehensively review recent developments and future perspectives of AI and then introduce the technology and components of IAI and LLMs. We then explore the integration of IAI and LLMs into the next-generation networks, focusing on how implicit and explicit interactions can enhance network functionality, improve user experience, and promote efficient network management. Subsequently, we propose an IAI-enabled network management and optimization framework, which consists of environment, perception, action, and brain units. We also design the pluggable large language model (LLM) module and retrieval augmented generation (RAG) module to build the knowledge base and contextual memory for decision-making in the brain unit. We demonstrate the effectiveness of the framework through case studies. Finally, we discuss potential research directions for IAI-based networks.

On the Automated Generation of Optimization Heuristics: A Dream or Reality?



Keynote: Professor Thomas Bäck, Ph.D., IEEE Fellow

**Professor of Natural Computing, Society Artificial Intelligence and Life Sciences (SAILS)
The Leiden Institute of Advanced Computer Science (LIACS), Leiden University, The Netherlands**

Abstract

For decades, researchers have been looking at paradigms gleaned from nature as inspiration for problem solving approaches, for example in the domain of optimization. There are many classes of such algorithms, including evolutionary algorithms, particle swarms, differential evolution, ant colony optimization, and the number of proposed variants of them is quite large. This makes it hard to keep track of the variants and their respective strengths, and even more so it creates a difficult situation for non-experts who are interested in selecting the best algorithm for their real-world application problem.

In this presentation, I will introduce and discuss ideas to automatically optimize the optimization heuristic. This task can be approached as an algorithm configuration problem, for which I will present some examples illustrating that this task can be handled by direct global optimization algorithms – in other words, by “automatically optimizing the optimization algorithm”. I will give an example how a combinatorial design space of thousands of configuration variants of evolution strategies in a so-called modular Covariance Matrix Adaptation Evolution Strategy framework can be searched, and how the results can be analyzed using data mining. This approach provides an opportunity for discovering the unexplored areas of the optimization algorithm design space. Extensions towards other algorithm design spaces such as particle swarm optimization and differential evolution are then outlined, too.

In the second part of the presentation, I will discuss a range of real-world engineering design applications, for which such an approach could truly provide a competitive advantage. In such cases, optimizing the optimization algorithm requires a proper definition of the problem class, for which the optimization is executed. For the example of automotive crash optimization problems, I will present first results demonstrating that these problems differ a lot from the classical benchmark test function sets used by academic community, and present an automated approach to find test functions that properly represent the real-world problem. First results on the performance gain that can be achieved by optimizing the optimization algorithm on such real-world problems are also presented.

To conclude, I will briefly show a novel approach for using a large language model in an iterative loop to automatically generate metaheuristic algorithms for optimization, and how this approach which we call LLaMEA (Large Language Model Evolutionary Algorithm) can generate novel metaheuristics that perform very well on a standard set of benchmark functions.

Sustainable AI Computing: A Mathematical Perspective



Keynote: Professor Gitta Kutyniok, Ph.D., IEEE Fellow

Bavarian AI Chair for Mathematical Foundations of Artificial Intelligence, LMU Munich
Adjunct Professor for Machine Learning, University of Tromsø
Consultant, Institute for Robotics and Mechatronics, DLR-German Aerospace Center
Mathematisches Institut, Ludwig-Maximilians-Universität München, Germany

Abstract

The new wave of artificial intelligence is impacting industry, public life, and the sciences in an unprecedented manner. However, one current major drawback is the lack of reliability as well as the enormous energy problem.

The goal of this lecture is to first provide an introduction into this new vibrant research area. We will then present a mathematical perspective on the reliability and energy problem and discuss novel research results in this realm, which reveal possibilities to overcome these current limitations. This will lead us naturally to spiking neural networks and novel computing hardware such as neuromorphic hardware for future AI computing.

Building the Digital University: Framework for the Future of Learning, Campus, and Research



Keynote: Mr. Thanapop Juthavantana

**Technical Director, Commercial and Distribution Sales Dept
Huawei Thailand**

Abstract

We will explore the framework for creating a digital university that embraces next-generation learning, intelligent campus environments, and cutting-edge research capabilities. Drawing from Huawei's vision of future technology, we will examine how digital transformation can enhance personalized education, facilitate smart campus infrastructure, and foster collaborative research ecosystems. Attendees will gain insights into the role of AI, cloud, 5G 5.5G, and data analytics in reshaping educational institutions, ensuring they remain competitive in a rapidly evolving digital landscape.

Day 1 — Tutorials and Workshops

November 6th, 2024 12:00 – 17:00 hrs (GMT+7)

Tutorial 1: Quantum Intelligence

Quantum Intelligence: An Introduction to Quantum Computing and Quantum Machine Learning

Professor Stephen John Turner, Ph.D.

School of Information Science and Technology (IST), Vidyasirimedhi Institute of Science and Technology (VISTEC), Wangchan Valley, Rayong, Thailand.

Quantum computing is the study of information processing based on the quantum properties of matter. By combining the rich representational power of quantum states with the possibility of exponential parallelism, quantum computing has the potential to revolutionize many aspects of science, technology and industry. While quantum computing is still at an early stage of development, we have recently seen rapid advances in quantum technology, and quantum computers with hundreds of qubits are now readily available via cloud services. In this current “utility” era, quantum computers are demonstrating their potential to provide an advantage over classical computers in certain application areas. The first part of this tutorial will explain the basic concepts of quantum systems and their properties, including superposition, entanglement and interference, and how the inherent parallelism of quantum computers may be exploited. Examples of quantum algorithms and applications will be given, including quantum networks and security. The second part of the tutorial will describe approaches to quantum machine learning (QML). Some important QML algorithms will be described, including quantum neural networks, with examples taken from real-world applications. Finally, the tutorial will explore the exciting possibilities offered by the convergence of quantum computing and artificial intelligence to form quantum intelligence.

Room: Fah Mui 1 & 2
Time 13:00 - 14:30 hrs

Keywords: Quantum Computing, Quantum Intelligence, Quantum Machine Learning

Tutorial 2: Generative AI in Data Science and Analysis

Generative AI in Data Science and Analysis

Thanachart Numnonda, Ph.D.

Khon Kaen University, Thailand.

Generative AI in data science and analysis, focusing on tools like ChatGPT, Gemini, and Claude.ai. It aims to equip participants with the skills to employ AI technologies in extracting, interpreting, and analyzing data without the need for traditional programming. Attendees will explore the functionalities of ChatGPT across different versions, gaining insights into how these tools can be used for deep data analysis and decision-making processes in various data science contexts. The workshop will delve into practical aspects of data science, including data engineering, visualization, predictive analytics, and natural language processing, all through the lens of Generative AI. Participants will engage in hands-on lab sessions, applying these AI tools to real-world data science problems, and learning to conduct end-to-end data projects. This program is designed for individuals looking to integrate advanced AI capabilities into their data science toolkit, enabling them to efficiently handle complex data analysis and predictive modeling tasks with minimal reliance on coding or external IT resources.

Room: Chat Tan 1
Time 13:00 - 14:30 hrs

Keywords: Generative AI, Data Science, Data Analysis

Tutorial 3: Large Language Models

An Introduction to Training and Optimizing Large Language Models

Asst. Prof. Jan N. van Rijn, Ph.D.

The Leiden Institute of Advanced Computer Science (LIACS), Leiden University, The Netherlands.

Transformer-based language models have achieved milestones in natural language processing, but they come with challenges, mainly due to their computational footprint. While large language models are readily available for use, it remains important to do academic research towards these for the following reasons: (i) the training procedure and datasets of these models are typically not disclosed, and they are essentially operating as black-boxes maintained by companies. (ii) the size of these models gives them a high computational footprint, even when deployed (inference-stage). Therefore, developing compute-efficient models that can be deployed with the computational resources available at the disposal of small- and medium-size enterprises is crucial. (iii) models such as ChatGPT interact with society in ways that we could not imagine several years before, but many open questions remain, related to trustworthiness, privacy, security, and efficiency, especially in lower-resource contexts. It is therefore important that the research community addresses these topics and develops open-source models for future applications. In this tutorial, we will present our research regarding how to train and optimise large language models. It will cover both the pre-training as well as the finetuning stage.

Room: Fah Mui 4 & 5

Time 13:00 - 16:30 hrs

Keywords: Large Language Model, Transformer-Based Language Model, Optimization

Workshop 1: Digital Security Engineered for Digital-Age Education

Digital Security Engineered for Digital-Age Education

Mr. Sophon Thanaratikun, Sr. Channel Systems Engineer

Fortinet Security Network (Thailand) Ltd.

Room: Erawan 1 & 2

Time 13:00 - 16:30 hrs

Keywords: Digital Security, Next Generation Firewall, Endpoint Protection

The digital transformation of the education environment has empowered schools & university students and teachers with new methods and tools to learn, teach and conduct research. However, the same technology along with cloud services, Bring Your Own Devices (BYOD) and Internet of Things (IoT), increases the attack surface and introduces security risks which makes the campus networks vulnerable to cyber threats and security breaches. The challenge is to find a right security posture that protects its resources and users while at the same time providing a collaborative learning environment. Fortinet is well-positioned to accompany schools, universities, and colleges on their digital transformation journey with security transformation provided by the Fortinet Security Fabric. Attend this hands-on technical training workshop to learn how Fortinet can help you find the right balance between an open and secure academic environment by providing intelligent security for a safe learning environment.

Workshop 2: Smart City Digital Data Platform

Your city, smarter than ever with City Digital Data Platform

Mr. Arun Ongartsittigul

Bedrock Analytics Co., Ltd.

Room: Chat Tan 2

Time 13:00 - 14:30 hrs

Keywords: Smart City, Digital Data Platform

A centralized data management system designed to gather, store, organize, and analyze data related to various aspects of a city's operations and services. This integrated approach ensures that all relevant information is easily accessible and actionable, enabling local governments to make informed decisions, optimize public service delivery, and enhance overall operational efficiency.

Workshop 3: Deepzoom Platform

Deepzoom Platform

*Mr. Kasisidis Mahakijdechachai
Bedrock Analytics Co., Ltd.*

Room: Chat Tan 1 & 2
Time: 14:45 - 16:30 hrs

The Deepzoom platform is an innovative AI-driven solution designed to enhance conventional CCTV systems. Deepzoom offers robust tracking and visualization capabilities, enabling the precise monitoring of any object of interest. This will create a seamless and powerful tool for the security sector.

Keywords: Computer Vision, CCTV, Security

Session 11: Internet of Things, Wireless Networks and Communications, and Cloud

Session Chair: Isoon Kanjanasurat, Ph.D.
College of Computing, Khon Kaen University, Thailand

Room: Fah Mui 3
Time: 13.30-16.30 hrs

Secrecy Offloading Performance Analysis for UAV Relay-Assisted NOMA MEC System
Anh-Nhat Nguyen (ICT&FPT University, Vietnam); *Gia-Huy Nguyen**, Ngo Tung Son, Bui Ngoc Anh, Le Phuong Chi and Hoang Manh Duc (FPT University, Vietnam)

Paper#1571047783

This paper investigates a secure offloading system for nonorthogonal multiple access (NOMA) mobile edge computing (MEC) in the Internet of Things (IoT), utilizing an unmanned aerial vehicle (UAV) as a relay. We focus on a scenario where two edge devices (EDs) with limited resources need to offload their tasks to a base station (BS) through the UAV relay. To evaluate secrecy performance, we derive a closed-form expression for the secrecy successful computation probability (SSCP) under the Nakagami- m fading channel model. Numerical results reveal the influence of key system parameters, including the average transmit power at the EDs and UAV, UAV altitude, and power allocation coefficient (PAC). These results indicate that there is an optimal UAV altitude and PAC value that enhances secure offloading performance. The accuracy of our analysis is confirmed through Monte Carlo simulations.

Keywords: Unmanned Aerial Vehicle, Nonorthogonal Multiple Access, Mobile Edge Computing, Internet of Thing

Secrecy Offloading Analysis of UAV-Assisted NOMA-MEC Incorporating WPT in IoT Networks

Paper#1571049029

*Gia-Huy Nguyen** (FPT University, Vietnam); Anh-Nhat Nguyen (ICT&FPT University, Vietnam); Minh-Sang Nguyen, Khai Nguyen, Ngo Tung Son, Bui Ngoc Anh, Le Phuong Chi and Hoang Manh Duc (FPT University, Vietnam)

This article studies the efficiency of secrecy data offloading for an unmanned aerial vehicle (UAV)-assisted nonorthogonal multiple access (NOMA)-integrated mobile-edge computing (MEC) incorporating wireless power transfer (WPT) within an Internet of Things (IoT) network. Specifically, this study assumes an UAV to function in dual roles: as a mobile computation platform and as an aerial power-supply station, offering substantial advantages for resource-constrained edge devices (EDs) in mitigating interference from an passive eaves-dropper. To assess the system's secrecy offloading efficacy, the secrecy successful computation probability (SSCP) closed-formed formulation under Nakagami- m fading channel is derived. The theoretical results are conducted with a variety of parameters, thereby validating the precision of our analysis.

Keywords: Unmanned Aerial Vehicle, Nonorthogonal Multiple Access, Wireless Power Transfer, Mobile Edge Computing

Computation Offloading Analysis of IoT Networks With UAV-Enabled MEC With NOMA and WPT

Paper#1571056231

*Khai Nguyen** (FPT University, Vietnam); Anh-Nhat Nguyen (ICT&FPT University, Vietnam); Gia-Huy Nguyen and Minh-Sang Nguyen (FPT University, Vietnam)

In this paper, the performance of an Internet of Thing (IoT) system using an unmanned aerial vehicle (UAV) in an urban setting is investigated using mobile-edge computing (MEC) based on non-orthogonal multiple access (NOMA). We analyze two clusters of IoT devices (IDs) with limited resources that can harvest energy from a power beacon (PB) operating as a wireless power transfer (WPT) station and offload their tasks to a UAV. We propose a four-phase technique for IDs offloading and energy harvesting (EH). To evaluate offloading performance, we define the expression of offloading outage probability (OOP) and successful computation probability (SCP) for the entire system. Additionally, we offer a formulation of the optimization problem that optimizes the OOP and SCP by optimizing the EH time and height of the UAV. Using particle swarm optimization (PSO), these problem were fixed. To confirm the correctness of our analysis, a variety of system parameters are assessed based on the Monte Carlo simulation, such as the height of the UAV, the number of IDs in each cluster and the EH time.

Keywords: Internet of Things, Unmanned Aerial Vehicles, Energy Harvesting, Wireless Power Transfer, Mobile Edge Computing, Non-orthogonal Multiple Access, Particle Swarm Optimization

Offloading Analysis of UAV-Assisted NOMA-MEC in IoT Network With SC/MRC

Paper#1571056234

*Minh-Sang Nguyen** (FPT University, Vietnam); Anh-Nhat Nguyen (ICT & FPT University, Vietnam); Gia-Huy Nguyen and Khai Nguyen (FPT University, Vietnam)

In this paper, we study an unmanned aerial vehicle (UAV) equipped with multiple antennas, integrating non-orthogonal multiple access (NOMA) and mobile edge computing (MEC), with the task of compute support for IoT devices (IDs). Therefore, we propose a three-phase process to ensure NOMA-based task transfer. We calculate and find the best scheme for the system, we suggest using the selection combination (SC) or maximum ratio combination (MRC) scheme. We derive closed-form formulas to calculate the successful computation probability (SCP) according to the fading Nakagami-m channel model to evaluate the system's effectiveness. The results provide insight into system performance based on parameters such as number of antennas, number of IDs, UAV height, and transmit power distribution.

Keywords: Unmanned Aerial Vehicle, Non-orthogonal Multiple Access, Mobile Edge Computing, Selection Combination, Maximum Ratio Combination

Day 2 — Invited Talks and Presentations

November 7th, 2024 13:15 – 17:00 hrs (GMT+7)

Invited Talk 1: Real-Time AI-Based Video Analytics

Real-Time AI-Based Video Analytics: Theory and Applications

Assoc. Prof. Peerapon Vateekul, Ph.D.

Chulalongkorn University, Thailand

Room: Chat Tan 2

Time 13.15-14.15 hrs

Nowadays, AI techniques have been advancing and are being applied in many kinds of data, especially in video analytics. In this session, we aim to present many of our research works in real-time deep learning-based video analytics. First, DeepGI is our innovation to assist endoscopists in detecting anomalies in gastrointestinal (GI) tracts in real-time from various types of endoscopy videos. Our models can (i) detect polyps from colonoscopy videos to prevent colon cancer, (ii) segment gastric intestinal metaplasia (GIM) lesions from gastroscopy videos, and (iii) classify malignant scenes of bile duct strictures from cholangioscopy videos. Second, D-mind is an innovation from AI for Mental Health (AIMET) that helps detect depression from interview videos in real-time through a mobile application. At the moment, more than 200,000 users are using the D-mind application. Third, we can identify the severity level of Parkinson's Disease (PD) patients using facial expression and gait videos. All of these works are good examples that theory in the AI domain can be applied in real-world applications.

Keywords: Artificial Intelligence, Video Analytics, Deep Learning

Invited Talk 2: Nature-Inspired Robot Intelligence

Nature-Inspired Robot Intelligence: From Nature to Advanced Robotics Technology

Professor Poramate Manoonpong, Ph.D.

School of Information Science and Technology (IST), Vidyasirimedhi Institute of Science and Technology (VISTEC), Wangchan Valley, Rayong, Thailand.

Room: Fah Mui 1 & 2

Time 13.15-14.15 hrs

Living creatures can quickly form their gaits within minutes of being born. This is due to their neural locomotion control circuits comprising genetically encoded. They can quickly adapt their movement to traverse a variety of substrates and even take proactive steps to avoid colliding with an obstacle. Furthermore, in addition to locomotion, they can also perform diverse complex autonomous behaviors, such as object transportation and navigation, with a high degree of energy efficiency. Biological studies reveal that these capabilities are the result of the coupling of their biomechanics (e.g., structures, muscles, and materials) and neural mechanisms with plasticity and memory (brain). In this talk, I will present “how we can realize biomechanics and neural mechanisms inspired by nature for robots so they can become more intelligent like living creatures”. I will also demonstrate that this nature-inspired robotics can help us not only address scientific questions, but also advance robotics technology for real world (industrial) applications. It may even bring the goal of creating “true robot intelligence” a little bit closer.

Keywords: Biomechanics, Robotics, Nature-Inspired Robotics

Invited Talk 3: Revolutionizing Healthcare with Digital Twins

Revolutionizing Healthcare with Digital Twins: The Power of Generative AI Integration

Professor Paisarn Muneesawang, Ph.D.

Department of Computer Engineering, Mahidol University, Bangkok, Thailand.

Room: Erawan 2

Time 13.15-14.15 hrs

This session explores the transformative potential of Digital Twin technology in healthcare, enhanced by the integration of Generative AI. We will delve into how Digital Twins—virtual replicas of physical entities—can revolutionize patient care by simulating real-time health scenarios and predicting outcomes. By leveraging Generative AI, these systems can generate comprehensive health reports, interpret complex datasets, and provide actionable insights. This talk will cover key use cases, including predictive healthcare models, patient monitoring, and the application of AI to optimize treatments and diagnoses, driving a new era of precision medicine.

Keywords: Digital Twin, Generative AI, Healthcare

Session 1: Applied AI, Generative AI, and Machine Learning

Session Chair: Asst.Prof. Jan N. van Rijn, Ph.D.

Leiden Institute of Advanced Computer Science, Leiden University, The Netherlands

Room: Fah Mui 1 & 2

Time 14.30-17.00 hrs

Machine Learning Model for Skill Level Prediction in Multiplayer Online Battle Arena

Vachirawit Pepatang and Vishnu Kotrajaras (Chulalongkorn University, Thailand)*

Paper#1571038517

Accurately predicting player skill levels in the Multiplayer Online Battle Arena (MOBA) game, Defense of the Ancients 2 (DotA 2), is important for improving the overall gaming experience and ensuring fair competition. This study proposed machine learning models to improve skill prediction, which can help developers create better matchmaking systems. We used data from 2.7 million matches and employed models such as Random Forest, LightGBM, and Artificial Neural Networks (ANN). To effectively represent player behavior, we introduced new features related to player strategies, items purchased, and in-game movements. Additionally, we introduced a match splitting method to address dynamic gameplay phases. The ANN model with Equal Duration-Based splitting demonstrated the best performance, achieving a Mean Absolute Error of 0.60 and an R-squared value of 0.85. Hypothesis testing confirmed that the model's prediction errors aligned with actual player rank fluctuations, thus confirmed that the models' performance is acceptable and consistent with the natural progression and fluctuation of player ranks.

Keywords: Machine Learning, MOBA, Player Skill Prediction, Defense of the Ancient 2

Weight-Shifting Based Pruning for Convolutional Neural Networks

Panuwat Threethanuchai and Chidchanok Lursinsap (Chulalongkorn University, Thailand)*

Paper#1571054980

The paper presents an adaptation of the novel selfrecovering technique known as weight-shifting for application in the pruning of nodes from the fully-connected layers of convolutional neural networks. The proposed methodology involves a binary search strategy to identify the optimal subset of nodes for removal, facilitating efficient redistribution of node weights using the Moore-Penrose pseudo-inverse. The proposed methodology was evaluated by across multiple data sets, including CIFAR-100, Food101, Stanford Cars, and Flowers102. The experimental results demonstrated that the proposed methodology is able to maintain high accuracy and top-k categorical accuracy performance with minimal reductions even after pruning a significant percentage of nodes. The paper contributes to neural network compression and optimization by providing a versatile solution that enhances model efficiency without significantly compromising performance, offering potential benefits for applications in resource-constrained environments.

Keywords: Neural Networks, Model Compression, Deep Learning, Pruning, Optimization

Hand, Heart, and AI Harmony: Integrating Generative AI to Innovate Northern Thai Local Wisdom

Paper #1571054576

Pruet Putjorn (Mae Fah Luang University & Center of Excellence in AI and Emerging Technologies, Thailand)*, Pollavat Prapattong, Omsin Boonleart, Cherdchart Hirunro, Chalongrat Charoensri, Wilawan Champakaew, and Pattayaporn Unroj (Mae Fah Luang University, Thailand)

This paper investigates the application of Generative AI (GenAI) in the design processes of Thai Lue textiles, aiming to enhance creativity, sustainability, and cultural preservation. The study employs a three-phase methodology: Engagement and Ideation, AI Integration and Design Generation, and Human-AI Collaboration. In the first phase, community workshops with local students, designers, and artisans focused on capturing cultural values through hand-drawn designs inspired by community stories and personal reflections, emphasizing the "Hand" and "Heart" aspects to foster deep cultural connections and personal engagement. The second phase utilized AI tools like DALL-E to generate diverse design prototypes from detailed prompts, evaluating these AI-generated designs for cultural relevance and aesthetic appeal through qualitative interviews and observations. This phase demonstrated the "AI-Harmony" concept, illustrating AI's role in complementing human creativity and expanding design possibilities. The final phase featured collaborative workshops where artisans and designers refined the AI-generated designs, gathering feedback on AI tools' usability and creative impact. Card sorting techniques and Human-Computer Interaction (HCI) studies were used to refine and validate design components, highlighting the effective synergy between human creativity and AI. This phase accelerated the design process and ensured that the outputs were both innovative and culturally resonant. The study's findings reveal the potential of GenAI to blend traditional craftsmanship with modern design elements, enhancing creative efficiency and making traditional crafts more appealing to younger generations. Additionally, the Funnel of Human and GenAI Creation model demonstrated that integrating AI tools can significantly streamline the design process, reduce resource consumption, and promote sustainable production practices. This integration supports the preservation of cultural heritage while adapting to contemporary contexts, fostering sustainability and innovation. The research underscores the value of combining human creativity with AI technology to create a harmonious, dynamic, and culturally sensitive design process.

Keywords: Generative AI, Creative Innovation, Community-based Design, AI-assisted Design, Thai Lue Textiles, Human-Computer Interaction (HCI)

Human vs. AI: Leveraging Machine Learning and Deep Learning to Verify Image Authenticity

Paper #1571056060

Thittaporn Ganokratanaa, Manotham Damnnoen, Puchit Katesomboon, Phacharaphon Aiamphan, Korrapant Maneeta and Warin Wattanapornprom* (King Mongkut's University of Technology Thonburi, Thailand)

The sophistication of generative AI models has led to AI-generated images that are nearly indistinguishable from human-made ones, presenting challenges in digital art, media, and content verification. This study addresses these challenges using both traditional machine learning (ML) and deep learning (DL) approaches. We leverage a balanced dataset from Hugging Face, containing equal numbers of human-created and AI-generated images, and use Gray Level Co-occurrence Matrix (GLCM) features and Local Binary Patterns (LBP) for texture analysis to discern subtle differences. Evaluating models such as K-Nearest Neighbors (KNN), Random Forest, Decision Tree, Support Vector Machine (SVM), Multi-Layer Perceptron (MLP), and deep learning architectures like ResNet50 and VGG16, we find that traditional ML models with well-selected features can outperform advanced DL models in certain contexts, highlighting the importance of feature engineering. These findings offer robust tools for verifying digital image authenticity and protecting intellectual property, benefiting digital artists, content creators, forensic analysts, and online platforms.

Keywords: AI-generated Images, Grey Level Co-occurrence Matrix, Image Classification

Energy Efficiency Evaluation of Neural Network Architectures on the Neuromorphic-MNIST Dataset

*Niti Thienbutr** and Wansuree Massagram (Naresuan University, Thailand)

With the ever-growing need for artificial intelligent applications, the demand for energy-efficient neural networks is more critical than ever given the significant environmental and economic challenges posed by high energy consumption. Inspired by synaptic spikes in the brain mechanism, SNNs with their event-driven processing, are proposed as a promising alternative due to their potential for lower power consumption. This study presents a comparative analysis of Artificial Neural Networks (ANNs), Convolutional Neural Network (CNNs), Spiking Neural Networks (SNNs), and Convolutional Spiking Neural Networks (SCNNs) to evaluate their energy efficiency and performance. Using the N-MNIST dataset, a neuromorphic adaptation of the traditional MNIST dataset, we trained and tested those four NN architectures. The ANN model, trained using a backpropagation algorithm, achieved an accuracy of 97.68%. The CNN model, LeNet-5 architecture, produced a slightly better accuracy of 97.68%. The SNN model, utilizing Leaky Integrate-and-Fire (LIF) dynamics and rate-coding, reached 96.56% accuracy. And the SCNN, using surrogate gradient descent, reported 97.66% accuracy. Despite the expectations for SNN and SCNN, the ANN not only achieved higher accuracy but also demonstrated greater energy efficiency, consuming the least amount of energy at approximately 0.27 watt-hours. %compared to the SNN's 3.93 watt-hours. These findings also indicate that ANNs and CNNS currently outperform SNN variations in both performance and energy consumption. This study underscores the need for further research into optimizing SNNs to bridge the performance and energy efficiency gap with traditional ANNs, highlighting the challenges and potential directions for improvement in neuromorphic computing applications.

Paper#1571049092

Keywords:

Neuromorphic Computing, Neural Network, ANN, CNN, SNN, SCNN, Energy Consumption

Session 2: Big Data, Data Science, and Applications

Session Chair: Assoc.Prof. Wararat Songpan, Ph.D.
College of Computing, Khon Kaen University, Thailand

Room: Fah Mui 3
Time 14.30-17.00 hrs

Next Point of Interest Recommendation Using Adaptive Weights for Specific Behavioral Patterns

*Oraya Sooknit** (Burapha University, Thailand), Jakkarin Suksawatchon (Faculty of Informatics, Burapha University, Thailand), Ureerat Suksawatchon (Burapha University, Thailand)

Next Point of Interest (POI) recommendation plays a pivotal role in assisting users in discovering relevant and enjoyable destinations during their travels by analyzing historical check-in data. However, a significant challenge arises when users are travelling unfamiliar territories where their preferences and contextual factors may differ from daily life pattern. The pattern of user behavior when traveling to new places is dynamic. Furthermore, we cannot import data from local pattern traveling to compensate for this scenario. To address this issue, we propose the Next Point of Interest Recommendation Using Adaptive Weights for Specific Behavioral Patterns (AWSBP) to learn user preferences for two patterns of users. Our focus is on rearranging and structuring the dataset to optimize model performance and the relevance of recommendations. Rigorous measures are implemented in this research to uphold user privacy; only anonymized location data is utilized, ensuring that no user profile information is accessible or analyzed. This safeguards the confidentiality and anonymity of individuals' personal data from two real-world datasets. The AWSBP framework outperforms state-of-the-art models in terms of Recall and NDCG metrics for next POI recommendation.

Paper#1571048575

Keywords: Location based, POI Recommendation, Behavior Pattern, Dynamic Pattern, Adaptive Weight

BiG: Bidirectional Graph Convolutional Networks for Social and Sequential Recommendation

Paper#1571048275

*Nikorn Kannikaklang** (Rajamangala University of Technology Krungthep) and Sartra Wongthanavasu (Khon Kaen University, Thailand)

Graph convolutional networks have obviously influenced recommender systems. However, we argue that previous research has limitations: 1) unidirectional approaches are not enough to explicitly capture the representation learning, 2) social influence is ignored to extract the user preference drifts, and 3) simple and crude fusion methods are not enough to seamlessly amalgamate the diverse behavioral perspective. To address these limitations, this research proposes a novelty of Bidirectional Graph convolutional networks for social and sequential recommendation (BiG). A novel graph convolutional networks are modified into bidirectional graphs to explicitly learn the representation of dynamic user preference at social level and sequential level. A novel Bidirectional Gate (BiGate) is designed to amalgamate the diverse preferences of social and sequential influences. Empirical experiment illustrates that BiG outperforms state-of-the-art methods.

Keywords: Bidirectional Graph, Graph Convolutional Network, Gate, Sequential Recommendation, Social Recommendation

Internal-Cluster-Validation-Based Model Selection for k-Means Clustering

Paper#1571043789

*Mozammel Khan** (East West University, Bangladesh)

Clustering is an important data mining process that partitions the data points of an unlabeled dataset based on the similarities of the data points. The k-Means algorithm is a widely used clustering method. We propose a model selection method for k-Means clustering algorithm that identifies the number of optimal clusters and selects the suitable feature subset for better clustering of a dataset. For this purpose, we use internal cluster validation index called Sum of Euclidean Distances (SED). To make the SED Index produced by different feature subsets comparable, we preprocess the dataset and define a per feature SED Index. We generate the candidate feature subsets using a Genetic Algorithm and choose the feature subset that produces the minimum per feature SED Index. We use the per feature SED Index for determining the optimal number of clusters. We also propose a method for selecting initial centroids of the clusters for better clustering performance. We validate our proposed model selection method using Iris, Wine, and Seeds datasets from UCI Machine Learning Repository.

Keywords: Feature Subset Selection, Initial Centroid Selection, Internal Cluster Validation, k-Means Clustering, Optimal Cluster Number Determination

Approximate Axis-Aligned Nearest Neighbor

Paper#1571052530

*Yodthong Rodkaew** (University of the Thai Chamber of Commerce, Thailand) and Warin Wattanapornprom (King Mongkut's University of Technology Thonburi, Thailand)

The nearest neighbor problem is a fundamental challenge in computer and data science, essential for tasks ranging from classification to clustering and beyond. As data dimensionality increases, traditional methods like brute-force search and structure-oriented algorithms such as k-D trees become computationally infeasible. This paper introduces the Approximate Axis-Aligned Nearest Neighbor (AAANN) algorithm, designed to efficiently address the nearest neighbor problem in both low and high-dimensional spaces. The algorithm leverages axis-aligned projections to achieve superior performance for dimensions less than 10, outperforming traditional methods. For higher dimensions, the Taxicab algorithm is recommended due to its robustness and efficiency. Extensive experimental evaluations demonstrate the effectiveness of AAANN, with potential applications in classification searches, ray-tracing, path planning, collision detection, and n-body simulations. The AAANN algorithm represents a significant advancement in the field, offering a scalable and efficient solution to the nearest neighbor problem across a wide range of dimensions.

Keywords: Nearest Neighbor Problem, Axis-aligned, k-D Tree, Taxicab Brute-force.

Enhancing Sequential Floating Search Feature Selection Using Niching-Genetic Algorithm

Paper#1571049136

*Kanyanut Homsapaya** (Kasetsart University, Thailand), Supaporn Bundasak (Kasetsart University Sirirach Campus, Thailand), Boonchoo Jitnupong (Kasetsart University, Thailand)

Classification, a process for predicting the class of a given input data, is one of the most fundamental tasks in data mining. Feature Selection is a crucial and beneficial task for data preparation of data modelling because its process to choose a small subset of relevant features from the original ones by eliminating noisy, irrelevant and redundant. We applied ten popular datasets combining smaller and higher number of variables such as Breast Cancer, Iris, Abalone and Heart datasets to conduct the experiment. Combining niching algorithms with feature selection is inspired by the need to avoid local optima and maintain diversity in feature subsets. Niching helps explore different areas of the solution space, increasing the chances of finding the global optimum. We provide results for deterministic crowding; show how different crowding replacement rules can be combined in algorithms. The experimental results show that SVM classifier gives the highest accuracy and low error rate. In probabilistic crowding, subpopulations are maintained stably, and we demonstrate that it is possible to analyze and bring the new sub features that genetic algorithm can't discover. We also provide novel results for deterministic crowding, show how different crowding replacement rules can be combined in portfolios, and discuss population sizing.

Keywords: Feature Selection, Floating Search, Curse of Dimension, Genetic Algorithm, Niching Algorithm

Session 3: Natural Language Processing

Session Chair: Pongsathorn Janyoi, Ph.D. and Arfat Ahmad Khan, Ph.D.
College of Computing, Khon Kaen University, Thailand

Room: Erawan 1
Time 14.30-17.00 hrs

Impolite Words Detection Algorithm for Standard Thai and Thai Regional Dialects
Kanida Charungchit (Rajabhat Rajanagarindra University, Thailand), *Nannapas Abhiratthanarath** (Rajabhat Rajanagarindra University, Thailand), *Chouvalit Khancome** (Ramkhamhaeng University, Thailand)

Paper#1571038788

Impolite word detection, also known as rude word detection, is a natural language processing (NLP) technique designed to identify inappropriate or offensive language in texts and various media. This technique aims to prevent the use of language that could be considered inappropriate or cause discomfort in online communities and communication applications. This research article introduces a novel approach for detecting impolite Thai words, encompassing various Thai dialects, and identifying the regional origin of the offensive words. The new algorithm employs multiple dictionaries; each stored using inverted lists based on character positions rather than direct word storage. This dictionary structure enables the search process to achieve 100% efficiency with no errors. Experimental results from a program developed to detect impolite words in standard Thai, as well as Northern, Southern, and Northeastern Thai dialects, demonstrated 100% accuracy, significantly outperforming previous detection algorithms. Additionally, the new algorithm outperformed current Generative AI models, even without considering sentence context or utilizing AI.

Keywords: Impolite Words, Algorithm, Rude Words Detection, Inverted List, Data Structure

Leveraging NLP for Building Efficient Information Retrieval Systems: A Performance Analysis

Paper#1571049090

Chen Chung Tung and Zhi Hao Tan (Tunku Abdul Rahman University of Management & Technology, Malaysia); Zhen Yew Chook (Tunku Abdul Rahman University of Management and Technology, Malaysia); Chi Wee Tan, Ts.* (Tunku Abdul Rahman University of Management and Technology (TAR UMT), Malaysia); Khai Yin Lim (Tunku Abdul Rahman University of Management and Technology, Malaysia)

The advancement of technology has highlighted the inefficiencies of traditional methods for extracting information from written materials such as PDFs. This paper explores an interactive chat application designed to enhance interaction with PDF content using Large Language Models (LLMs). The application aims to streamline the extraction process by allowing users to query PDF content efficiently. This project evaluates various models, including RoBERTa, TinyRoBERTa, and MDeBERTa, for their performance in question-and-answer tasks, and assesses their multilingual capability. The research questions investigate the effectiveness and language support of these models, with hypotheses predicting that RoBERTa will excel in accuracy, MDeBERTa will perform well with Chinese queries. Results reveal that RoBERTa achieved the highest accuracy for English queries, MDeBERTa performed best with Chinese queries. This project demonstrates the potential of these technologies to improve information extraction and user interaction with documents. Future work will focus on addressing the system's limitations with mixed languages and non-text inputs to enhance its overall functionality.

Keywords: Question Answering, PDF, RoBERTa, TinyRoBERTa, MDeBERTa, Human Level Performance

Fiction Gene: A Thai Genre Based Fiction Visualization Testimonial System

Paper#1571039074

Warin Wattanapornprom*, Chatchaya Innarong, Isara Kerdpra and Chisanupong Treesutrummas (King Mongkut's University of Technology Thonburi, Thailand); Supatcha Lertampaiporn (BIOTEC, Thailand); Wittawin Susutti (King Mongkut's University of Technology Thonburi, Thailand)

In today's digital era, fiction has become immensely popular and accessible through various channels, particularly online platforms where some content requires payment for access. Readers, therefore, seek fictions that align with their specific genre preferences to make informed reading choices. To assist in this process, we have developed a sophisticated genre-based fiction visualization testimonial system. This system leverages TF-IDF natural language processing algorithms for extracting key features and employs machine learning, specifically Naive Bayes algorithms, for accurate text classification. Implemented as a user-friendly sample website, the system visually represents fiction genres through pie charts and line charts. Our model achieved up to 91% accuracy in predicting the primary genre of fiction, thereby providing valuable support for readers in selecting fictions that best meet their preferences.

Keywords: Genre Classification, Natural Language Processing (NLP), Fiction Analysis, Thai Text Classification

Enhanced Sentiment Detection in Thai University Admissions Using Complement Naive Bayes

Warin Wattanapornprom, Nattapon Tongta, Naruebet Jaisamak, Panisara Lakan, Pirun Dilokpatpongsa and Wittawin Susutti (King Mongkut's University of Technology Thonburi, Thailand)*

This research delves into the pivotal role of social media, particularly Facebook, in influencing public sentiment concerning university admissions. Given that university admissions are a highly discussed topic among students and prospective applicants, this study harnesses advanced natural language processing techniques to scrutinize sentiments expressed through Facebook reactions to related posts. By employing TF-IDF for word weighting and Naive Bayes classification for sentiment categorization, the research aims to construct a model that accurately deciphers emotional responses from users. The results indicate that the model achieves an 80% accuracy rate in predicting reactions, underscoring the potential of sentiment analysis in comprehending public opinion on educational issues. This innovative methodology not only sheds light on the prevailing sentiments surrounding university admissions but also exemplifies the efficacy of social media as a dynamic tool for real-time public sentiment assessment. The implications of this research are profound, offering valuable insights for educational institutions and policymakers in understanding and responding to the sentiments of prospective students.

Paper#1571056048

Keywords: Sentiment Analysis, Complement Naive Bayes, TF-IDF, Social Media

CNN-LSTM-Based Bilingual Receipt Information Extraction Using Template-Based Data Generation

Santitham Prom-on, Phoramint Chotwarutkit, Poonyawee Wongwisetsuk and Jaturon Harnsomburana (King Mongkut's University of Technology Thonburi, Thailand)*

This paper discusses the development of a bilingual receipt information extraction system using a CNN-LSTM model with data augmentation techniques. The system targets the extraction of essential information such as company names, dates, and total amounts from receipts containing both Thai and English text. To address the limited availability of annotated data, synthetic receipt samples were generated from initial templates, creating a diverse training dataset. The model's performance was evaluated on both the generated dataset and the SROIE 2019 dataset, achieving high accuracy across all tested information classes. While the CNN effectively extracts features, the LSTM processes these features for accurate information extraction. Future work aims to incorporate transformer-based models to enhance the system's contextual understanding and generalization capabilities. This research highlights the effectiveness of combining CNNs and LSTMs in handling complex, multilingual datasets for practical applications in information extraction.

Paper#1571048596

Keywords: Receipt Information Extraction, CNN-LSTM, Data Augmentation, Image Captioning, Low-resource Modeling

Automated Sequence Labeling for Causality Extraction in Medical Domain

Enny Dwi Oktaviyani, Pusadee Seresangtakul, Pongsathon Janyoi, and Chitsutha Soomlek (College of Computing, Khon Kaen University, Thailand)*

The main factor hindering the progress of causality extraction research is the lack of a unified causal sequence labeling technique. One of the most effective methods for solving sequence labeling problems is Conditional Random Field-based neural models. Conditional Random Field are typically used for structured labeling or sequence prediction tasks, aiming to predict a structured output based on a set of input features. This research proposes a method for automated causality sequence labeling using a Conditional Random Field that utilizes the Part of Speech features. We also propose a new label to improve the results. We evaluate our method in the medical domain with Indonesian language datasets and compare it with traditional machine learning algorithm and rule-based methods to assess the performance. Experimental results show that our proposed method achieves the highest F1 score of 0.80 for causality sequence labeling when compared to traditional methods.

Paper#1571035405

Keywords: Conditional Random Field, Part of Speech, Causality Sequence Labeling

Session 4: Computer Educational Technology

Session Chair: Assoc.Prof. Kanda Runapongsa Saikaew, Ph.D.
Faculty of Engineering, Khon Kaen University, Thailand

Room: Fah Mui 4
Time 14.30-17.00 hrs

Paper#1571037497

Deep Learning-Based Course Recommendations Using Sentence Embeddings and User Information for Learning Platforms

Teerapord Lin, Suriya Natsupakpong and Paisit Khanarsa (King Mongkut's University of Technology Thonburi, Thailand)*

Online learning platforms have gained immense popularity in recent years, offering learners a wide range of course options. However, the vast number of available courses can make it difficult for learners to find the most relevant and suitable courses for their needs and interests. To address this challenge, a deep learning-based approach for personalized course recommendations is proposed, leveraging sentence embeddings and user information to enhance the relevance and accuracy of recommendations. The method utilizes the Multilingual Universal Sentence Encoder (MUSE) to generate dense vector representations of course content, effectively capturing semantic relationships between courses. These embeddings are then combined with user-specific features, such as level of education, year of birth, and geographical location, to create comprehensive user profiles. Two state-of-the art recommendation models, Convolutional Sequence Embedding (Caser) and Session-Based Recommendations with Recurrent Neural Networks (GRU4Rec), are employed and trained on the edX dataset to predict the most relevant courses for each user. Experimental results demonstrate that the Caser model, incorporating embeddings and user information, achieves a Precision@5 of 0.190, Recall@5 of 0.897, and a Mean Average Precision (MAP) of 0.635. The GRU4Rec model, with embeddings and user information, obtains a Precision@5 of 0.185, Recall@5 of 0.876, and a MAP of 0.611. These findings show the improved performance of the models, resulting in more accurate and personalized course recommendations for users.

Keywords:
 Recommendation System,
 Deep Learning, Sentence
 Embedding

Instructional Framework for Digital Drawing Management Through Studio-Based Pedagogy in Higher Education Context - Case Study

Dimitrije Curcic (Prince of Songkla University, Thailand)*

Paper#1571056131

Keywords: Freehand
 drawing, Digital drawing,
 Sketch inhibition,
 Instructional model

In outcomes-based teaching and learning practices, the digital drawing subject focuses on discipline-specific knowledge and skills acquired by students. The varying skills and competency levels of entry-level university students present challenges in class management and instructional design within a studio-based class setup. This study proposes an instructional framework based on the direct instruction model and examines its impact on students' performance. The study utilized three phases of data collection: formative assessment, post-intervention assessment, and a self-reflection questionnaire to gauge students' perceptions of the learning process. The participants were thirty-two first-year university students with varying levels of freehand drawing skills enrolled in a digital drawing course. Statistical analysis revealed a p-value of $0.00 < 0.05$, indicating a significant relationship between instructional procedures and students' learning performance. Furthermore, the average scores showed an improvement, with semester 2021 scoring 23.08 and semester 2023 scoring 34.64. These findings suggest that the use of the instructional model enhanced learning outcomes compared to previous teaching practices that did not employ a specific model, but it should be applied consistently over time for permanent improvements in results.

A Comparative Study of Graph Databases Versus Relational Databases for Modeling Outcome-Based Education

Paper#1571048580

*Tisanai Chatuporn** and Chortip Rahong (King Mongkut's University of Technology Thonburi, Thailand); Umaporn Supasitthimethee (KMUTT, Thailand); Kriengkrai Porkaew (King Mongkut's University of Technology Thonburi, Thailand)

Education in Thailand is adapting due to rapid technological changes, an aging society, and the need for education to meet the industry's demands for relearning and reskilling. The education must focus on learner-centered outcome-based learning and flexible learning unit to support lifelong learning. Our previous work designed a model to support flexible outcome-based learning using a relational database. This work extends the previous study by creating the two new models. The first model improves the original by using the relational structure to enhance query performance as well as reducing redundancy and operational costs. The second model adopts a graph database design due to its flexibility in handling different structures and its efficiency in managing large volumes of complex relationships. The performance of CRUD (Create, Read, Update, and Delete) operations was compared across three models: Model#1 is our previous work's relational model, Model#2 is our improved relational model and Model#3 transforms to a graph database model. The results showed that the two new models: Model#2 and Model#3 have different advantages. Model#2 is better in data creation, loading, and indexed retrieval, while Model#3 is better when updating, deleting, and handling complex queries.

Keywords: Query Performance, Graph Database, Relational Database, Outcome-based Education, Learning Outcomes

Interactive Educational Game Development Using Modified Single Stage Detector

Paper#1571056345

*Kristiawan Dwi Usmano** (Universitas Sanata Dharma, Indonesia); Nova Eka Budiyanta and Eko Mulyanto Yuniarso (Institut Teknologi Sepuluh Nopember, Indonesia); Cyprianus Kuntoro Adi (Universitas Sanata Dharma, Indonesia)

This research develops a real-time hand gesture detection system using the You Only Look Once (YOLO) algorithm for simple math learning applications aimed at children with special needs. This application is a simple drag and drop game using hand gesture indicators. The system utilizes computer vision and deep learning technology to recognize hand gestures in videos which are then converted into interactive inputs in learning media. System testing involves hyperparameter tuning methods, including learning rate, image size, and momentum adjustments. The test results show that the YOLO algorithm with hyperparameter tuning method with hyperparameter values of learning rate 0.0001, image size 320, and momentum 0.937 is effective in detecting hand gestures with an $mAP@0.5 : 0.95$ score of 93.27%. The test results provide the potential for using a real-time hand gesture detection system as an interesting and interactive learning method for children with disabilities, especially for those who have limitations in communication.

Keywords: YOLO (You Only Look Once), Hand Gesture Detection, Mathematics Learning, Children with Special Needs, Hyperparameter Tuning, Computer Vision, Deep Learning

Student Academic Performance Prediction Using Machine Learning With Various Features and Scenarios

Paper#1571048315

Nott Santiketa and Suluk Chaikhan (SIT, King Mongkut's University of Technology Thonburi, Thailand); Unhawa Nirutsirikun (KMUTT & SIT, Thailand); Niwan Wattanakitrungroj (King Mongkut's University of Technology Thonburi, Thailand)*

This paper examines the use of machine learning algorithms to predict student performance, focusing on past academic achievements and scores from core subjects in science-math program of high school. The study addresses two prediction types: regression for predicting GPA and classification for predicting grades. Experiments were conducted on 853 students, implementing predictive models across five scenarios corresponding to five semesters. Linear Regression achieved the highest R-squared value of 0.8911. For grade classification, Support Vector Machine, K-Nearest Neighbors, Logistic Regression, and Artificial Neural Networks with Grid-search hyper parameters performed better than default hyper-parameters. Random Forest and K-Nearest Neighbor achieved 100% accuracy in grade predictions across all scenarios. Achieving perfect accuracy indicates that these models could play a transformative role in educational settings by providing precise predictions that could enhance personalized learning strategies and academic support systems.

Keywords: Machine Learning, Academic Performance Prediction

Session 5: Computer Vision and Image Processing

Session Chair: Professor Poramate Manoonpong, Ph.D.
Vidyasirimedhi Institute of Science and Technology (VISTEC), Thailand

Room: Chat Tan 1
Time 14.30-17.00 hrs

Advance Attention-Based Techniques for Small Object Detection in Remote Sensing Images
Farhan Iqbal and Suree Pumrin (Chulalongkorn University, Thailand)*

Paper#1571055857

Most studies in remote sensing have focused on identifying and recognizing small, distant objects within large scenes. Detecting small objects, a particular subset of object detection, encounters significant difficulties due to image resolution, object size, quantity, and orientation. Current methods frequently rely on deep neural networks to create strong feature representations, which results in substantial computational requirements. To tackle these issues, we implemented Advance Attention Mechanism (AAM) consisting of Combined Channel and Spatial Attention (CCSA) and Atrous Spatial Pyramid Pooling (ASSP) to boost detection accuracy. Our model outperforms baseline model and provides a detection accuracy of 82.00% in overall performance.

Keywords: Object Detection, Remote Sensing, Attention Mechanism, Feature Extraction, Machine learning

Packaging Defect Detection in Lean Manufacturing: A Comparative Study of YOLOv8, YOLOv9, and YOLOv10

Paper#1571048928

Amonpan Chomklint, Saichon Jaiyen and Niwan Wattanakitrungroj (King Mongkut's University of Technology Thonburi, Thailand); Pornchai Mongkolnam (Kmutt, Thailand); Suluk Chaikhan (SIT, King Mongkut's University of Technology Thonburi, Thailand)*

This paper presents a comprehensive evaluation of various YOLO models for packaging defect detection within a lean manufacturing context. We utilized a dataset comprising images of boxes on a packaging line labeled with seven classes, including six classes of defects and one class without any defects. A comparative study of YOLO models including YOLOv8n, YOLOv8s, YOLOv8m, YOLOv9t, YOLOv9s, YOLOv9m, YOLOv10n, YOLOv10s, and YOLOv10m were exploited to create models for detecting defects on the packaged boxes. Based on the experiments, the YOLOv10 models especially the YOLOv10s and YOLOv10m models, perform better in term of precision and time efficiency, compared to previous versions like YOLOv8 and YOLOv9. The recommended model depends on the trade-off between mAP and processing time. YOLOv10m achieves the highest mAP at 0.989 within 33.5 ms, YOLOv10s achieves the highest mAP at 0.987 within 25.60 ms, and YOLOv10n achieves the highest mAP at 0.976 within 15.40 ms. This paper provides valuable insights into the effectiveness of YOLO for defect detection in packaging within industrial settings, contributing to improved quality control processes and operational efficiency.

Keywords: Lean Manufacturing, Packaging Defect Detection, YOLOv8, YOLOv9, YOLOv10

Enhance Efficient of Support Vector Machine With CNN and PSO for Solving Handwritten Digits Recognition

Paper#1571038665

Narong Punkong (Kanchanaburi Rajabhat University, Thailand); Chiabwoot Ratanavilisagul (King Mongkut's University of Technology North Bangkok (KMUTNB), Thailand); Somkiat Kosolsombat (Thammasat University, Thailand); Siwach Janprasit (King Mongkut's University of Technology North Bangkok, Thailand)*

Handwritten digit recognition is a crucial task in various fields such as postal mail sorting, bank check processing, and digitizing handwritten documents. This research aims to compare the effectiveness of using Convolutional Neural Network (CNN) for feature extraction combined with Support Vector Machine (SVM) for classification, against the traditional method of using Discrete Wavelet Transform (DWT) and Discrete Cosine Transform (DCT) for feature extraction. Additionally, Particle Swarm Optimization (PSO) is applied to optimize SVM parameters to further enhance model performance. The experiments are conducted on two datasets: the MNIST dataset and an individual handwriting dataset from 50 participants. The results indicate that the proposed method of using CNN for feature extraction and PSO-optimized SVM achieves superior accuracy compared to traditional DWT and DCT methods. Specifically, the proposed method achieved an accuracy of 99.05% on the MNIST dataset and 67.79% on the individual handwriting dataset, demonstrating its robustness and effectiveness in handwritten digit recognition.

Keywords: Handwritten Digits Recognition, Convolutional Neural Network (CNN), Support Vector Machine (SVM), Particle Swarm Optimization (PSO)

Human Sliced Feature-Based Head Segmentation on 3D LiDAR Point Cloud Data

*Nova Eka Budiyanta** and *Eko Mulyanto Yuniaro* (Institut Teknologi Sepuluh Nopember, Indonesia); *Mauridhi Hery Purnomo* (Institut of Technology Sepuluh Nopember, Indonesia)

Paper#1571048239

Human surveillance can be achieved while reducing extensive privacy concerns by utilizing a 3D LiDAR point cloud data application method. However, due to its lack of organization, point cloud data necessitates additional exertion in processing. Similar to identifying important body components like the human head, segmentation in 3D LiDAR human point clouds presents unique difficulties. This paper aims to propose an alternate method for segmenting human head in 3D LiDAR point cloud data, specifically focusing on walking behavior using the raw KITTI dataset instead of exploiting RGB image data. The dataset used in this study consists of 54 frames of 3D LiDAR point cloud projections capturing human activity as individuals walk toward the LiDAR sensor. Head segmentation can be effectively achieved by utilizing the layer plane features in the vertical axis of human objects. This approach thoroughly analyzes the percentage changes in plane width by utilizing Principal Component Analysis (PCA) in each layered area. When there is a significant percentage difference of $\alpha \geq 25\%$ between layers, specific sections of the human head can be retrieved and utilized for further research in anomaly detection.

Keywords: Head Segmentation, 3D LiDAR, Human Point Cloud, Slice Feature

Benchmarking Pedestrian Attribute Recognition Systems for UAVs Using Locally Collected Dataset: A Case Study in Thailand

*Kantida Parattanawong** (Kasetsart University, Thailand); *Supaporn Erjongmanee* (Kasetsart University, Bangkok, Thailand); *Eakarat Suwanagood* and *Chaiwat Klumpol* (Kasetsart University, Thailand)

Paper#157104809

Abstract—Unmanned Aerial Vehicles (UAVs) are increasingly pivotal in security surveillance and crowd monitoring. A key step in automating these missions is pedestrian attribute recognition (PAR). This paper explores three PAR concepts for potential future implementation on UAVs with limited resources. First, a PAR system using a locally collected dataset in Thailand is implemented. The tracklets of 12,185 pedestrian images from CCTV camera footage—a UAV-like data source—are processed using YOLOv8 and BoT-SORT. These tracklets are manually annotated with 53 distinct attribute values, forming our Thailand Pedestrian Attribute Dataset (TPAD). Then, five models of attribute classification—DenseNet, EfficientNet, ConvNeXt, MobileNet, and ShuffleNet—are applied. The ConvNeXt model achieved the highest mean accuracy (mA) of 94.03%, while DenseNet yielded relatively similar mA of 92.93% but with lower complexity. Hence, DenseNet is a promising PAR-model candidate in UAV applications. Secondly, models trained on the TPAD, UPAR, and Market1501 datasets are compared. While data diversity enhanced performance with unseen data, models trained on locally collected datasets achieved higher accuracy. Lastly, the similarities and differences across the three datasets are examined. It revealed that models performed better on attributes with larger percentages. Some attributes were location specific. Variations in the percentages of common dominant attributes affected prediction performance. These findings emphasize the importance of using locally collected datasets for developing effective PAR systems. The work establishes a benchmark for creating more accurate PAR systems in the future.

Keywords: Unmanned Aerial Vehicles, Pedestrian Attribute Recognition, Locally Collected Dataset

Session 6: Computer Simulation and Modeling

Session Chair: Assoc.Prof. Olarik Surinta, Ph.D.

Multi-agent Intelligent Simulation Laboratory, Mahasarakham University, Thailand

Room: Chat Tan 2

Time 14.30-17.00 hrs

A Categorical Particle Swarm Optimization for Hyperparameter Optimization in Low-Resource Transformer-Based Machine Translation

*Puttisan Chartcharnchai**, Yutana Jewajinda and Kata Praditwong (Silpakorn University, Thailand)

This paper proposes a categorical particle swarm optimization (PSO) for hyperparameter optimization of the Transformer-based neural machine translation for low-resource training. The proposed PSO is a set-based PSO representing particles as probability distributions rather than solution values. The experiments on two datasets under various low-resource conditions on the standard dataset of German-English and Thai-English translations validate the proposed PSO. Empirical results demonstrate that our proposed PSO algorithm converges to near optimum solutions and improves the translation quality over the non-optimized Transformer models and manually optimized models under low-resource training.

Paper#1571056256

Keywords: Neural Machine Translation, Transformer, Particle Swarm Optimization, Hyperparameter Optimization

An Improvement of a Heuristic Algorithm for 3D Bin-Packing Problem

*Sarun Krisadee** and Wattana Jindaluang (Chiang Mai University, Thailand)

Paper#1571038480

We are given the large 3-dimensional rectangular items, which we refer to as the bins, in the 3D bin-packing problem. They have specific weight, length, height, and depth measurements. Additionally, we have various small, rectangular, 3-dimensional items that we call boxes. These boxes also have specific weights, lengths, heights, and depths. The goal of this problem is to pack all the small boxes into the bins so that their combined weight does not exceed the weight limit of each bin. Additionally, we aim to use as few bins as possible. In this paper, we refine the computational processes to enhance an algorithm by Youssef Harrath [1]. Experimental results indicate that as the number of boxes increases, our improvements can reduce the number of bins used, decrease running time, increase efficiency, and reduce memory usage. That is, the number of bins used, processing time, and memory use were all decreased to 38.68%, 58.42%, and 63.33%, respectively. In the meantime, bin space utilization efficiency scaled to 35.38%.

Keywords: 3D Bin-packing Problem, Spatial Layer-based Heuristic, Three-Stage Layer-Based Heuristic (TSLBH)

Intelligent Traffic Management: Optimizing Roadway Efficiency With the Snake Algorithm

*Hanadi Hassan Karim Al-maliki** (University of Basrah, Iraq) and Hamid Alasadi (IRAQ-BASRA & basra UNIV., Iraq)

Paper#1571056025

This paper focuses on the contributions of routing protocols in the improvement of flow and safety of traffic within the urban setting by analyzing the VANETs using a Snake Optimization Algorithm. They are the proactive, reactive and hybrid protocols OLSR, DSDV and WRP to which it compares the performance of the RBVT-P protocol. By employing OMNET++ and SUMO at a combination of protocols, the efficiency of the protocols is exhibited by the comparison of the different traffic conditions and node densities. The evaluations show that there are drastic dissimilarities with regards signal and data transfer rate primarily in dense networks. For instance in a network comprising one 1000 vehicles RBVT-P has a measure of average path length that is equal to 3.859 at a packet rate of 2 packets/second, whereas the optimized SOA-RBVT-P reduced the path length to 0.896. At the packet rate of 10 packets/second the average path length of RBVT-P was 4.334, while newly qualified nurses were only 0.716 for SOA-RBVTP. Hence, it has become apparent that the optimized protocol works better than the earlier one especially in areas relating to the transmission of data which is integral for the operational framework of Intelligent Transportation Systems (ITS) in urban situations.

Keywords: Vehicle Ad Hoc Networks (VANETs), Routing Protocols, Traffic Management, Urban Environments, Intelligent Transportation Systems (ITS), Network Performance, Data Routing.

An Adaptive Smell Agent Optimization with Binomial Crossover and Linnik Flight for Engineering Optimization Problems

Poomin Duankhan*, Khamron Sunat, and Chitsutha Soomlek (College of Computing, Khon Kaen University, Thailand)

Paper#1571054846

Optimization problems are prevalent in engineering, often requiring effective methods to navigate complex, high-dimensional landscapes with multiple local minima. Existing algorithms frequently fall short due to limitations in handling diverse constraints and complexities. This paper proposes the adaptive crossover-based smell agent optimization (ACB-SAO) algorithm inspired by the olfactory sense in living organisms. The new algorithm introduces two key contributions, i.e., a long-tail exploring mode integrating Linnik Flight with a golden ratio configuration to improve exploration capabilities and a dynamic crossover rate adjustment for smell agent optimization (SAO). This synergy enhances solution accuracy by balancing global and local search capabilities. To validate its performance on complex numerical benchmarks and engineering design problems, ACB-SAO is compared with seven well-known and recent competitive algorithms on 23 classical, 29 CEC2017, 30 CEC2022 benchmark functions, and 14 real-world engineering design problems. The results in a scoring system indicate that ACB-SAO achieved the maximum score of 100 for the CEC2017, CEC2022, and real-world engineering designs, demonstrating that it outperforms other algorithms and significantly improves upon the standard SAO. These results highlight ACB-SAO's potential in solving practical optimization problems, proving its effectiveness and advantages in addressing complex challenges.

Keywords: Smell Agent Optimization (SAO), Linnik Flight, Dynamic Crossover Mechanism, Engineering Optimization Problems

A Novel Comprehensive Learning JAYA Algorithm Based on Lévy Flights

Xintong Shen* and Khamron Sunat (College of Computing, Khon Kaen University, Thailand)

Paper#1571055924

To address the issue of the JAYA algorithm becoming stuck in suboptimal solutions, this paper introduces the Lévy flight method and proposes a novel CLJAYA-LF algorithm. This new approach integrates the Lévy flight's "big step" movement strategy with multistrategy particle updates, which helps particles escape local extrema and restart in new search spaces, thus significantly enhancing exploration capabilities. Additionally, the algorithm utilizes the Lévy flight's "small step" random movement strategy to improve local exploitation and address unidirectional particle progress at specific positions. The CLJAYA-LF algorithm's combination of large and small step movements provides a balanced mechanism for overcoming local optima and refining search efficiency. Experimental results confirm that CLJAYA-LF outperforms existing advanced methods, demonstrating exceptional performance across both low-dimensional and high-dimensional optimization tasks and showing promise for broader applications.

Keywords: Jaya Algorithm, Lévy Flight, Comprehensive Learning, Global Optimal

Ensuring IoT Controller Reliability With Colored Generalized Stochastic Petri Net

Kruntarat Samngamnoi*, Sutinun Pomsiri, Apipath Kamput and Chanon Dechsupa (Intelligent Software Engineering Research Group, College of Computing, Khon Kaen University, Thailand)

Paper#1571054437

In IoT systems managing multiple devices simultaneously, errors in system controllers often undermine intended operations. Formal verification offers a method to assess system reliability. Colored Generalized Stochastic Petri Net (CGSPN), a formal language, facilitate correctness checks of such systems. This study proposes a verification approach by translating a C++-based system controller of a self-service machine into a CGSPN models and validating it using the Snoopy Tool. Mapping techniques employed to transform components in the controller into CGSPN models are provided. Results demonstrate the method's efficacy in verifying system safety properties, simulating system events, and enabling quantitative verification.

Keywords: Formal Model, Colored Stochastic Petri Net, Safety Properties, Internet of things

Session 7: Geo-informatics and Remote Sensing

Session Chairs:

Professor Masahiko Nagai

Center for Research and Application for Satellite Remote Sensing, Yamaguchi University

Sakpod Tongleamnak, Ph.D.

College of Computing, Khon Kaen University, Thailand

Room: Fah Mui 5

Time 14.30-17.00 hrs

GIS and Street View Integration: Analyzing Spatial Factors of Motorcycle Taxi Stands in Bangkok

Paper#1571056376

*Wirat Rattanapitak** (King Mongkut's Institute of Technology Ladkrabang, Thailand) and Phatthan Sirikitsathian (Pibulsongkram Rajabhat University, Thailand)

Abstract—Motorcycle taxis play a vital role in addressing last-mile connectivity challenges in Bangkok's complex urban transportation system. However, the factors influencing the spatial distribution of these informal transport services remain poorly understood. Kernel Density Estimation (KDE) was employed to examine the spatial distribution patterns, revealing two primary high-density clusters of stands in southern Chatuchak. Proximity analysis quantified relationships between the 208 stand locations and urban infrastructure factors, finding strategic positioning near mass transit stations (avg. 1.79 km), on sidewalks (70.5%), and in mixed-use areas with predominantly residential (33.19%) and commercial (29.32%) land use within a 100m radius. A decision tree model identified residential area proportion (importance 0.3423) and distance from metro stations (0.2935) as key predictors of stand presence, but achieved moderate accuracy (52.38%). The results highlight the close integration of motorcycle taxi stands within the urban fabric and their role in enhancing accessibility.

Keywords: Motorcycle Taxi, Informal Transport, Stands, Street View Image, GIS

Identifying Peatland Fire Detection and Spatiotemporal Distribution: Implications for Land Use and Land Cover Changes in Riau Province, Indonesia

Paper#1571051358

Dhanu Sekarjati, Wasana Putklang and Nagon Wattanakij (Khon Kaen University, Thailand)*

This research investigates the spatial and temporal dynamics of peatland fires in Riau Province, Indonesia, from 2018 to 2023, and their impacts on land use and land cover (LULC). The study integrates hotspot data from MODIS and ESRI Global Land Cover to identify fire occurrence patterns and assess the resulting land use changes. Peak fire activity occurred in 2019, with 6,773 hotspots recorded, leading to significant land degradation. By 2023, 45.76% of peatlands had been converted to cultivated land, primarily for agricultural purposes, while forest cover declined by 46.85%. Cropland expanded by 2,010.25 km², and urbanization showed gradual growth, with built-up areas increasing. Additionally, geospatial analysis was conducted to examine the impact of fires on land use and land cover changes around the 2018–2023 hotspot buffer areas. The results indicate that approximately 84.20% of the buffer area experienced no land use change, with forests, agricultural land, and open areas remaining stable. However, 8.63% of the area underwent deforestation, as forest land was converted to agricultural use, contributing to a 4.01% increase in cultivated land, primarily from forests or open areas. Urbanization affected a small fraction of the area (0.07%), while 1.39% experienced land degradation, characterized by vegetation loss and declining soil quality. Additionally, around 1.70% of the area showed signs of recovery through natural or human-assisted reforestation efforts. This research highlights the critical necessity for comprehensive fire prevention strategies, sustainable land management practices, and restoration initiatives to address the environmental degradation of peatland ecosystems.

Keywords: Peatland Fire, Remote Sensing, Land Change Detection, Geoinformatics

Assessment of Aboveground Biomass and Carbon Stock of Rubber Plantation Using Random Forest Regression With Satellite Imagery Data From Planet NICFI and GEDI Data

Surasak Keawsomsee and Sakpod Tongleamnak (Khon Kaen University, Thailand)*

Assessing the aboveground biomass and carbon stock of rubber plantation areas accurately and precisely is crucial for utilizing them as tools to drive low-carbon societies in line with the Sustainable Development Goals (SDGs). Goal 13 specifically targets reducing greenhouse gas emissions. This study classified rubber plantation areas using satellite image data from Planet NICFI through Random Forest (RF) classification. Additionally, it evaluated the above-ground biomass and soil carbon assessment of rubber plantation areas in Bueng Kan Province using GEDI data combined with random forest regression (RFR). The study found that the overall accuracy and kappa of rubber plantation area classification in Bueng Kan Province exceeded 85%. Meanwhile, for aboveground biomass assessment and soil carbon sequestration in rubber plantation areas, the model's correlation coefficient (R^2) was 0.77, indicating a relatively high level of accuracy with a root mean square error (RMSE) of 65.98 megagrams per hectare. The spatial distribution of carbon sequestration ranged from 15.16 to 212.28 megagrams per hectare. These results can support biomass and carbon stock education technology for use in formulating spatial management policies and plans from regional to local levels and serve as tools to drive low-carbon societies alongside sustainable environmental management.

Paper#1571055588

Keywords: Rubber Plantation, Biomass Estimation, Carbon Stock Estimation, Random Forest Regression, Planet NICFI

Development of Low Cost Lorawan Gateway

Nattaphit Jengsriwong and Suppakarn Chansareewittaya (Mae Fah Luang University, Thailand)*

This research introduces the development and application of a DIY LoRaWAN Gateway operating in the 925MHz frequency band. LoRaWAN technology is well-known for its long-range communication capabilities and low power consumption. Currently, it has a limited user base compared to Wi-Fi due to the high cost of gateways in the market. Consequently, existing gateways have been customized to be compatible with cost-effective devices. Therefore, we propose a cost-effective, medium-sized, customizable design that significantly reduces costs. For this development, Raspberry Pi 4 is used as the main processing unit integrated with the SX1302 module. We configure the gateway to facilitate smooth communication between EndNode gateways and NetworkServer and ensure flexibility in component format adjustments to meet the requirements of various projects. The objective of this project is to make low-cost LoRaWAN Gateways accessible through efficient and cost-effective solutions, serving as excellent mediators for communication. These gateways can be self-built and cater to diverse target groups such as individual users, manufacturers, and smart farm owners. The aim is to facilitate widespread convenience in usage and promote innovation in IoT applications.

Paper#1571038720

Keywords: LoraWAN Gateway, SX1302, Heltech, Semtech

Special Session: HPC, Data Lakes, and Computing Continuum (HPC-ComCon 2024)

Session Chair: Professor Pascal Bouvry, Ph.D.

Faculty of Science, Technology and Medicine, University of Luxembourg, Luxembourg

Room: Erawan 2

Time: 14.30-17.00 hrs

Three-Way Task Scheduling Algorithm for Cloud Computing

Awatef Salem Balobaid* (Jazan University, Saudi Arabia)

Paper#1571054432

Cloud task scheduling is a crucial aspect of cloud computing, and it directly influences cloud resource usage. This study presents a cloud task scheduling algorithm based on granularity and three-way decision making (CTSA-3WD). This research aims to address the issues of load imbalance, low resource utilization, and job completion time. In the proposed approach, the execution duration of cloud jobs and the actual computing resource situation restrict the task set's light-load and heavy-load functions. The algorithm is based on the three-way decisionmaking and separates the work set into three pieces. The system focusses on three distinct task sets and determines an optimal scheduling strategy by employing the Max-Min algorithm for the significant proportion of light-load jobs task set, the Min-Min algorithm for the substantial percentage of heavy-load studies, and the Min-Min and Max-Min algorithms combination for the task set with both light and heavy load tasks. The experimental results demonstrate that the CTSA-3WD algorithm, when compared to Min-Min, Max-Min, and selective scheduling algorithms, effectively enhances overall resource utilization. Additionally, it enables improved load balancing across the entire system.

Keywords: Cloud Computing, Task Scheduling, Multigranularity, Three-way Decision, Load Balancing

Tri-FusionDet: Leveraging User Engagement, Textual, and Visual Features for Enhanced Fake News Detection

Samir El-amrany (University of Luxembourg & Parallel Computing and Optimization Group, Luxembourg); Matthias Brust*, Johnatan E Pecero and Pascal Bouvry (University of Luxembourg, Luxembourg)

Paper#1571047854

The exponential rise of fake news presents numerous social problems, diminishing trust in news sources, intentionally distributing incorrect information to the public, and disrupting social cohesion. Generative Artificial Intelligence (GenAI) has worsened this problem by producing highly realistic fake news through text, images, and other modalities, often indistinguishable from authentic content. To address this pressing and critical issue, advanced multimodal detection methods are crucial. Existing multimodal fake news detection primarily focuses on textual and visual features, neglecting valuable social engagement metrics such as comments, likes, and shares. This hampers the effective differentiation between authentic and manufactured content. In this paper, the Tri-Modal Fusion Detector (Tri-FusionDet), a more sophisticated system for improved multimodal fake news detection, is proposed. It applies a late fusion technique to combine textual analysis, visual processing, and social engagement cues within one framework in order to provide a better assessment of information credibility. This approach marks the first integration of textual, visual, and engagement features for fake news detection using a late fusion method. A comprehensive evaluation of the large-scale Fakeddit dataset demonstrates that Tri-FusionDet surpasses state-of-the-art methods, achieving an accuracy of 94%, which is 6% higher than the best-performing baseline model.

Keywords: Fakeddit Dataset, Fake News, GenAI, Multimodal Detection, Social Disruption, Tri-Modal Fusion Detector (Tri-FusionDet)

A Scoping Review of Simulation-Based Optimization Applied to Flexible Shop Floor

Petra Loncar* (University of Luxembourg, Luxembourg); Julien Schleich (University of Luxembourg & Interdisciplinary Center for Security and Trust (SnT), Luxembourg); Laurent Van Mieghem (Goodyear SA, Luxembourg); Pascal Bouvry (University of Luxembourg, Luxembourg)

Paper#1571071673

This scoping review aims to assess the current use of simulation-based optimization approaches to address the complex challenges on the flexible shop floor. The primary focus is to identify emerging research trends and methodologies that drive successful production, while also outlining any existing gaps in the literature. A total of 56 research publications from Scopus, IEEEXplore and Google Scholar databases were reviewed and analyzed. The research findings indicate that most of the analyzed studies focused on the Genetic Algorithm, an adaptive nature-inspired metaheuristic optimization algorithm, using proprietary licensed discrete-event simulators. This review highlights and proposes new opportunities for future research.

Keywords:

Simulation-based Optimization, Flexible Job Shop, Flexible Flow Shop, Lot Sizing, Discrete-event Simulation

Day 3 — Invited Talk and Presentations

November 8th, 2024 13:15 – 17:00 hrs (GMT+7)

Invited Talk 4: TBA (Virtual Presentation)

TBA

Prinya Hom-Anek, Ph.D.

President and Executive Committee, ACIS Professional Center, Bangkok, Thailand.

-TBA-

Room: Erawan 2

Time 13.30-14.30 hrs

Keywords: Cyber Security

Special Session: AI in Medical and Healthcare (AIMedHealth 2024)

Session Chair: Thepchai Supnithi, Ph.D.

Artificial Intelligence Research Group (AINRG), National Electronics and Computer Technology Center (NECTEC), Thailand

Room: Chat Tan 1

Time 13.15-14.15 hrs

Diagnosis of Skin Cancer via Transfer Learning With Combined Channel Attention and Spatial Attention

Zahid Maqbool (Chulalongkorn University Thailand, Thailand); Suree Pumrin and Napong Panitanut (Chulalongkorn University, Thailand)*

Paper#1571055893

Early detection of skin cancer significantly increases survival rates. However, even experienced dermatologists find it challenging to identify early-stage malignant tumors from skin images. Consequently, several methods for classifying dermatoscopic images have been developed. Unfortunately, many of these methods are either inadequate for accurate skin cancer detection or require significant computational resources. This study evaluates and enhances the performance of VGG16 and IRV2 models with channel attention and spatial attention mechanisms for detecting skin cancer. By incorporating these attention mechanisms, our approach achieves notable accuracy rates of 88.5% with VGG16 model and 94.68% with IRV2 model on the HAM10000 dataset. These conclusions emphasize the efficiency of using attention-augmented models in improving the accuracy of skin cancer detection and suggesting a valuable tool for early diagnosis and clinical decision-making.

Keywords: Skin Cancer, CBAM, Image Classification, Transfer Learning, Different Types of Skin Cancer

The Application of a Deep Learning Method for Kidney Stone Detection by CT Scans: A YOLOv8 Appr

Prin Twinprai (Khon Kaen University, Thailand)*

Paper#1571049305

Kidney stone is a common urological condition that causes a significant healthcare burden. Early detection is crucial for optimal treatment planning. Traditionally, urologists rely on manual analysis of Computed Tomography (CT) scans for kidney stone detection which is a time-consuming and potentially error-prone process. This study investigated the application of a deep learning approach, specifically YOLOv8, for automated kidney stone detection in CT scans. We evaluated the performance of YOLOv8, with the YOLOv8x model demonstrating exceptional performance, achieving a nearperfect F1 score of 0.99 in detecting kidney stones on CT scans. This approach improves diagnostic accuracy by providing radiologists and urologists with a computer-aided diagnosis (CAD) tool for faster and more accurate kidney stone detection by CT scans.

Keywords: Kidney Stone, Deep Learning, YOLO, Object Detection, Medical Imaging, Model Evaluation

Predictive Cloud-Based Application for the Early Detection and Risk Stratification of Oral Cancer Using Keratin Pearls, Multiple Nucleoli and Vascular Invasion

Paper#1571051917

Abhinav Benagi, Dhanyatha Narayan and Priya K (Ramaiah Institute of Technology, India); Savita Shetty (MS Ramaiah Institute of Technology, India); Dominic Augustine and Sowmya SV (Ramaiah University of Applied Sciences, India); Anita Kanavalli (M S Ramaiah Institute of Technology, India); Charith Rage and A Susmitha Reddy (Ramaiah Institute of Technology, India)*

Oral cancer is a significant public health concern, with high morbidity and mortality rates. Early detection is critical for improving patient outcomes and reducing the burden of the disease. Histopathological images, essential for distinguishing between normal, oral precancerous, and cancerous lesions, may miss critical diagnostic features of aggressiveness. Additionally, routine histopathology struggles to effectively identify high-risk OSCC patients. This work was conducted in collaboration with Ramaiah Institute of Technology and Ramaiah Dental College to improve OSCC detection through a pipeline-based computer-assisted screening approach involving classification, feature detection, and risk stratification. First, the classification module achieved an accuracy of 99.25% with EfficientNet in classifying cancerous and non-cancerous lesions. The feature detection module successfully identified key indicators of aggressiveness, including keratin pearls and multiple nucleoli using YOLO-NAS, while vascular invasion was detected by the EfficientNet classifier. Finally, we stratified cancer risk based on these detected features, producing a comprehensive pathology report that provides clinicians with valuable insights for informed diagnosis. Ultimately, this work aims to provide doctors with insights from analyses using models trained on key features like keratin pearls, multiple nucleoli, and vascular invasion.

Keywords: OSCC, YOLO, Keratin Pearls, Multiple Nucleoli, Vascular Invasion

Enhanced Cross-Modality MRI Segmentation Using Dilated Convolutions and Multi-Scale Gradient Map

Paper#1571055925

Ghulam Murtaza and Charnchai Pluemtiwiriyawej (Chulalongkorn University, Thailand); Somkiat Wangsiripitak (KMITL, Thailand); Mohammad Jawad Fareed and Mudassar Khalid (Chulalongkorn University, Thailand)*

In recent years, convolutional neural networks have significantly advanced image segmentation, particularly for brain images, where important edge features are automatically found. However, accurate segmentation of tumors in a brain remains a challenge across different magnetic resonance modalities, like T1, T2, T1ce, and FLAIR. Using a simple gradient map as an input to the neural networks is not effective due to variations in cross-modality image characteristics. To address this issue, we introduced multi-scale gradient maps that incorporate Holistically Nested Edge Detection (HED) and dilated convolutions into the UNet model. The HED model captures detailed gradient information, enhancing structural feature identification across modalities, while dilated convolutions expand the UNet receptive field for better contextual understanding without increasing parameters. Our method was trained and evaluated on the BraTS2018 dataset. The experimental results demonstrate significant improvements in segmentation accuracy and robustness. Specifically, our method achieved a Dice Similarity Coefficient (DSC) of 0.6902 for T2 to T1ce, 0.6858 for T2 to T1, 0.4329 for FLAIR to T1, and 0.6004 for FLAIR to T1ce, outperforming previous state-of-the-art methods. This demonstrates the effectiveness of our approach in enhancing segmentation performance across different MR image modalities.

Keywords: MR Image Segmentation, HED, Cross Modality, Brain Tumor Segmentation, Domain Generalization, Test-Time Adaption.

Session 8: Applied AI and Machine Learning

Session Chair: Praisana Padungweang, Ph.D.
College of Computing, Khon Kaen University, Thailand

Room: Fah Mui 3
Time 13.30-16.30 hrs

Real-Time Car Part Instance Segmentation: The Comparison of the State-Of-The-Art
Wittawin Susutti*, Siwarat Laoprom, Thanaphit Suttipanyo, Kanok Vongsaroj, Pirun Dilokpatpong and Warin Wattanapornprom (King Mongkut's University of Technology Thonburi, Thailand)

Paper#1571056139

This study investigates Deep Learning's (DL) impact on car part segmentation, particularly through Convolutional Neural Networks (CNNs). While frameworks like Mask R-CNN improve object detection, efficiency concerns motivate the exploration of faster models. Our research prioritizes high-precision car part segmentation for real-world applications. We compared one-stage and multi-stage models, selecting Mask R-CNN, DetectoRS, QueryInst, RTMDet, and YOLOv8 for car part segmentation. Utilizing the 'Humans in the Loop' dataset with 998 extensively annotated car part images, the study contributes to computer vision advancement in the automotive domain. Training the selected models with on-the-fly data augmentation and evaluated using mean Average Precision (mAP) and mAP-50 metrics for bounding box evaluation. YOLOv8, a real-time one-stage model, achieved mAP scores of 0.70 and mAP50 scores of 0.89, highlighting its potential for efficient in car part segmentation task.

Keywords: Car Part Segmentation, Convolutional Neural Networks, Instance Segmentation, One-stage Instance Segmentation, Multi-stage Instance Segmentation

Stream Image Classification Using Class-Wise Incremental Learning and Pre-Trained Convolution Neural Network

Paper#1571056241

Kongkan Kalakan* and Chidchanok Lursinsap (Chulalongkorn University, Thailand)

Training deep learning architectures for computer vision tasks has required resource-intensive environments, although decreasing costs of memory and processing units have made this more feasible. However, the volume and velocity of incoming data in the context of big data make it impractical to retrain a complex convolutional neural network (CNN) on the entire dataset every time new data is received, especially for real-time processing. As the dataset grows continuously, the learning algorithm slows down and may even suffer performance degradation. To address this issue, the trained model must be updated incrementally with only new data points. This approach, however, often leads to catastrophic forgetting, where the model loses previously learned knowledge. This paper proposes a novel method to partially train the neural network using a subset of samples and fine-tune its accuracy by employing the modified version of Streaming Chunk Incremental Learning (SCIL), called CNN-SCIL. We demonstrate that this method, CNN-SCIL, not only improves accuracy but also significantly accelerates the learning process compared to fine-tuning the CNN model.

Keywords: Machine Learning, Computer Vision, Incremental Learning, Fine-tuning

Machine Learning for Increasing Productivity in Shrimp Hatchery

Thap Panitanarak (Chulalongkorn University, Thailand) and Boonyapron Kaowleg* (Chulalongkorn University, Thailand & Round Two Solutions G-Able, Thailand)

Paper#1571055829

Poor quality in the shrimp hatchery stage increases susceptibility to infections during the shrimp grow-out stage, leading to lower survival rates and daily gains. This study focuses on leveraging machine learning to enhance productivity in shrimp hatcheries, particularly targeting the critical hatchery stage of shrimp cultivation in Thailand. The aim of this research is to develop and compare four classifier models for shrimp hatchery. Data was collected from various sources, pre-processed, and analyzed using the four models including logistic regression, random forest, support vector machine, and neural networks. The study emphasizes the importance of feature selection in optimizing machine learning models for shrimp hatchery, improving predictive capabilities and decision-making for enhanced productivity in shrimp farming operations. The results revealed that the Random Forest model achieved the best performance, with perfect scores across all evaluation metrics, including an accuracy of 100%. In contrast, logistic regression, while not achieving perfect scores, showed the greatest improvement after applying feature selection, with an accuracy rate of 95% and enhancements in all result metrics, including recall, precision, specificity, and F1-score.

Keywords: Machine Learning, Shrimp Hatchery, Logistic Regression, Random Forest, Support Vector Machine, Neural Networks, Aquaculture

A Web-Based Food Image Classification System Using an Ensemble of Multi-Color Space Parallel CNNs

Lester Lascano*, Samson Jr D Rollo and John Paul T Yusong (University of the Philippines, Philippines)

Paper#1571049093

There is a strong correlation between health and dietary choices. Thus, we must pay attention to our food to maintain a healthy diet. Whether you are a health-conscious individual trying to maintain a balanced lifestyle or a traveler eager to experience novel and exotic foods, it is important to be mindful of the food you consume. However, as new dishes are created, identifying food becomes increasingly difficult. Currently, the primary approaches to food image classification rely on deep learning models or ensembles of deep learning models that utilize single color space inputs, usually RGB images. This paper introduces a web-based food image classification system, DishNet, that employs a user-selectable ensemble of two-input parallel CNN models using multi-color spaces. Moreover, this system allows users to choose the voting mechanism for aggregating predictions and select the models to include in the ensemble. Our experiments on ensembles of two-input parallel CNN models yielded promising results. In particular, the ensemble involving the input pairs of RGB+XYZ, RGB+LUV, and LAB+LUV color spaces and using the product of probabilities voting method was the most effective combination because it attained an 85.16% accuracy on the Food-101 dataset.

Keywords: Food Image Classification, Multi-color Spaces, Parallel CNNs, Ensemble Voting Methods

Session 9: Business Intelligence

Session Chair: Jakkrit Kaewyotha, Ph.D.
College of Computing, Khon Kaen University, Thailand

Room: Fah Mui 4
Time 13.30-16.30 hrs

A Machine Learning and Ratemaking Evaluation of Four Auto Insurance Pure Premium Modeling Algorithms

Rakesh Kumar and Manik Rakhra (Lovely Professional University, India); Deepak Prashar (Lovely Professional University (LPU), India); Saurabh Upadhyay (Lovely Professional University, India); Leo Mrsic (Algebra University, Croatia); Arfat Ahmad Khan* (Khon Kaen University, Thailand)

Actuarial science is increasingly using machine learning. Machine learning has improved actuarial pricing prediction by forecasting future claims. Insurers are testing these algorithms, but model explainability and implementation cost are issues. The current literature barely touches upon this broad field of inquiry. Fujita et al. published a 2020 study on % predictive frequency models using AGLM, GLM, GAM, and GBM. König and Loser (2020) compared GLMs, neural networks, and XGBoost for frequency prediction. We want to add to existing research by forecasting pure premium rather than frequency or severity, comparing four methodologies, and analyzing and presenting a wide range of quantitative and qualitative performance evaluation metrics. This paper compares four approaches for predicting pure premium: GLM, AGLM, XGBoost, and neural networks. On a test set, the study compares each model's pros and cons in P&C insurance pricing, as well as its quantitative and qualitative performance. Despite % these obstacles, machine learning in actuarial pricing has clear benefits. By may improve risk profiles, pricing accuracy, profitability, and market competitiveness by using massive volumes of data and advanced analytics. However, getting these results needs a holistic approach that balances machine learning's technical sophistication with insurance's regulatory and operational limits. Further research should construct interpretable machine learning models customized to insurance pricing needs and limits while addressing the ethical, regulatory, and implementation obstacles to their adoption.

Paper#1571051617

Keywords: Machine Learning in Actuarial Science, Pure Premium Prediction, Insurance Pricing Models, GLM and AGLM, XGBoost and Neural Networks

Stock Trading Signal Prediction Using Transformer Model and Multiple Indicators

Chaikamon Chantrasmee* (King Mongkut's University of Technology Thonburi (KMUTT), Thailand & Rajamangala University of Technology Krungthep, Thailand); Saichon Jaiyen (King Mongkut's University of Technology Thonburi, Thailand); Suluk Chaikhan (SIT, King Mongkut's University of Technology Thonburi, Thailand); Niwan Wattanakitrungroj (King Mongkut's University of Technology Thonburi, Thailand)

Paper#1571049112

This study investigates the ability of Transformer models to predict stock trading signals. The Transformer model, focusing on encoder architectures and multi-head attention mechanisms, was applied to transform multiple indicators. The output of the Transformer is fed into a fully connected layer, followed by a softmax layer to generate output probabilities for three possible stock signals: sell, buy, and hold. To predict the stock signal, input patterns were created using indicators from the previous 5 and 61 days based on a sliding window approach. Five popular industry sector stocks from the SET50 index, covering the period from 2010 to 2023, were collected and experimented on. Based on the experimental results, the Transformer model, particularly with a small window size, consistently outperformed Deep Neural Networks, Recurrent Neural Networks, and Long Short-Term Memory models in terms of accuracy, precision, recall, and F1-score. Moreover, the maximum profit predicted by the Transformer was approximately 1.8 to 6.4 times greater than those of all other models. These findings demonstrate that the Transformer model can effectively predict stock trading signals, assisting investors in making informed decisions.

Keywords: Indicator Signals, Stock, Stock Market of Thailand, Technical Analysis, Transformer Neural Networks

Customer Insight Analysis With Sentiments and Topic Modeling From Wellness Centers in Phuket

Paper#1571046180

Kyaw Jan Jan Bo* (Prince of Songkla University, Thailand); Nattapong Tongtep (Prince of Songkla University, Phuket Campus, Thailand); Katekanok Kamonmarttayakul (Prince of Songkla University, Hatyai Campus, Thailand)

The wellness tourism sector has seen rapid growth, making it an essential component of global tourism, particularly in destinations like Phuket, Thailand, known for its holistic wellness programs. This study aims to analyze customer insights derived from online reviews of wellness centers in Phuket using natural language processing (NLP) techniques. We collected reviews from established wellness centers listed on Google Maps and TripAdvisor and employed sentiment analysis using TextBlob to classify customer reviews into positive, negative, or neutral sentiments. In addition, we used supervised topic modeling to categorize reviews into predefined wellness dimensions, including physical, mental, spiritual, emotional, social, and environmental wellness. The analysis showed that most of the reviews are mainly positive, with physical and mental wellness being the topics most frequently discussed. However, there are areas for potential service improvement, particularly in environmental and social wellness. Rather than focusing on developing or comparing machine learning models, this work provides key recommendations for wellness centers to refine their programs and align with customer preferences.

Keywords: Sentiment Analysis, Natural Language Processing, Supervised Topic Modeling, Customer Insights, Wellness Tourism

Gamification Marketing in Roblox Metaverse Tourism: A Case Study of Anytime Tour

Atchara Witosurapot* (Prince of Songkla University, Thailand)

Paper#1571056252

This paper investigates the effectiveness of gamification in Roblox-based Metaverse tourism through a case study of Anytime Tour. The study evaluates how gamified virtual tours enhance user engagement, motivate real-world travel, and support marketing efforts for tour agencies. Data from questionnaire responses of players and tour agencies were analyzed using descriptive statistics. The results demonstrate high levels of user immersion and motivation to visit real-world locations, with tour agencies reporting significant marketing benefits. The findings highlight gamification's potential to transform virtual tourism experiences and serve as powerful marketing tools.

Keywords: Metaverse Tourism, Gamification Marketing, User Engagement, Roblox, Anytime Tour

Session 10: Cyber Security, Embedded Systems, and Robotics

Session Chair: Professor Deepak Prashar, Ph.D.
Lovely Professional University, India
Assoc. Prof. Punyaphol Horata, Ph.D.
College of Computing, Khon Kaen University, Thailand

Room: Chat Tan 2
Time 13.30-16.30 hrs

Behavioral Analysis of Multi-Core Random Forest Models: Case Study on Domain Name Randomness Detection

Korrawit Chaikangwan, Withawat Tangtrongpairoj, Pirawat Watanapongse and Surasak Sanguanpong (Kasetsart University, Thailand)*

Paper#1571038341

The field of cybersecurity is constantly evolving, necessitating the development of Machine Learning (ML) models for Domain Name System (DNS) anomaly detection that prioritize high accuracy alongside operational efficiency, particularly in real-time threat scenarios. This study explores the behavioral analysis of Random Forest, an Ensemble Learning technique, focusing on improving training time efficiency through the application of multi-core processing technologies. Our empirical research investigates the impact of modifications to Random Forest hyperparameters, such as the number of trees, parallel processing configurations, and tree splitting criteria, on training and classification times within multi-core environments. The findings demonstrate that while increasing the number of trees generally improves model accuracy, it also increases computational demands. However, the results reveal that leveraging parallel processing effectively mitigates these extended training times, offering a scalable approach for rapid DNS anomaly detection. By emphasizing these aspects of ML efficiency, this research contributes valuable insights into optimizing ML-driven cybersecurity tools, which is crucial for effectively combating sophisticated DGA-based malware threats.

Keywords: Multi-core Processing, Random Forest, DNS Randomness Detection, Domain Generation Algorithms (DGA), Botnet Detection, Cybersecurity

5G the Missing Piece in Construction's Digital Transformation

Shaik Chandini (Gulf American University UAE, India); Muhammad Jebran Khan (Sarhad University, Pakistan); Fasee Ullah (Universiti Teknologi PETRONAS, Malaysia); Arfat Ahmad Khan (Khon Kaen University, Thailand); Deepak Prashar (Lovely Professional University (LPU), India)*

Paper#1571048652

The 5th generation of wireless technology with a continuum leap rushing towards the future in the world of communication has a puzzle that enables the autonomous machine to work in site making a louder voice that shows the era where even if we cannot be fully robotic, we can make the machines do the work by sitting on a faraway control room. Making ways clear to see the work done miles away on construction sites the 5th generation has not only brought the people close through communication but also made them work collegiately with a clearer view front. The paper discusses 5G and the other related technologies that are emerging all over the world and how it is needed specifically in the construction industry. In the present paper, we tried to shed light on the acceptance and implementation of 5G technology in the construction sector. It is seen that the construction sector in India is lagging behind when it comes to implementation and availability of required support and resources for the 5G implementation.

Keywords: Technology, 5G, AI, Construction, Technological Advancements, IoT

Hashing Algorithm for Protecting Credential Information Against Channel Interception and Server-Side Data Leakage

Paper#1571048687

*Kittipon Piyawanno** and Taweechai Nuntawisuttiwong (King Mongkut's University of Technology Thonburi, Thailand)

This research proposes a novel algorithm for password hashing, called the Sandwich Hashing algorithm, designed to protect credential information from channel interception as well as server-side data leakage. The algorithm comprises three main steps: credential information enrollment, credential information hashing at the client side, and credential information checking at the server side. Sandwich Hashing employs slow but secure hash functions like bcrypt or Argon2, combined with PBKDF2, to provide robust security against rainbow-table and brute-force attacks. By using unique, random salts and timestamp buffers for each credential check, the algorithm enhances the protection of credential information from channel interception and server-side data leakage. Furthermore, hash values are partially stored on the server to resist such attacks. However, it is acknowledged that the algorithm remains vulnerable to parallel attacks involving simultaneous channel interception and server data leakage. This study details the algorithm's implementation, parameter settings, security capabilities, and limitations, demonstrating its superiority over traditional server-side and client-side hashing methods.

Keywords: Sandwich

Hashing, Client-side

Hashing, Server-side

Hashing, Multi-layer

Hashing, Credential Check

Security Robot With ROS System

Paper#1571049216

*Damrongkiat Lim** (KMUTNB, Thailand & CIT, Thailand)

This paper aims to develop and test a security robot with the Robot Operating System (ROS) to enhance safety in various locations, such as factories, hotels, hospitals, shopping malls, and other places requiring security measures. The robot is equipped with functionalities to patrol predetermined points, capture images, stream live footage from its onboard camera, and send the captured images to the LINE application for real-time inspection and incident reporting. The developed system comprises hardware, including the robot fitted with Lidar and a camera, ROS-based software for control and navigation, and a program for connectivity and data transmission to LINE. The experiments were divided into several stages, including testing the installation and operation of the ROS system, assessing the robot's movement along predefined paths, capturing images at specified locations, and transmitting the images to LINE. The results demonstrated that the robot could move accurately along the predetermined paths, capture high-quality images, and send these images to the LINE application quickly and reliably. The development of this robotic system not only enhances the efficiency of security and surveillance operations but also reduces the workload of personnel and increases safety in areas where the robot is deployed. Furthermore, the findings of this research pave the way for future advancements in robotic security systems by integrating more advanced technologies and enhancing functionality.

Keywords: Robot, ROS, Lidar, Security, Line

A Low-Cost Bit-Serial Hardware Architecture and FPGA Implementation of Spiking Neural Network

Paper#1571056251

*Thanapol Thongkham** and Yutana Jewajinda (Silpakorn University, Thailand)

This paper presents a low-cost bit-serial spiking neural network architecture that employs a binary signed-digit (BSD) number system, which relies on the most significant digit-first (MSD-first) serial addition. A pipeline online bit-serial adder is proposed. The online bit-serial adder performs addition with a limited carry chain and variable length precision. The experiments are conducted using Xilinx Zynq-7000 FPGA. The proposed bit-serial architecture with the adder circuits reduces FPGA resources against bit-parallel implementation. The benefit of the proposed bit-serial architecture is that it allows high throughput computing with scalable precision of the leak-integrate-and-fire (LIF) neural model. The experimental results highlight the suitability of the proposed architecture for deployment in resource-constrained FPGA-based embedded systems.

Keywords: Spiking Neural Network, FPGA, Bit-Serial

Session 12: HCI, Software Engineering, and Software Development

Session Chair: Assoc.Prof. Kanda Runapongsa Saikaew, Ph.D.
Faculty of Engineering, Khon Kaen University, Thailand

Room: Erawan 1
Time 13.30-16.30 hrs

Automating Tower Defense Game Level Design With Evolutionary Algorithms

*Warin Wattanapornprom**, Chonlasit Satsuk, Thianrawit Sirisakornsakul and Trirat Jamornthawuch (King Mongkut's University of Technology Thonburi, Thailand); Yodthong Rodkaew (UTCC, Thailand); Wittawin Susutti (King Mongkut's University of Technology Thonburi, Thailand)

Paper#1571056052

This paper explores the use of Genetic Algorithms (GA) and Customized Estimation of Distribution Algorithms (CEDA) to dynamically design enemy waves in a Tower Defense game. By varying population sizes (5 to 50), the study evaluates each algorithm's efficiency and effectiveness in generating balanced and challenging enemy waves. Fitness scores are based on the severity of attacks on the player's base and the distance traveled by each monster. Results show that both GA and CEDA are capable of producing diverse and challenging gameplay experiences, with optimal performance achieved using moderate population sizes. This AI-driven approach introduces a new dimension to Tower Defense games, enabling dynamic and adaptive level design that enhances engagement and replayability.

Keywords: Tower Defense Game, Genetic Algorithms, Estimation of Distribution Algorithms, Automating Game Level Design

Revolutionizing Tower Defense: Automating Game Level Design With Rogue-Lite Integration

*Warin Wattanapornprom**, Jirawat Santichavalit, Arnon Pakdee and Witoon Ruamngoen (King Mongkut's University of Technology Thonburi, Thailand); Yodthong Rodkaew (UTCC, Thailand); Wittawin Susutti (King Mongkut's University of Technology Thonburi, Thailand)

Paper#1571056055

This paper introduces "Deferent," a proof-of-concept game designed to showcase the application of Procedural Content Generation (PCG) in enhancing gameplay dynamics and player engagement. By employing PCG techniques such as automated level design, resource allocation, wave generation, and evolutionary mechanics, "Deferent" offers a unique gameplay experience that fosters high replayability. A usability study involving 15 players revealed positive reception regarding the ease of navigation and upgrade systems, while identifying areas for improvement, particularly in resource management and game balancing. The findings indicate that with further optimization, "Deferent" can effectively demonstrate the potential of PCG in advancing modern game design practices.

Keywords: Procedural Content Generation (PCG), Automated Level Design, Game Development, Tower Defense

Procedural Content Generation for 2.5D Rogue-Lite Games: An Evolutionary Algorithm Approach

Paper#1571056056

*Warin Wattanapornprom**, Chisanupong Wipachainun, Thanathat Lertpinitamonkul and Wasamon Suksai (King Mongkut's University of Technology Thonburi, Thailand); Yodthong Rodkaew (UTCC, Thailand); Wittawin Susutti (King Mongkut's University of Technology Thonburi, Thailand)

This paper introduces Ropburi, a 2.5D rogue-lite game that employs procedural content generation (PCG) to enhance player experience. The game utilizes a Weight-Based Genetic Algorithm (WBGA) to create balanced, engaging maps and a (1+1) Evolution Strategy (ES) for tuning difficulty levels by adjusting enemy attributes. Our approach surpasses traditional deterministic PCG methods by incorporating genetic algorithms, providing flexibility and efficiency in generating complex game environments. Experimental results demonstrate that smaller population sizes converge faster and require lower computational time, while optimized bots ensure precise difficulty adjustments. This research highlights the balance between optimization quality and computational efficiency, setting a new standard for automated level design in rogue-lite games and showcasing the potential of evolutionary algorithms in creating dynamic, immersive gaming experiences.

Keywords: Procedural Content Generation, Genetic Algorithms, Evolution Strategy, Rogue-Lite Game

User Experiences on a Blockchain-Based Ticket Sales Platform

Paper#1571048826

*Natsatika Pirapattipanad** (Kasetsart University, Thailand); Paruj Ratanaworabhan (Faculty of Engineering Kasetsart University, Thailand)

Blockchain technology has been gaining a lot of interest as it brings in decentralization and immutability, leading to transparency and traceability. Many industries can benefit from these two qualities. One such industry is the entertainment industry, which regularly organizes fan-based events, generating income via ticket sales. However, current centralized ticket sales platforms lack transparency and traceability. Every now and then, we hear stories of fake or “privilege” tickets. A blockchain-based platform can provide a solution to these problems. Many of these platforms, however, fail to deliver their full value to the users. One of the reasons that makes it difficult to adopt these platforms is that they use interfaces that are quite different from conventional ones. Many users simply do not want that. Our main goal for this paper is to showcase a blockchain-based ticket sales platform that offers the look-and-feel and the performance that are comparable to conventional platforms. We conduct usability tests, identify potential problems, and suggest some plausible solutions for them.

Keywords: Blockchain-based Ticket Sales Platforms, Non-fungible Tokens (NFTs), User Interface and Experience (UI/UX), Avalanche Blockchain, Ethereum Blockchain

About ICSEC2024

The International Computer Science and Engineering Conference (ICSEC) serves as the leading platform for researchers, practitioners, and educators to present and discuss the most recent innovations, research findings, experiences, trends, and challenges in the field of Computer Science, Computer Engineering, Software Engineering, and Information Technology. ICSEC 2024 is co-organized by the IEEE Thailand Section (IEEE Computer Society Thailand Chapter) and the College of Computing, Khon Kaen University in collaboration with the Faculty of Engineering and Faculty of Interdisciplinary Studies, Khon Kaen University; Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology Association of Thailand (ECTI Association); Artificial Intelligence Association of Thailand (AIAT); and Council of IT Deans of Thailand (CITT). ICSEC 2024 takes place over three days in Khon Kaen, Thailand, featuring special sessions and presentations by esteemed researchers from international communities, including renowned keynote speakers. The conference adopts a hybrid format, offering both on-site and virtual participation options to accommodate diverse attendees. Accepted papers will be considered for inclusion in IEEE Xplore, subject to meeting its standards for scope and quality. In addition, selected papers may have the opportunity to extend the research work for submission to associated SCOPUS-indexed journals, each of which will conduct its peer review process.

Equity, Diversity, and Inclusion (EDI) Plan

Equity, Diversity, and Inclusion (EDI) are fundamental values that aim to cultivate equal opportunities (equity), embrace and honor individual, social, and cultural differences (diversity), and facilitate meaningful participation of all individuals in various discussions and environments (inclusion). In line with these principles, ICSEC 2024 is committed to promoting:

- *Diversity of the committees:* We aim to assemble a diverse organization committee, technical committees, and reviewers, considering various social, cultural, and academic backgrounds and skills (e.g., gender, nationality, and research expertise).
- *Speaker Diversity:* Diversity centers on recognizing and appreciating human differences and acknowledging diverse talents. We aim to invite speakers and panelists representing diverse populations, backgrounds, research areas, and expertise within Computer Engineering, Software Engineering, and Information Technology to enhance the breadth of perspectives and thinking.
- *Bias Mitigation and Fairness Promotion:* We advocate double-blind review to mitigate unconscious biases related to social, cultural, and economic factors (e.g., nationality, gender, sexual orientation, and race). Additionally, we encourage reviewers to approach their assessments with empathy and kindness, subject to meeting IEEE Xplore's standards for scope and quality.
- *Participation:* We expect that all ICSEC 2024 participants actively contribute to the development of an inclusive and welcoming environment where people feel respected and safe regardless of their social, cultural, sex, or economic background.
- *Student Grants:* Although ICSEC 2024 offers a limited number of conference participation grants to award students to present their papers at the conference, we prioritize diversity considerations, including social, cultural and economic factors such as gender, age, geographic location, and research interests, in addition to merit and need-based criteria.
- *EDI Awareness:* We encourage all committee members, reviewers, and participants to dedicate time to enhance their understanding of the principles of equity, diversity, and inclusion (EDI) and their significance in conference activities.

This EDI plan aims to promote an equitable, diverse, and inclusive environment at ICSEC 2024 in Khon Kaen, Thailand. By creating accessible and welcoming environments and actively embracing diverse perspectives, our objective is to foster a conference atmosphere where all participants feel included, valued, and empowered. The EDI plan elevates the overall participant experience at ICSEC 2024.

No Show Policy

One of the authors and/or their representatives of an accepted manuscript **MUST PRESENT** their paper at the conference, either by appearing physically or online. Papers with no-show participants without a valid reason and solid proof will not be submitted to IEEExplore. No refund of the paid fees may be claimed by the no-show author.

Committee

Honorary Committee

- Supavadee Aramvith, IEEE Thailand Section, Thailand
- David Banjerdpongchai, Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology Association of Thailand (ECTI Association), Thailand
- Thanaruk Theeramunkong, Artificial Intelligence Association of Thailand (AIAT), Thailand
- Chetneti Srisa-an, Council of IT Deans of Thailand (CITT), Thailand

International Advisory Committee

- Rajkumar Buyya, University of Melbourne, Australia
- Zhu Han, University of Houston, United States of America
- Ian F. Akyildiz, Georgia Institute of Technology, United States of America
- Samee U. Khan, Mississippi State University, United States of America
- Guang Bin Huang, Nanyang Technological University, Singapore
- Tony Q.S. Quek, Singapore University of Technology and Design, Singapore
- Ali Kashif Bashir, Manchester Metropolitan University, United Kingdom
- Feng Xia, RMIT University, Australia
- Pascal Bouvry, University of Luxembourg, Luxembourg
- Abderrahim Benslimane, Avignon University, France
- Le Hoang Son, Vietnam National University, Vietnam
- KC Santosh, University of South Dakota, United States of America
- Keshav Dahal, University of the West of Scotland, Scotland
- Sudeep Tanwar, Nirma University, India
- Zubair Baig, Deakin University, Australia
- Dr-Ashish Khanna, Maharaja Agrasen Institute of Technology, India
- Herwig Unger, FernUniversität in Hagen, Germany
- Nguyen Gia Nhu, Duytan University, Vietnam
- Naito Tomoyuki, Kobe Institute of Computing, Japan
- Sheng Lung Peng, National Taipei University of Business, Taiwan
- Joao L. Monteiro, University of Minho, Portugal
- Mitsunori Makino, Chuo University, Japan
- Marcello M. Bonsangue, Leiden University, The Netherlands
- David Hoffman, Duke University, United States of America
- Stephane Bressan, National University of Singapore, Singapore
- Watanabe Katsumi, Waseda University, Japan
- Susanto Rahardja, Institute for Infocomm Research, Singapore

Advisory Committee

- Booncharoen Sirinaovakul, King Mongkut's University of Technology Thonburi, Thailand
- Boonserm Kijsirikul, Chulalongkorn University, Thailand
- Chai Wutiwiwatthai, National Electronics and Computer Technology Center (NECTEC), Thailand
- Kanchana Kanchanasut, Asian Institute of Technology, Thailand
- Peter Haddawy, Mahidol University, Thailand
- Veera Boonjing, King Mongkut's Institute of Technology Ladkrabang, Thailand
- Sukit Limpijumnong, National Science and Technology Development Agency (NSTDA), Thailand
- Thepchai Supnithi, Artificial Intelligence Association of Thailand (AIAT), Thailand

Steering Committee

- Anan Phonphoem, Kasetsart University, Thailand
- Chidchanok Lursinsap, Chulalongkorn University, Thailand
- Ekkarat Boonchieng, Chiang Mai University, Thailand
- Kosin Chamnongthai, King Mongkut's University of Technology Thonburi, Thailand
- Prabhas Chongsitvatana, Chulalongkorn University, Thailand
- Prasong Praneepolgrang, Navaminda Kasatriyadhiraj Royal Thai Air Force Academy, Thailand
- Punpiti Piamsa-nnga, Kasetsart University, Thailand
- Sartra Wongthanavasu, Khon Kaen University, Thailand

General Chair and General Co-Chair

- Sirapat Chiewchanwattana, Khon Kaen University, Thailand
- Ekkarat Boonchieng, Chiang Mai University, Thailand

Committee (Cont.)

Technical Program Chair

- Khamron Sunat, Khon Kaen University, Thailand

Technical Program Co-Chairs

- Chakchai So-In, IEEE Computer Society Chapter/ Khon Kaen University, Thailand
- Jan N. van Rijn, Leiden University, The Netherlands
- Krisana Chinnasarn, IEEE Computer Society Chapter/ Burapha University, Thailand
- Dusit Niyato, Nanyang Technological University, Singapore

Publication Chairs

- Aziz Nanthaamornphong, Prince of Songkla University, Thailand
- Chanon Dechsupsa, Khon Kaen University, Thailand
- Somchai Chuan-Udom, Khon Kaen University, Thailand

Publicity Chairs

- Sarun Apichontrakul, Khon Kaen University, Thailand
- Kanda Runapongsa Saikew, Khon Kaen University, Thailand
- Panupong Wanjantuk, Khon Kaen University, Thailand

Financial and Registration Chair

- Pusadee Seresangtakul, Khon Kaen University, Thailand

Local Arrangement Chairs

- Monlica Wattana, Khon Kaen University, Thailand
- Phet Aimtongkham, Khon Kaen University, Thailand
- Wachirawut Tamviset, Khon Kaen University, Thailand
- Praisan Padungweang, Khon Kaen University, Thailand
- Urawan Chanket, Khon Kaen University, Thailand

General Secretary

- Chitsutha Soomlek, Khon Kaen University, Thailand
- Yanika Kongsortot, Khon Kaen University, Thailand

Technical Program Committee

- Akadej Udomchaiporn (KMITL, Thailand)
- Anuchit Jitpattanakul (KMUTNB, Thailand)
- Anusorn Chaikae (Chiang Rai Rajabhat Univ., Thailand)
- Arijit Roy (Indian Institute of Technology Patna, India)
- Arthorn Luangsodsai (Chulalongkorn University, Thailand)
- Assadarat Khurat (Mahidol University, Thailand)
- Atchara Namburi (Kasetsart University, Thailand)
- Atthapol Suwannasa (Mahasarakham Univ., Thailand)
- Aziz Nanthaamornphong (PSU, Thailand)
- Benchaphon Limthanmaphon (KMUTNB, Thailand)
- Bowornrat Sriman (Kasetsart University, Thailand)
- Chalee Vorakulpipat (NECTEC, Thailand)
- Chanon Dechsupa (KKU, Thailand)
- Chantana Chantrapornchai (Kasetsart Univ., Thailand)
- Chidchanok Lursinsap (Chulalongkorn Univ., Thailand)
- Chotiros Surapholchai (Chulalongkorn Univ., Thailand)
- Duangjai Jitkongchuen (Big Data Institute, Thailand)
- Ekkarat Boonchieng (Chiang Mai University, Thailand)
- Erna Nababan (Universitas Sumatera Utara, Indonesia)
- Grégoire Danoy (University of Luxembourg, Luxembourg)
- Hutchatai Chanlekha (Kasetsart University, Thailand)
- Isoon Kanjanasurat (KKU, Thailand)
- Jacek Blazewicz (Poznan Univ. of Technology, Poland)
- Jaree Thongkam (Mahasarakham Univ., Thailand)
- Jedrzej Musial (Poznan Univ. of Technology, Poland)
- Jirawat Thaenthong (PSU Phuket Campus, Thailand)
- Jitsaran Seekuka (Kasetsart University, Thailand)
- Johnatan Pecero (University of Luxembourg, Luxembourg)
- Kalika Suksomboon (NECTEC, Thailand)
- Kanjana Laosen (PSU, Thailand)
- Kc Santosh (University of South Dakota, USA)
- Kensuke Fukuda (National Institute of Informatics, Japan)
- Khamron Sunat (KKU, Thailand)
- Kitiporn Plaimas (Chulalongkorn University, Thailand)
- Kitsana Waiyamai (Kasetsart Univ., Thailand)
- Krung Sinapiromsaran (Chulalongkorn Univ., Thailand)
- Le Hoang Son (Vietnam National University, Vietnam)
- Kwankamon Dittakan (PSU, Thailand)
- Manasawee Kaenampornpan (KKU, Thailand)
- Muhammad Zeeshan Shakir (UWS, United Kingdom)
- Nagon Wattanakij (KKU, Thailand)
- Narit Hnoohom (Mahidol University, Thailand)
- Nasith Laosen (Phuket Rajabhat University, Thailand)
- Natsuda Kaothanthong (SIIT, Thailand)
- Nattapong Tongtep (PSU Phuket Campus, Thailand)
- Nele Mentens (Leiden University, The Netherlands)
- Nopadon Juneam (Kasetsart University, Thailand)
- Noppadol Chalortham (Chiang Mai University, Thailand)
- Noppon Lertchuwongsa (PSU, Thailand)
- Nutthanon Leelathakul (Burapha University, Thailand)
- Olga Gadyatskaya (Leiden University, The Netherlands)
- Pakaket Wattuya (Kasetsart University, Thailand)
- Pakarat Musikawan (KKU, Thailand)
- Pakawan Pugsee (Chulalongkorn University, Thailand)
- Part Pramokchon (Maejo University, Thailand)
- Pascal Bouvry (University of Luxembourg, Luxembourg)
- Paul Harvey (University of Glasgow, United Kingdom)
- Paween Khoenkaw (Maejo University, Thailand)
- Payungsak Kasemsumran (Maejo University, Thailand)
- Peera Liewlom (Kasetsart University, Thailand)
- Peerapon Vateekul (Chulalongkorn University, Thailand)
- Phattharamon Phanphaeng (CMRU, Thailand)
- Phet Aimtongkham (KKU, Thailand)
- Pipat Reungsang (KKU, Thailand)
- Piyawad Kasabai (Udon Thani Rajabhat Univ., Thailand)
- Pokpong Songmuang (Thamasat University, Thailand)
- Pongsathon Janyoi (KKU, Thailand)
- Pornchai Mongkolnam (KMUTT, Thailand)
- Praisan Padungweang (KKU, Thailand)
- Prabhas Chongstitvatana (Chulalongkorn Univ., Thailand)
- Prakarn Unachak (Chiang Mai University, Thailand)
- Punpiti Piamsa-nga (Kasetsart University, Thailand)
- Punyaphol Horata (KKU, Thailand)
- Pusadee Seresangtakul (KKU, Thailand)
- Ratsameetip Wita (Chiang Mai University, Thailand)
- Sakorn Mekruksavanich (University of Phayao, Thailand)
- Saichon Jaiyen (KMUTT, Thailand)
- Sancha Panpaeng (CMRU, Thailand)
- Sangsuree Vasuponggaya (PSU, Thailand)
- Sanparith Marukatat (NECTEC, Thailand)
- Sanpawat Kantabutra (Chiang Mai University, Thailand)
- Santi Phithakkitnukoon ((Chiang Mai University, TH)
- Sartra Wongthanavasu (KKU, Thailand)
- Sarun Apichontrakul (KKU, Thailand)
- Sasin Tiendee (Kasetsart University, Thailand)
- Sasipa Panthuwadeethorn (Chulalongkorn Univ., TH)
- Sasithorn Suchaiya (Kasetsart University, Thailand)
- Sathit Prasomphan (KMUTNB, Thailand)
- Satit Kravent (KKU, Thailand)
- Sethavidh Gertphol (Kasetsart University, Thailand)
- Silada Intarasonthonchun (KKU, Thailand)
- Siriporn Tubtim (Kasetsart University, Thailand)
- Songyut Phoemphon (SUT, Thailand)
- Somnuk Puangpronnit (Mahasarakham University, TH)
- Sucha Supittayapornpong (VISTEC, Thailand)
- Sudeep Tanwar (Nirma University, India)
- Sudsanguan Ngamsuriyaroj (Mahidol University, Thailand)
- Sumonta Kasemvilas (KKU, Thailand)
- Supanya Aphiwongsophon (Chulalongkorn Univ., TH)
- Supaporn Chairungsee (Walailak University, Thailand)
- Suppakkarn Chansareewittaya (MFU, Thailand)
- Surasak Tangsakul (Kasetsart University, Thailand)
- Susama Chokphoemphun (Kasetsart University, Thailand)
- Sutasinee Jitanan (Naresuan University, Thailand)
- Tanomsak Wongmeekaew (Kasetsart University, Thailand)
- Teerapong Panboonyuen (Chulalongkorn Univ., TH)
- Thanawin Rakthanmanon (Kasetsart University, Thailand)
- Thanawut Thanavanich (Chiang Rai Rajabhat Univ., TH)
- Thanaruk Theeramunkong (SIIT, Thailand)
- Theerat Saichoo (Walailak University, Thailand)
- Thepchai Supnithi (NECTEC, Thailand)
- Thongchai Chuachan (Surindra Rajabhat University, TH)
- Thongchai Kaewkiriya (KMITL, Thailand)
- Urachart Kokaew (KKU, Thailand)
- Usa Sammapun (Kasetsart University, Thailand)
- Vo Van (Duy Tan University, Vietnam)
- Walailuck Wongruen (Kasetsart University, Thailand)
- Wanchaloem Nadda (Chiang Mai University, Thailand)
- Wararat Songpan (KKU, Thailand)
- Wattana Jindaluang (Chiang Mai University, Thailand)
- Wirapong Chansanam (KKU, Thailand)
- Wiwat Vatanawood (Chulalongkorn University, Thailand)
- Yanika Kongsortot (KKU, Thailand)
- Zhishu Shen (Wuhan University of Technology, China)
- Zubair Baig (Deakin University, Australia)

Sponsored by

