ĐẠI HỌC BÁCH KHOA SOICT

VIASM
VIETNAM INSTITUTE FOR ADVANCED STUDY IN MATHEMATICS

SoICT 2022

THE 11TH INTERNATIONAL SYMPOSIUM ON INFORMATION AND COMMUNICATION TECHNOLOGY

December 1-3, 2022 | Hanoi - Halong Bay, Vietnam

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FOREWORD

The 11th International Symposium on Information and Communication Technology (SoICT 2022) is held on December 1–3, 2022, in Hanoi and Halong, Vietnam. SoICT 2022 is an international academic forum for researchers and graduate students to share their latest research findings and to identify future challenges in computer science.

SoICT 2022 has received papers from 14 countries in four major areas of research including AI Foundation and Big Data, Network Communication and Security, Image and Natural Language Processing, Software Engineering and Digital Technology Trends, in addition to a special session on Blockchain and Financial Technology. The Program Committee has followed a formal standard reviewing process; bidding, reviewing, and deliberating for selecting 42 papers for regular presentation, and 19 papers for poster presentation and publication in the proceedings. It is our great honor to receive world-class invited speakers Mourad Baiou (LIMOS Lab, France), Tung Dao (Shopee, Singapore), Laurent El Ghaoui (VinUniversity, Vietnam; UC Berkeley, United States), Long Bao Le (University of Quebec, Canada), David Lo (Singapore Management University, Singapore), Nasir Memon (New York University, United States), Shin'ichi Satoh (National Institute of Informatics, Japan), and Shui Yu (University of Technology Sydney, Australia).

We would like to thank the Program Committee members for their great responsibility in reviewing papers, thank all track chairs for actively monitoring the review and deliberation process and for proposing decisions on papers: Le Dinh Xuan Bach (Melbourne University, Australia), Pierluigi Gallo (University of Palermo, Italy), Cathal Gurrin (Dublin City University, Ireland), Nguyen Quoc Viet Hung (Griffith University, Australia), Zhi Liu (University of ElectroCommunications, Japan), Le Quang Loc (University College of London, United Kingdom), Nguyen Binh Minh (Hanoi University of Science and Technology, Vietnam), Duong Quang Khanh Ngoc (Interdigital R&D, France), Kien Nguyen (Chiba University, Japan), Makoto Onizuka (Osaka University, Japan), Youyang Qu (CSIRO, Australia), Hiroyuki Torikai (Hosei University, Japan), Michel Toulouse (Hanoi University of Science and Technology, Vietnam), David Tran (University of Massachusetts, United States), Tran Minh Triet (University of Science, Vietnam National University Hochiminh City, Vietnam), Pham Quoc Viet (Pusan National University, Korea), and Muriel Visani (La Rochelle University, France). In particular, we would like to thank all Organizing Committee members, who have worked hard to ensure the best quality of the symposium.

We are grateful to Vingroup Innovation Foundation (VINIF) for financial support. Finally, we hope that the SoICT 2022 conference provided an interesting and up-to-date scientific program. we would like to thank all authors and participants for making SoICT 2022 a memorable and enjoyable academic event in Hanoi and Halong, Vietnam.

Together, we make this SoICT 2022 Conference a successful event!

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Prof. David Lo
Singapore Management University, Singapore

Title: Data to Knowledge to Automation: How Can AI Boost Software Quality?

Abstract

Bugs are prevalent in software systems. Needless to say, these bugs need to be identified, managed and fixed to improve software quality. Unfortunately, these tasks are non-trivial; many bugs remain hidden or unfixed for weeks (or even years!). Can AI help? Of course! AI can be trained on rich historical data to allow it to mimic developers in squashing bugs (and more!). For AI to work well, it often needs to be trained on a sizable amount of data. Fortunately, many projects maintain large historical data in various repositories that are publicly available. Although full automation is not feasible yet (at least in the general sense), AI-infused solutions can support developers in their quest to identify, manage, and fix bugs (and thus remaining successful despite living with bugs). This talk will provide an overview and reflection of the large body of work that builds automated tools that leverage the power of AI, trained on rich data in various repositories, for various tasks in the bug identification, management, and fixing process. Some open challenges will also be presented, with the goal of encouraging more research in this exciting area in the intersection of Software Engineering and AI.

Biography

David Lo is a Professor of Computer Science and Director of the Information and Systems Cluster at School of Computing and Information Systems, Singapore Management University. He leads the Software Analytics Research (SOAR) group. His research interest is in the intersection of software engineering, cybersecurity, and data science, encompassing socio-technical aspects and analysis of different kinds of software artifacts, with the goal of improving software quality and security and developer productivity. His work has been published in major and premier conferences and journals in the area of software engineering, AI, and cybersecurity attracting substantial interest from the community. His work has been supported by NRF, MOE, NCR, AI Singapore, and several international research projects. He has won more than 15 international research and service awards including 6 ACM SIGSOFT Distinguished Paper Awards. He has received a number of international honors including IEEE Fellow (class of 2022, through Computer Society), Fellow of Automated Software Engineering (class of 2021), and ACM Distinguished Member (class of 2019).

Prof. Nasir Memon
New York University, United States

Title: Combating Deepfakes. Recent Approaches and Challenges

Abstract
The integrity of online video interactions is threatened by the widespread rise of AI-enabled high-quality deepfakes that are now deployable in real-time. In this talk we will discuss how deepfakes are generated, focusing mainly on videos. We will then describe some of the approaches that have been developed to combat deepfakes and associated research challenges.

Biography
Nasir Memon is Vice Dean for Academics and Student Affairs and a Professor of Computer Science and Engineering at the New York University Tandon School of Engineering. He is an affiliate faculty at the Computer Science department in NYU's Courant Institute of Mathematical Sciences, and department head of NYU Tandon Online. He introduced cyber security studies to NYU Tandon in 1999, making it one of the first schools to implement the program at the undergraduate level. He is a co-founder of NYU's Center for Cyber Security (CCS) at New York as well as NYU Abu Dhabi. He is the founder of the OSIRIS Lab, CSAW, the NYU Tandon Bridge program as well as the Cyber Fellows program at NYU. He has received several best paper awards and awards for excellence in teaching. He has been on the editorial boards of several journals, and was the Editor-In-Chief of the IEEE Transactions on Information Security and Forensics. He is an IEEE Fellow and an SPIE Fellow for his contributions to image compression and media security and forensics. His research interests include digital forensics, biometrics, data compression, network security and security and human behavior.

Prof. Laurent El Ghaoui
VIN University, Vietnam
UC Berkeley, United States

Title: Implicitly-defined prediction rules in deep learning

Abstract
In the quest of using machines to predict and learn complex behaviors and situations, deep learning is the rage of the day.

Recently, prediction rules based on so-called implicit models have emerged as a new high-potential paradigm in deep learning. These models rely on an "equilibrium" equation to define the prediction, instead of a recurrence through multiple layers. Currently, even very complex deep learning models are based on a "feedforward" structure, without loops, and as such the popular term "neural" applied to such models is not fully warranted, since the brain itself possesses loops. Allowing for loops may be the key to describe complex higher-level

reasoning, which has so far eluded the deep learning paradigms. However, it raises the fundamental issue of well-posedness, since there may be no or multiple solutions to the corresponding equilibrium equation.

In this talk, I will review some aspects of implicit models, starting from a unifying "state-space" representation that enables to connect deep learning with (convex) optimization. I will illustrate these connections via topics such as model compression and robustness; and show that the implicit models have the potential to capture more complex behaviors than current deep learning ones.

Biography

Laurent El Ghaoui is Dean of College of Engineering & Computer Science. Prior to his current appointment at VinUniversity, Prof. El Ghaoui taught at the Department of Electrical Engineering & Computer Science and Department of Industrial Engineering & Operations Research at University of California, Berkeley (ranked #32 worldwide according to the QS World University Rankings 2021). He also taught Data Science within the Master of Financial Engineering at UC Berkeley's Haas Business School. Besides being a researcher and a lecturer, Prof. El Ghaoui is also a consultant and an entrepreneur. According to him, these experiences solving real-world problems have supplemented his research life tremendously.

Prof. Mourad Baiou

CNRS, LIMOS lab, FRANCE

Title: Path disruption games in networks

Abstract

Path Disruption Games study the placement of checkpoints in a network where an adversary is trying to travel from an origin s to a destination t. A cooperative game is defined where each agent owns an arc, and is able to place a checkpoint on it. Placing a checkpoint at a location yields a cost that depends upon the location. A coalition gets a reward if it can intercept all paths from s to t, and a coalition must choose a set location of minimum cost. We study the core and the nucleolus of this game. We give polynomial combinatorial algorithms to test whether a vector belongs to the core, and to compute the nucleolus. The components of the nucleolus reflect the relative importance of each arc to detect the adversary. Our techniques also apply to the case when the players are associated with the nodes.

Biography

MOURAD BAÏOU, is a Directeur de Recherche of the CNRS and he is currently the head of the Laboratoire of Computer Science LIMOS of Clermont Auvergne INP and the Université Clermont Auvergne. Before joining the CNRS he has taught at the engineering school

Polytech'Clermont of the Université Clermont Auvergne, after stays at the Ecole Polytechnique and the Departamento de Ingenieria Matematica, Universidad de Chile,

Santiago. His interests focus on combinatorial optimization, with a special penchant for the "polyhedral approach." He works on stable solutions and their generalizations, on the optimal

design of reliable networks, on facility location—p-median problems and on algorithmic game theory. He published on top level journals and conferences on computer science and combinatorial optimization such as Mathematics of Operations Research, Siam Journal on discrete Mathematics, Mathematical Programming, Algorithmica, Theoretical Computer Science, Integer Programming and Combinatorial Optimization conference, Discrete Mathematics.

Prof. Le Bao Long
University of Quebec, Canada

Title: Metaverse: Towards the next-generation immersive internet

Abstract
Metaverse is the term coined the first time in a science fiction novel named Snow Crash written by Neal Stephenson 30 years ago. A full-flesh metaverse, which merges the physical and digital worlds in a self-sustaining and persistent manner, is expected to provide the medium in which people not only play, work, and entertain but also perform most other real-life activities such as education, training, finance, and shopping. Metaverse, therefore, has the potential to transform every aspects of human life and the economy creating tremendous opportunities for the tech and many other industries. Metaverse research has gained tremendous interest and momentum in recent years where a great deal of efforts and resources has been invested by both academia and industry (e.g., Meta, Microsoft, Apple, etc) to build this immersive 3D internet. In this talk, I first discuss the key aspects and components of the metaverse including avatar, virtual economy, user generated content (UGC), trust, security, and privacy. Then, some initial versions of the metaverse existing today (mostly massively multiplayer online games) together with their characteristics and services are described. Important technologies and their roles in enabling the metaverse such as virtual/augmented/mixed reality, artificial intelligence, digital twin, blockchain, edge/cloud computing, 5G/6G wireless mobile networks, and Internet of things are presented. Some recent research results achieved by my research lab related to metaverse are then described. Finally, I discuss key open research challenges, which must be addressed to realize the future metaverse.

Biography
Long Bao Le is a full professor at INRS, University of Quebec, Canada where he is the director of Networks and Cyber Physical Systems Lab (NECPHY-Lab). Before joining University of Quebec, he had held research positions at Massachusetts Institute of Technology (MIT) and University of Waterloo. His current research interests include enabling technologies for 5G-and-beyond wireless networks, next-generation Internet, metaverse, and smart applications such as smart power grids and smart transportation systems. Prof. Le and his research team have published more than 220 articles on leading IEEE journals and conferences where his publications have received more than 11,000 citations according to Google Scholar. He is a co-author of the books Radio Resource Management in Multi-Tier Cellular Wireless Networks (Wiley, 2013) and Radio Resource Management in Wireless Networks: An Engineering Approach (Cambridge

University Press, 2017). Prof. Le has served as an editor for several flagship IEEE journals including IEEE Transactions on Wireless Communications, IEEE Communications Surveys & Tutorials, IEEE Wireless Communications Letters, and IEEE Transactions on Cognitive Communications and Networking.

Prof. Shin'ichi Satoh

National Institute of Informatics, Japan

Title: Boosting Image Retrieval by Diffusion

Abstract

Image retrieval is the technology which retrieves images relevant to a query from given large-scale image database. Image retrieval witnesses significant performance improvement by recent technical breakthrough, especially deep learning technologies, similar to other visual recognition tasks such as image classification, object detection, segmentation, among others. However, image retrieval has different technical aspect compared to the other visual recognition tasks: the performance is strongly influenced by referring to the distribution of images in the database. Diffusion is such a technology: it is know to be very effective and also flexible in boosting the performance of image retrieval by inspecting the distribution of images in the database. In this talk, the basics of diffusion will be introduced first, and then couple of technical attempts to improve the performance of image retrieval will be explained.

Biography

Shin'ichi Satoh is a professor at National Institute of Informatics (NII), Tokyo. He received PhD degree in 1992 at the University of Tokyo. His research interests include image processing, video content analysis and multimedia database. Currently he is leading the video processing project at NII, addressing video analysis, indexing, retrieval, and mining for broadcasted video archives.

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CONFERENCE PROGRAM & SCHEDULE

1 December 2022
Hanoi University of Science and Technology, Hanoi, Vietnam

8:30	**Registration** **Lecture Hall, 3rd floor, B1 Building, Hanoi University of Science and Technology**		
9:00-9:15	**Opening** **Lecture Hall, 3rd floor, B1 Building, Hanoi University of Science and Technology**		
9:15-9:45	**Keynote** **Data to Knowledge to Automation: How Can AI Boost Software Quality?** *David Lo, Singapore Management University, Singapore* Chair: Ho Tu Bao		
9.45-10.15	**Keynote** **Implicitly-defined prediction rules in deep learning** *Laurent El Ghaoui, VIN University, Vietnam; UC Berkeley, United States* Chair: Jeff Edmons		
10:15-10:30	**Photo session**		
10:30-10:45	**Coffee Break**		
	Lecture Hall, 3rd floor, B1 Building **AI Foundation and Big Data** Chair: Kyungbaek Kim, Than Quang Khoat	**Room 404, 4th floor, B1 Building** **Image and Natural Language Processing** Chair: Akiyo Nadamoto, Le Thi Lan	**Room 403, 4th floor, B1 Building** **Blockchain** Chair: David Tran, Nguyen Binh Minh
10:45-11:05	*An Vo, Tan Ngoc Pham, Van Bich Nguyen and Ngoc Hoang Luong* **Training-Free Multi-Objective and Many-Objective Evolutionary Neural Architecture Search with Synaptic Flow**	*Minh-Hieu Huynh, Bao Bui-Xuan and Minh-Triet Tran* **Sports Visual Data Analysis with Deep Vision**	*Ta Minh Thanh* **Blockmarking: Hybrid Model of Blockchain and Watermarking Technique for Copyright Protection**
11:05-11:25	*Luat Le Ba, Bach Do Viet, Hoang Ha Minh and Giang Pham Hoang* **Optimizing energy generation in short-term hydro unit commitment using efficiency points**	*Quang-Tien Pham, Duc-Anh Nguyen, Tien-Thanh Nguyen, Thanh Nam Nguyen, Duy-Tung Nguyen, Dinh-Tan Pham, Thanh Hai Tran, Thi-Lan Le and Hai Vu* **A study on skeleton-based action recognition and its application to physical exercise recognition**	*Ba-Lam Do, Hoang-Nam Dinh, Van-Thanh Nguyen, Manh-Hung Tran, Thanh-Long Le and Viet-Thang Nghiem* **B4E: A System for Creating and Validating Digital Credentials using Remote Signing and Blockchain**
11:25-11:45	*Yusuke Kimura, Takahiro Komamizu and Kenji Hatano* **Multi-task Learning-based Text Classification with Subword-Phrase Extraction**	*Hai Vu, Cong Nguyen Xuan, Minh Nghia Le, Duc Anh Nguyen and Viet Hang Dao* **A robust and high-performance neural network for classifying anatomical landmarks from Upper GastroIntestinal Endoscopy Images**	*Thanh-Chung Dao, Le-Duc Pham, Tien-Thao Nguyen, Ba-Lam Do and Binh Minh Nguyen* **V-Endpoint: Decentralized Endpoint for Blockchain Applications Based on Spark and Byzantine Consensus**
11:45-12:05	*The Duy Phan, Tran Duc Luong, Nguyen Hoang Quoc An, Quyen Nguyen Huu, Hoang Khoa Nghi and Van-Hau Pham* **Leveraging Reinforcement Learning and Generative Adversarial Networks to Craft Mutants of Windows Malware against Black-box Malware Detectors**	*Anh Le, Quang Uy Nguyen, Ngoc Tran Nguyen, Hai-Hong Phan and Thi Huong Chu* **An integration of Pseudo Anomalies and Memory Augmented Autoencoder for Video Anomaly Detection**	*Phuong N. H. Pham, Quy T. N. Co, Anh N. Su, Phuong T. Pham, Canh V. Pham and Vaclav Snasel* **k-Submodular Cover Problem: Application and Algorithms**
12:05-13:00	**Lunch - 10th floor, BKAI, B1 Building, Hanoi University of Science and Technology**		
	Lecture Hall, 3rd floor, B1 Building **AI Foundation and Big Data** Chair: Tadahiko Kumamoto, Dang Tuan Linh	**Room 404, 4th floor, B1 Building** **Image and Natural Language Processing** Chair: Ngo Thanh Trung, Vu Hai	**Techshow** **B1 Building**
13:00-13:20	*Thai Bao Tran and Ngoc Hoang Luong* **Benchmarking Gradient Estimation Mechanisms in Evolution Strategies for Solving Black-Box Optimization Functions and Reinforcement Learning Problems**	*Quang Tien Duong, Duc Huy Nguyen, Bao Thang Ta, Nhat Minh Le and Van Hai Do* **Improving Self-supervised Audio Representation based on Contrastive Learning with Conformer Encoder**	
13:20-13:40	*Anh Son Ta and Ngoc Bach Pham* **Solving resource forecasting in WiFi Network by NeuralProphet**	*Hanh Pham Van and Huong Le Thanh* **Improving Khmer-Vietnamese Machine Translation with Data Augmentation methods**	
13:40-14:00	*Asad Khattak and Adil Khan* **Cross-Location Activity Recognition using Adversarial Learning**	*Namal Rathnayake, Tuan Linh Dang and Yukinobu Hoshino* **Designing and Implementation of Novel Ensemble model based on ANFIS and Gradient Boosting methods for Hand Gestures Classification**	
14:00-14:20	*Khoa Nguyen, Nghia Vu, Dung Nguyen and Khoat Than* **Random Generative Adversarial Networks**	*Huu Hiep Nguyen, Ngoc Dung Nguyen and Khac-Hoai Nam Bui* **Intent Detection and Slot Filling with Low Resource and Domain Similarity**	
14:30-15:00	**Tutorial 1: Building Better Models Faster: A Charming Tool for Versioning Data and Experiments** *Tung Dao, Shopee, Singapore* **Lecture Hall, 3rd floor, B1 Building,** **Hanoi University of Science and Technology**	**Tutorial 2: High Quality Paper Writing – persuasive writing with evidence** *Shui Yu, University of Technology Sydney, Australia* **Room 404, 4th floor, B1 Building,** **Hanoi University of Science and Technology**	
15:30	**Transfer to Ha Long Bay**		

2 December 2022
Wyndham Legend Halong, Ha Long Bay

8:30	**Registration** **2nd floor, Wyndham Legend Halong**
8:30-9:00	**Keynote** **Combating Deepfakes. Recent Approaches and Challenges** *Nasir Memon, New York University, United States* Chair: David Tran **Diamond Ballroom 1**
9:00-9:30	**Keynote** **Boosting Image Retrieval by Diffusion** *Shin'ichi Satoh, National Institute of Informatics, Japan* Chair: Nguyen Hung Son **Diamond Ballroom 1**
9:30-9:45	**Coffee Break**

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	Diamond Ballroom 1 **AI Foundation and Big Data** Chair: Akiyo Nadamoto, Nguyen Phi Le	**Diamond 2** **Image and Natural Language Processing** Chair: Takahiro Komamizu	**POSTER SHOW**
9:45-10:05	*Thu Hang Phung, Duc Long Nguyen, Viet Hung Vu, Thanh Trung Huynh, Thanh Hung Nguyen and Phi Le Nguyen* **Unsupervised Air Quality Interpolation with Attentive Graph Neural Network**	*Tri Le, Nham Huynh-Duc, Chung Thai Nguyen and Minh-Triet Tran* **Motion Embedded Image: A combination of spatial and temporal features for Action Recognition**	
10:05-10:25	*Kazuhiro Ito, Taichi Murayama, Shuntaro Yada, Shoko Wakamiya and Eiji Aramaki* **Identifying A Target Scope of Complaints on Social Media**	*Tuan Linh Dang, Sy Dat Tran, Thuy Ha Hoang, Trong Nghia Nguyen and Tuan Minh Vu* **Prototype of a parking system with path recommendation**	
10:25-10:45	*Dao Hoang Long, Nguyen Hong Ngoc, Nguyen Thi My Binh, Huynh Thi Thanh Binh and Nguyen Khanh Phuong* **Investigate Evolutionary Strategies for Black-box Attacks to Deepfake Forensic Systems**	*Sang Dinh Viet and Quang Nguyen Duy* **Incremental Boundary Refinement using Self Axial Reverse Attention and Uncertainty-aware Gate for Colon Polyp Segmentation**	
10:45-11:05	*Bui Thi-Mai-Anh, Anh Ho and Nguyen Nhat Hai* **Combining Deep Learning and Kernel PCA for Software Defect Prediction**	*Cong Tran, Khanh Nguyen-Trong, Cuong Pham, Dat Tran and Tien Nguyen-Thi-Tan* **Improving text recognition by combining visual and linguistic features of text**	
11:05-11:20	*Binh Nguyen Thanh, Minh Nguyen N. H., Hanh Le Thi My and Binh Nguyen Thanh* **ml-Codesmell: A code smell prediction dataset for machine learning approaches**	*Duc Minh Le, Linh Quang Tran, Hong Thi Le, Hai Van-Anh Tong and Anh Phuong Nguyen* **Generating Multi-platform Single Page Applications: A Hierarchical Domain-Driven Design Approach**	
11:20-11:40	*Van-Quyet Nguyen, Van-Hau Nguyen, Minh-Quy Nguyen, Quyet-Thang Huynh and Kyungbaek Kim* **Big Data Knowledge Acquisition Platform for Smart Farming**	*Thi Huong Giang Vu and Thi Hong Anh Nguyen* **An improved NSGA-II based-on project scheduling principles for workforce scheduling optimization in warehouse**	
11:40-12:00	*Linh Trinh and Bach Ha* **An incorporation of deep temporal convolutional networks with hidden markov models post-processing for sensor-based human activity recognition**	*Anna Scius-Bertrand, Andreas Fischer and Marc Bui* **Retrieving Keywords in Historical Vietnamese Stele Images Without Human Annotations**	
12:00-13:30	**Lunch - Blue Bay Restaurant, 1st floor**		
13:30-14:00	**Keynote** **Path disruption games in networks** *Mourad Baiou, LIMOS lab, FRANCE* Chair: Nguyen Viet Hung **Diamond Ballroom 1**		
14:00-14:30	**Keynote** **Metaverse: Towards the next-generation immersive internet** *Long Bao Le, University of Quebec, Canada* Chair: Abdelhamid Mellouk **Diamond Ballroom 1**		
14:30-14:45	**Coffee Break**		
	Diamond Ballroom 1 **Poster Session** **10 mins oral presentation + poster prerentation** Chair: Tran Hai Anh, Hironori Nakajo	**Diamond 2** **Network Communication and Security** Chair: Sami Souhi, Trinh Van Chien	**POSTER SHOW**
14:45-15:05	*- Nguyen Tu, Do Tri, Le Khanh, Go Seungkyu, Na Sunghyun, Kim Dukyun and Tran Duc* **A LSTM-based approach for Predicting Resource Utilization in Cloud Computing** *- Thanh Nguyen Tien and Khanh-Van Nguyen* **Decision graph for timely delivery of multi-AGVs in healthcare environment** *- Luyen Ngan Van, Anh Hoang Tuan, Duy Phan The, Tan-Khoa Vo and Van-Hau Pham* **A Privacy-Preserving Approach For Building Learning Models in Smart Healthcare using Blockchain and Federated Learning**	*Hien Do Thi Thu, The Duy Phan, Hao Le Anh, Lan Nguyen Duy, Khoa Nghi Hoang and Van-Hau Pham* **A Method of Mutating Windows Malwares using Reinforcement Learning with Functionality Preservation**	
15:05-15:25	*- Nguyen Bac Trinh, The Duy Phan and Van-Hau Pham* **Leveraging Deep Learning Image Classifiers for Visual Similarity-based Phishing Website Detection** *- Viet-Bang Pham and Tuan-Dat Trinh* **Analysis Model for Decentralized Lending Protocols**	*Nam-Thang Hoang, Cong-Son Duong, Tran-Le-Tuan Nguyen, Van Tong and Hai Anh Tran* **Knowledge-defined Heterogeneous Network: Use-case of QoS-based Server and Route Selection in Large-scale Network**	
15:25-15:45	*- Bui Quoc Trung, Bui Thi-Mai-Anh and Tran Van Tri* **Empirical Analysis of Filter Feature Selection Criteria on Financial Datasets** *- Thi-Thu-Trang Do, Thai-Bao Mai-Hoang, Van-Quyet Nguyen and Quyet-Thang Huynh* **Query-based Performance Comparison of Graph Database and Relational Database** *- Nhat-Hoa Tran* **Model Checking Techniques Enable Schedulability Analysis of Real-Time Systems**	*Khanh Nguyen Quoc, Tung Bui, Dong Le, Duc Tran, Toan Nguyen and Huu Trung Nguyen Nguyen* **Detecting DGA Botnet based on Malware Behavior Analysis**	
15:45-16:05	*- Anh T. V. Nguyen and Mizuhito Ogawa* **Automatic Stub Generation for Dynamic Symbolic Execution of ARM binary** *- Hidetaro Tanaka, Tomoaki Tanaka, Ryosuke Higashi, Tsutomu Sekibe, Shuichi Takada and Hironori Nakajo* **Implementation of a RISC-V SMT Core in an AI processor**	*Thi Huong Giang Vu, Trung Hieu Hoang and Manh Tuan Nguyen* **Assessing Web Security Risks Using Dynamic Bayesian Network**	

16:05-16:25	- *Kenji Fukumoto, Risa Takeuchi, Hiroyuki Terada, Masafumi Bato and Akiyo Nadamoto* **Method for Evaluating Quality of Automatically Generated Product Descriptions** - *Taehoon Kim, Kyoung-Sook Kim and Yijun Duan* **A Shape of Geo-tagged Media Bias in COVID-19 Related Twitter** - *Anton Agafonov and Andrew Ponomarev* **Localization of Ontology Concepts in Deep Convolutional Neural Networks**	*Thi Mien Nguyen, Linh T. Nguyen, Khac-Tuan Nguyen and H. Chau Le* **Performance Analysis of Short-Packet Communications in Multi-RIS-based Uplink Systems**	
16:25-16:45	- *Futo Yamamoto, Tadahiko Kumamoto, Yu Suzuki and Akiyo Nadamoto* **Methods of Calculating Usefulness Ratings of Behavioral Facilitation Tweets in Disaster Situations** - *Namal Rathnayake, Tuan Linh Dang and Yukinobu Hoshino* **Designing and Implementation of Novel Ensemble model based on ANFIS and Gradient Boosting methods for Hand Gestures Classification**	*Minh Hai Vu, Giang T. T. Nguyen, Hai Dang Tran, Thanh Trung Nguyen, Phan Thuan Do, Phi Le Nguyen and Kien Nguyen* **An Empirical Study of MPQUIC Schedulers in Mobile Wireless Networks**	
16:45-17:05	- *Duc-Anh Nguyen, Trong-Dat Nguyen, Phuong-Hanh Du, Nam-Hai Dao and Hoa Nguyen Ngoc* **EnsFace: An Ensemble Method of Deep Convolutional Neural Networks with Novel Effective Loss Functions for Face Recognition** - *Nhu Khoa Nguyen, Emanuela Boros, Gaël Lejeune, Antoine Doucet and Thierry Delahaut* **Utilizing Keywords Evolution in Context for Emerging Trend Detection in Scientific Publications**	*Papa Bara Diakhate, Tran-Tuan Chu, Mohamed Aymen Labiod, Brice Augustin, Hai-Anh Tran and Abdelhamid Mellouk* **Experimental Evaluation of Multiple Multipath Schedulers over Various Urban Mobile Environments**	
17:05-17:25	- *Trinh Van Chien and Thuong Nguyen Canh* **Error Resilient Deep Compressive Sensing** - *Van Duc Khuat, Tuan Anh Tran, Minh Tuan Nguyen and Hai-Chau Le* **A Study on Machine Learning Based Gene Selection for Pediatric Sepsis Classification** - *Cong Phuoc Phan* **Covid-19 Deep Clustering: A Covid-19 Ontology construction method with research documents clustering and dynamic medical labeling**	*Hoang V.Vo, Duong H.Nguyen, Tuyen T.Nguyen, Hoa N.Nguyen and Duan V.Nguyen* **Leveraging AI-Driven Realtime Intrusion Detection by Using WGAN and XGBoost**	
18:30	**Gala dinner** **Diamond Ballroom 1** **Wyndham Legend Halong**		
3 December 2022 **Wyndham hotel, Ha Long Bay**			
14:00-16:30	**Transfer to Hanoi**		

THURSDAY, DECEMBER 1ST

08:30-09:00 Registration

LOCATION: Lecture Hall, 3rd floor, B1 Building, HUST

09:00-09:15 Opening

LOCATION: Lecture Hall, 3rd floor, B1 Building, HUST

09:15-09:45 Session 1

LOCATION: Lecture Hall, 3rd floor, B1 Building, HUST

09:15 *David Lo*

Keynote 1: Data to Knowledge to Automation: How Can AI Boost Software Quality?

ABSTRACT. Bugs are prevalent in software systems. Needless to say, these bugs need to be identified, managed and fixed to improve software quality. Unfortunately, these tasks are non-trivial; many bugs remain hidden or unfixed for weeks (or even years!). Can AI help? Of course! AI can be trained on rich historical data to allow it to mimic developers in squashing bugs (and more!). For AI to work well, it often needs to be trained on a sizable amount of data. Fortunately, many projects maintain large historical data in various repositories that are publicly available. Although full automation is not feasible yet (at least in the general sense), AI-infused solutions can support developers in their quest to identify, manage, and fix bugs (and thus remaining successful despite living with bugs). This talk will provide an overview and reflection of the large body of work that builds automated tools that leverage the power of AI, trained on rich data in various repositories, for various tasks in the bug identification, management, and fixing process. Some open challenges will also be presented, with the goal of encouraging more research in this exciting area in the intersection of Software Engineering and AI.

09:45-10:15 Session 2

LOCATION: Lecture Hall, 3rd floor, B1 Building, HUST

09:45 *Laurent El Ghaoui*

Keynote 2: Implicitly-defined prediction rules in deep learning

ABSTRACT. In the quest of using machines to predict and learn complex behaviors and situations, deep learning is the rage of the day. Recently, prediction rules based on so-called implicit models have emerged as a new high-potential paradigm in deep learning. These models rely on an “equilibrium” equation to define the prediction, instead of a recurrence through multiple layers. Currently, even very complex deep learning models are based on a “feedforward” structure, without loops, and as such the popular term “neural” applied to such models is not fully warranted, since the brain itself possesses loops. Allowing for loops may be the key to describe complex higher-level reasoning, which has so far eluded the deep learning paradigms. However, it raises the fundamental issue of well-posedness, since there may be no or multiple solutions to the corresponding equilibrium equation. In this talk, I will review some aspects of implicit models, starting from a unifying “state-space” representation that enables to connect deep learning with (convex) optimization. I will illustrate these connections via topics such as model compression and robustness; and show that the implicit models have the potential to capture more complex behaviors than current deep learning ones.

10:15-10:30 Photo session

LOCATION: Lecture Hall, 3rd floor, B1 Building, HUST

10:30-10:45 Coffee Break

10:45-12:05 Session 3A: AI Foundation and Big Data

LOCATION: Lecture Hall, 3rd floor, B1 Building, HUST

10:45 *An Vo, Tan Ngoc Pham, Van Bich Nguyen and Ngoc Hoang Luong*

Training-Free Multi-Objective and Many-Objective Evolutionary Neural Architecture Search with Synaptic Flow

ABSTRACT. Neural architecture search (NAS) algorithms often suffer from the expensive computation cost because a sufficient number of candidate architectures need to be evaluated during the search. Each architecture evaluation involves hundreds of training epochs to obtain proper weights for computing the accuracy of that architecture. Recently, a training-free performance metric Synaptic Flow has been proposed to facilitate these architecture evaluations. Synaptic Flow can be computed using randomly initialized network weights and its values are found to have certain correlation degree with network test accuracy. Furthermore, in real-world neural architecture designing, network performance (e.g., test accuracy) is not the sole objective, and network complexity metrics (e.g., the number of parameters, latency) are also considered. In this paper, we investigate several multi-objective NAS problem formulations, where each involves one performance metric and one complexity metric, and a many-objective NAS problem formulation, that involves one performance metric and four complexity metrics. We consider two variants of the performance metric for each formulation: a training-based variant that employs network accuracy and a training-free variant that employs Synaptic Flow. We use the non-dominated sorting genetic algorithm II to solve these NAS problem formulations, and then compare the quality of the obtained architectures and the efficiency of solving each formulation. Experimental results on standard benchmark NATS-Bench exhibit the advantages of the training-free many-objective evolutionary NAS (TF-MaOENAS) approach in obtaining competitive architectures with reasonable computing cost.

11:05 *Luat Le Ba, Bach Do Viet, Hoang Ha Minh and Giang Pham Hoang*

Optimizing energy generation in short-term hydro unit commitment using efficiency points

ABSTRACT. In this article, we consider the hydro unit commitment (HUC) problem arising at the Son La hydropower plant. This problem aims to minimize the total input power used to produce a given amount of electricity and satisfy the technological constraints of the turbines. The problem is divided into two phases: 1) estimating the unit efficiency function from the hill chart provided by the turbine's manufacturer, and 2) determining the optimal unit commitment based on that function. An Epsilon-Support Vector Regression (Epsilon-SVR) model is implemented to precisely approximate the nonlinear function of the unit efficiency in the first phase. The Mixed-Integer Linear Programming (MILP) formulation utilizing this function with binary variables, which determines the target power used at each unit set up, is established in the second phase. The final results are compared to the usual cost incurred by the manual approach to determine the effectiveness of this model.

11:25 *Yusuke Kimura, Takahiro Komamizu and Kenji Hatano*

Multi-task Learning-based Text Classification with Subword-Phrase Extraction

ABSTRACT. Text classification using deep learning, which is trained with a tremendous amount of text, has achieved superior performance than traditional methods. In addition to its success, multi-task learning has become a promising approach for text classification; for instance, a multi-task learning approach employs named entity recognition as an auxiliary task for text classification. The existing MTL-based text classification methods depend on auxiliary tasks using supervised labels, which require large human and/or financial efforts to create. To reduce these efforts, this paper proposes a multi-task learning-based text classification framework which reduces the additional efforts on supervised label creation. A basic idea to realize this is that to utilize phrasal expressions consisting of subwords (called subword-phrase). To the best of our knowledge, there has been no text classification approach on top of subword-phrases, because subwords do not always express a coherent set of meanings. The proposed framework is new to add subword-phrase recognition as an auxiliary task, and to utilize subword-phrases for text classification. To realize the low-cost auxiliary recognition task, the framework extracts subword-phrases in an unsupervised manner. The

experimental evaluation of the five popular datasets for text classification showcases the effectiveness of the involvement of the subword-phrase extraction as an auxiliary task. It also shows comparative results with the state-of-the-art method.

11:45 *The Duy Phan, Tran Duc Luong, Nguyen Hoang Quoc An, Quyen Nguyen Huu, Hoàng Khoa Nghi and Van-Hau Pham*

Leveraging Reinforcement Learning and Generative Adversarial Networks to Craft Mutants of Windows Malware against Black-box Malware Detectors

ABSTRACT. To build an effective malware detector, it is required to collect a diversity of malware samples and their evolution, since malware authors always try to evade detectors through strategies of malware mutation. So, this paper explores the ability to craft mutants of malware for gathering numerous mutated samples in training a machine learning (ML)-based malware detector. Specifically, we leverage Reinforcement Learning (RL) and Generative Adversarial Networks (GAN) to generate adversarial malware samples against ML-based detectors. The more we use this approach with different targeted antivirus and malware samples in training the RL agent as a malware mutator, the more it learns how to avoid black box malware detectors. The experimental results in real-world dataset indicate that RL can help GAN in crafting variants of malware with executability preservation to evade ML-based detectors and VirusTotal. Finally, this approach can be used as an automated tool for benchmarking the robustness of malware detectors against the metamorphic malwares.

10:45-12:05 Session 3B: Image and Natural Language Processing

LOCATION: Room 404, 4th floor, B1 Building, HUST

10:45 *Minh-Hieu Huynh, Bao Bui-Xuan and Minh-Triet Tran*

Sports Visual Data Analysis with Deep Vision

ABSTRACT. The sports industry is surrounded by opportunities in all facets, including sports marketing, sports media, education institutions, sponsorship, and so on. They are adopting the newest technology such as computer vision to improve coaching task as well as benefit the sport broadcasting industry. In this paper, we examine action spotting in sports, particularly soccer. We found the SoccerNet challenge, which is a soccer video understanding challenge. SoccerNet provides a dataset for action spotting in soccer of 550 videos of famous leagues in recent years along with the event annotations in 17 classes. Action spotting is a concept that SoccerNet defined as finding the anchor time (or spot) that identifies an event. Inspired by previous successful methods under the action spotting task NetVLAD++ [9] and AudioVid [15], we propose a multimodal architecture that learns temporal features of both visual and audio representation of video data. Our method achieves an mAP of 56.58%, which rises 3.18% higher than NetVLAD++ and 16.68% higher than AudioVid. Furthermore, we integrate that research into a web-based platform in order to contribute to the annotation industry. This platform consists of a client application written in ReactJS and a backend server. Both of them are deployed on the Google Cloud Platform so that users can experience our platform on any device without complex installation.

11:05 *Quang-Tien Pham, Duc-Anh Nguyen, Tien-Thanh Nguyen, Thanh Nam Nguyen, Duy-Tung Nguyen, Dinh-Tan Pham, Thanh Hai Tran, Thi-Lan Le and Hai Vu*

A study on skeleton-based action recognition and its application to physical exercise recognition

ABSTRACT. In recent years, human action recognition (HAR) has been an attractive research topic in computer vision since HAR has been widely applied in various fields, such as gaming, healthcare, surveillance, and human-machine interaction. In this paper, we present a feasible solution to develop a real-time HAR application that helps one monitor physical exercises. As an end-to-end solution, the proposed framework consists of techniques that recognize the physical exercises and spot each in real-time, and assess the quality of the practicing users. Firstly, we define nine common physical exercises, such as arm circles,

squats, jumping jacks, etc. We then construct a dataset named COMVIS-FITNESS consisting of the physical exercises dataset of nine subjects. We argue the advantages of two different deep neural networks for HAR to recognize the exercises. One is a compact HAR neuronal network named DD-Net, and another is a high-performance graph convolutional neural network called FF-AAGCN. For spotting the exercises from an image sequence, a sliding window method is combined with these two networks to make a real-time classification. A technique to evaluate the workout of the practicing user is proposed. Experimental results on COMVIS-FITNESS show that deep neural networks can recognize all exercises in the datasets with high accuracy. The accuracies and F1-scores of DD-Net are 99.24% and 99.23%, while those obtained by FF-AAGCN are 98.48% and 98.32%, respectively. The completed pipeline of the proposed method is warped in an application. The application works in real-time on edge device as Jetson Xavier AGX. The proposed techniques and dataset are made publicly available.

11:25 *Hai Vu, Cong Nguyen Xuan, Minh Nghia Le, Duc Anh Nguyen and Viet Hang Dao*

A robust and high-performance neural network for classifying anatomical landmarks from Upper GastroIntestinal Endoscopy Images

ABSTRACT. Gastrointestinal Endoscopy in real-time needs to be done quickly and accurately. During endoscopic examination, the technical doctor must spend a lot of time trying to classify anatomical landmarks before proceeding further works such as lesion detection or abnormal region segmentation. The endoscopist also can ensure the completion of examination with the help of the anatomical landmarks. In this study, we develop a robust and high-performance neural network classifying ten anatomical landmarks in Upper Gastrointestinal tract. To this end, the proposed method consists of a Siamese Neural Network (SNN) to learn an efficient (dis)similarity metric of a pair of the landmarks. We then propose to use the weight that is learnt by SNN to a CNN-based structure for the feature extraction. The proposed CNN-based architecture is a lightweight model of Resnet-18 that is designed to achieve the best performance as well as low cost of computational time. Finally, we utilize a SVM classifier to automatically classify ten anatomical landmarks from the Upper Gastrointestinal endoscopic images. The dataset used in this study is collected in four lighting modes such as White-light Imaging (WLI), FICE (Flexible spectral imaging color enhancement), BLI (Blue Light Imaging) and LCI (Linked color imaging). The dataset is labeled by endoscopists with more than five years of experience. To enrich the dataset, we also research and propose the argumentation techniques as effectively as possible. The augmented data includes combination of the geometrical transforms and the data generated using CycleGAN deep learning networks. The proposed method achieves work well with four lighting modes without depending on a certain lighting mode. It achieved 96.3% sensitivity, 99.6% specificity, and 99.3% accuracy. As result of the computational time, we achieved about 60 FPS (Frame Per Second) while using 20W average power with the deep learning framework Pytorch on the Jetson Xavier AGX.

11:45 *Anh Le, Quang Uy Nguyen, Ngoc Tran Nguyen, Hai-Hong Phan and Thi Huong Chu*

An integration of Pseudo Anomalies and Memory Augmented Autoencoder for Video Anomaly Detection

ABSTRACT. Video anomaly detection (VAD) has received a lot of attention from the research community in the recent years. The purpose of VAD is to identify anomalous appearance and behavior of objects in videos. Due to the difficulty in collecting anomalous data, video anomaly detection is often based on one-class classification (OCC) problem. Among the methods, deep autoencoders have been shown to be effective for anomaly detection in video. Specifically, autoencoders are only trained on normal images during the training time, then it is expected to reconstruct or predicted well for normal frames but poorly for anomalous ones at the test time. Contrary to the expectation, abnormal frames may have a chance being well constructed by trained autoencoders because of the powerful representation capacity of the deep neural network as well as the diversity of normal patterns. To address the issue, we propose a strategy called and shortened as PA-MAE (Pseudo Anomalies-Memory Augmented Autoencoder) which feeds pseudo anomalies into a memory augmented autoencoder network during training time. Therefore, the proposed model is able to take the advantage of both memory-based autoencoder networks and pseudo-anomaly synthesizers which can store

the prototypical features of the normal frames and produce high reconstruction errors on dummy anomaly examples. Experimental results on several benchmark video datasets (i.e. Ped2, Avenue and ShanghaiTech) demonstrate that our method outperforms some state-of-the-art memory augmented methods as well as several recent models using pseudo-anomaly synthesizers.

10:45-12:05 Session 3C: Blockchain

LOCATION: Room 403, 4th floor, B1 Building, HUST

10:45 *Ta Minh Thanh*

Blockmarking: Hybrid Model of Blockchain and Watermarking Technique for Copyright Protection

ABSTRACT. Digital contents have become more popular and rapid in recent years. The need of techniques for digital content protection is also quickly required. Various watermarking techniques are proposed for protecting the digital contents. Blockchain technology has also become very popular and applied on many solutions. This paper proposes a new hybrid model based on the combination of blockchain and watermarking method. The main purpose is not only to achieve the goal of image copyright protection but also storage the image into the blockchain network. Since our proposed method employs the blockchain mechanism, the digital contents authentication mechanism does not need third party resources. Our experimental results demonstrate that the proposed method successfully achieved the goal of digital copyright protection.

11:05 *Ba-Lam Do*, *Hoang-Nam Dinh*, *Van-Thanh Nguyen*, *Manh-Hung Tran*, *Thanh-Long Le* and *Viet-Thang Nghiem*

B4E: A System for Creating and Validating Digital Credentials using Remote Signing and Blockchain

ABSTRACT. In recent years, a large number of organizations and universities, such as EduCTX, BCDiploma, Singapore universities, etc., have used blockchain technology in creating and validating certificates because of the advantages of transparency and data immutability. The generated digital certificates can be quickly verified through decoding data and verifying the issuer information on the blockchain network. However, this digitization process contains a significant drawback in identifying the issuer. Specifically, the head of an educational institution typically cannot sign into digital certificates, but merely the data of these certificates is written to the blockchain network by technically proficient staff. To solve this problem, we build a digital credentials creation and validation system named B4E based on two technologies, i.e., remote signing and blockchain. In particular, the remote signing allows the head of the organization to digitally sign the credentials, similar to signing traditional paper credentials. After that, information about the signed digital credentials is uploaded to the blockchain network. In this paper, we present our approach, describe the B4E system, introduce the process of digitizing a specific certificate, and provide performance evaluations.

11:25 *Thanh-Chung Dao*, *Le-Duc Pham*, *Tien-Thao Nguyen*, *Ba-Lam Do* and *Binh Minh Nguyen*

V-Endpoint: Decentralized Endpoint for Blockchain Applications Based on Spark and Byzantine Consensus

ABSTRACT. A blockchain endpoint is a gateway where provides APIs to applications to read and write transactions on the blockchain network. As a result, endpoints such as Etherscan and BlockCypher make access to blockchain network easier and more flexible. However, we found that those centralized endpoints are unsafe and easy to be malicious and attacked. To address this issue, we present a decentralized endpoint named V-Endpoint which receives transactions from multiple endpoints and validates them based on Byzantine consensus. V-Endpoint is implemented based on Spark and evaluated on Hyperledger Fabric network. The experimental results show the throughput could be improved 240% on average in comparison with a centralized endpoint.

11:45 *Phuong N. H. Pham*, *Quy T. N. Co*, *Anh N. Su*, *Phuong T. Pham*, *Canh V. Pham* and *Vaclav Snasel*

k-Submodular Cover Problem: Application and Algorithms

ABSTRACT. In this paper, we investigate a novel combinatorial optimization, k-Submodular Cover, as follows: Given a finite set V, a monotone k-submodular function $f: (k+1)^V \mapsto \mathbb{R}_+$, and a threshold $T \leq \max_{\x \in (k+1)^V}f(\x)$. The problem aim at finding a solution $\s=(S_1, S_2, \ldots, S_k)$ with the size $|supp(\s)|=\sum_{i=1}^k|S_i|$ is minimal so that the function $f(\s)\geq T$. This problem is a general version of the well-known Submodular Cover problem and thus it is NP-hard. Two efficient algorithms for the k-Submodular Cover problem are proposed. The first one is Greedy algorithm and the second one is a Streaming algorithm with theoretical guarantees. Extensive experiments on real-world datasets show that the proposed algorithms are more effective than the state-of-the-art methods in the application of Influence Threshold with k topics. In particular, our streaming algorithm not only provides a guaranteed theoretical solution, but also proves to be superior to the rest of the algorithms in terms of time.

12:05-13:00 Lunch, 10th floor, BKAI, B1 Building, HUST

13:00-14:20 Session 4A: AI Foundation and Big Data

LOCATION: Lecture Hall, 3rd floor, B1 Building, HUST

13:00 *Thai Bao Tran and Ngoc Hoang Luong*

Benchmarking Gradient Estimation Mechanisms in Evolution Strategies for Solving Black-Box Optimization Functions and Reinforcement Learning Problems

ABSTRACT. In this paper, we investigate the gradient estimation mechanisms of three evolution strategies (ES) algorithms: the vanilla ES (VES), the Guided Evolutionary Strategies (GES), and the Self-Guided Evolution Strategies (SGES). The vanilla ES generates search directions (i.e., its population individuals) following an isotropic Gaussian distribution from the full parameter space, yielding unbiased estimations of the true gradient vectors but suffering from sample inefficiency in high-dimensional problems. GES and SGES aim to construct low-dimensional guiding subspaces, that potentially contain the true gradients, from which search directions for computing gradient estimates can be generated in a more efficient manner. We perform experiments with a variety of high-dimensional optimization problems, including multi-modal black-box functions and noisy reinforcement learning locomotion tasks. Experimental results help pinpoint the essential components of these algorithms and the important issues that need to be considered for their successful applications in solving challenging optimization problems.

13:20 *Anh Son Ta* and *Ngoc Bach Pham*

Solving resource forecasting in WiFi Network by NeuralProphet

ABSTRACT. Time series forecasting requires many techniques such as data preprocessing, model building, etc. During the covid 19 epidemic, the data is highly volatile, so data processing and effective modeling are concerned. Identifying trends, detecting anomaly data points, is one of the first steps to improve forecast results. A point is called an anomaly point when it is far away from the mean of the data series. In this paper, we apply an automatic anomaly detection method that combines data preprocessing of neuralprophet library. After that, we build a model by neuralprophet to forecast data after preprocessing data. The method is tested on a dataset of the times that public wifi was accessed per day with the aim of predicting the value of the next 30 days. Each day is a data point. The forecasted outcome is compared with that of Prophet, hybrid AR-LSTM, thereby showing that the proposed process in the paper gives the best results.

13:40 *Asad Khattak* and *Adil Khan*

Cross-Location Activity Recognition using Adversarial Learning

ABSTRACT. Human activity recognition (HAR) is an emerging field of study to recognize human movement and actions from recorded data. It plays a significant role in human-computer interaction. Depending upon their complexity, human activities are divided into gestures, actions, interactions, and group activities. This

work aims at introducing the importance of building a system for recognizing human actions such as indoor activities (sitting, standing) and outdoor activities (running, walking), often called low-level activities, using Wi-Fi signals. Although a Significant amount of work has been done on human activity recognition based on WiFi Channel State Information (CSI) with significant results but they face one major issue of Location Dependency. An activity recognition model trained at one location does not perform properly at other locations, because the human location also has significant influence on Wi-Fi signal propagation. The main objective is to make predictions independent of the location of the Wi-Fi device, which is necessary to improve the generalization of such systems. That is, our aim is to develop a location independent WiFi based HAR system that can be trained using data captured from different locations, such that it is capable of providing accurate predictions on data coming from new locations via Adversarial learning, i.e., locations that are not part of the training process. In this thesis, we highlight the importance of building such a system, its significance from the perspective of different real-world applications, a hierarchical architecture of the model for learning location-independent representations from the signals using adversarial training, and the results of validation/evaluation of the proposed system on a public benchmark. The obtained results highlight the success of our proposed system in learning location-independent representations which provide a significant boost in the recognition performance of downstream classifiers trained on such representations.

14:00 *Khoa Nguyen*, *Nghia Vu*, *Dung Nguyen* and *Khoat Than*

Random Generative Adversarial Networks

ABSTRACT. Generative Adversarial Networks have surprisingly shown great ability in synthesizing high-fidelity and diverse images while resolving the problem of so-called mode collapse still remains a challenge to all researches in this field. In this paper, we propose a new GANs method called Random Generative Adversarial Networks (RandomGANs), a combination of Random Forest algorithm and Generative Adversarial Networks, in which utilizes multiple discriminators where each discriminator is considered as a decision tree and each of them will be separately trained on a separated dataset that sampled without replacement from the original dataset. We empirically demonstrate (1) the quality of generated images in RandomGANs and their strong similarity to real images, (2) show how different knowledge each discriminator learns by comparing with others and overcoming the mode-collapse problem by encouraging the Discriminator to discover a wide range of different modes in the input data, and (3) indicate how our model betters in stabilizing the training process between generator and discriminator part.

13:00-14:20 Session 3B: Image and Natural Language Processing

LOCATION: Room 404, 4th floor, B1 Building, HUST

13:00 *Quang Tien Duong, Duc Huy Nguyen, Bao Thang Ta, Nhat Minh Le and Van Hai Do*

Improving Self-supervised Audio Representation based on Contrastive Learning with Conformer Encoder

ABSTRACT. Self-supervised contrastive learning has drawn much attention due to its stunning performance in speech and audio processing. Recent works in music information retrieval (MIR) or audio classification tasks also adopted this paradigm. However, most existing MIR frameworks construct their pipeline with augmented-segmented training and use convolution-based architecture; therefore, the audio sequential correlations are collapsed. This paper proposes a method using a Conformer-based encoder-projector model to deal with this problem. The experiments conducted on various test instances showed that our model has competitive results compared to the state-of-the-art convolution model in normal-speed audio and superior performance in speed-perturbed experiments thanks to preserving the sequential context ratio distribution.

13:20 *Hanh Pham Van* and *Huong Le Thanh*

Improving Khmer-Vietnamese Machine Translation with Data Augmentation methods

ABSTRACT. Machine translation has achieved significant improvements with the development of neural models. However, such approaches require large-scale parallel data, which are hard to collect for low-resource language pairs. This paper proposes an approach to deal with this problem by applying a pre-trained multilingual model and fine-tuning it with low-resource language training datasets. In addition, we propose a combination data-augmentation strategy to receive new training data, including: (i) back-translating with the dataset from the source language; (ii) translating sentences from the source language to the target one through a pivot language. The proposed approach is applied to the Khmer-Vietnamese machine translation. Experimental results shown that our proposed approach gains 4.426\% BLEU-score higher than the Google translator model using a test set of 2000 Khmer-Vietnamese sentence pairs.

13:40 *Namal Rathnayake*, *Tuan Linh Dang* and *Yukinobu Hoshino*

Designing and Implementation of Novel Ensemble model based on ANFIS and Gradient Boosting methods for Hand Gestures Classification

ABSTRACT. Communication through hand gestures has always been the primary method worldwide. There are numerous methods implemented for the classification of hand gestures. However, most successful attempts use Convectional Neural Network (CNN) based methods, which are high in resource consumption and computational complexity, leading to problematic implementation in low-resource platforms. This study proposes a lightweight, efficient, and effective hand gesture recognition method using a novel ensemble model. The proposed ensemble method used XGBoost, CatBoost, and LightGBM gradient boosting algorithms as the initial classification. Then the Adaptive Network-based Fuzzy Inference System (ANFIS) algorithm was used to boost the accuracy. The dataset used in this study contains seven hand gesture classes and 350 samples, while each sample was generated using 30 frames summation of a sequence. The results were evaluated using two methods such as 10-fold cross-validation and confusion matrix-based parameters. The proposed ensemble algorithm outperformed eXtreme Gradient Boosting (XGBoost), Categorical Boosting (CatBoost), and Light Gradient Boosted Machine (LightGBM) algorithms in average accuracy, precision, recall, and f1-score, having 99%, 0.99, 0.97, and 0.98.

14:00 *Huu Hiep Nguyen*, *Ngoc Dung Nguyen* and *Khac-Hoai Nam Bui*

Intent Detection and Slot Filling with Low Resource and Domain Similarity

ABSTRACT. This study takes an investigation on intent detection and slot filling, which are two critical tasks for spoken language understanding, of low-resource languages, for instance, the Vietnamese language. Specifically, recent joint models for intent detection and slot filling have achieved state-of-the-art performance, which has proved the strong relationship between the two tasks. In this paper, we focus on the problem of the joint models for two tasks on low resource language, in which the data resource is limited, which leads to the problem of similarity between samples (e.g., in the same domain). Particularly, we present a new method for the aforementioned issues by combining two recent state-of-the-art models in this research field such as JointBERT and JointIDSF for Vietnamese languages. The experiment on PhoATIS, the first public Vietnamese dataset, and our custom similarity for intent detection and slot filling, indicate the promising results of the proposed method.

14:30-15:00 Session 5A

LOCATION: Lecture Hall, 3rd floor, B1 Building, HUST

14:30 *Tung Dao*

Tutorial 1: Building Better Models Faster: A Charming Tool for Versioning Data and Experiments

ABSTRACT. Machine Learning is experimental in nature. We try various features, algorithms, modeling techniques, and parameter configurations in order to find the best solution for the problem as quickly as possible. The challenge is keeping track of what worked and what didn't, as well as preserving reproducibility

while maximizing code reusability. This is where MLOps comes to play an essential role in Machine Learning systems development. This tutorial equips ML researchers and practitioners, who want to automate and operate their ML products, with a lightweight and interoperable MLOps tool to spend less time manually tracking results, version datasets and experiments with reproducibility, and tune hyperparameters automatically.

14:30-15:00 Session 5B

LOCATION: Room 404, 4th floor, B1 Building, HUST

14:30 *Shui Yu*

Tutorial 2: High Quality Paper Writing – persuasive writing with evidence

ABSTRACT. High quality publication is an important metric to most of us (faculty members, especially PhD students). Many passionate young researchers struggle to find the right way to achieve their success in publication. In this talk, we would like to discuss this from different perspectives as an editor, a reviewer, and an author: the key is persuasive writing with evidence. We humbly hope the talk will shed light for ambitious hard-working young researchers.

15:30-18:00 Transfer to Ha Long Bay

FRIDAY, DECEMBER 2ND

08:30-09:00 Registration

LOCATION: 2nd floor, Wyndham Legend Halong

08:30-09:00 Session 6

LOCATION: Diamond Ballroom 1, Wyndham Legend Halong

08:30 *Nasir Memon*

Keynote 3: Combating Deepfakes: Recent Approaches and Challenges

ABSTRACT. The integrity of online video interactions is threatened by the widespread rise of AI-enabled high-quality deepfakes that are now deployable in real-time. In this talk we will discuss how deepfakes are generated, focusing mainly on videos. We will then describe some of the approaches that have been developed to combat deepfakes and associated research challenges.

09:00-09:30 Session 7

LOCATION: Diamond Ballroom 1, Wyndham Legend Halong

08:30 *Shin'Ichi Satoh*

Keynote 4: Boosting Image Retrieval by Diffusion

ABSTRACT. Image retrieval is the technology which retrieves images relevant to a query from given large-scale image database. Image retrieval witnesses significant performance improvement by recent technical breakthrough, especially deep learning technologies, similar to other visual recognition tasks such as image classification, object detection, segmentation, among others. However, image retrieval has different technical aspect compared to the other visual recognition tasks: the performance is strongly influenced by referring to the distribution of images in the database. Diffusion is such a technology: it is know to be very effective and also flexible in boosting the performance of image retrieval by inspecting the distribution of images in the database. In this talk, the basics of diffusion will be introduced first, and then couple of technical attempts to improve the performance of image retrieval will be explained.

09:30-09:45 Coffee Break

09:45-12:00 Session 8A: AI Foundation and Big Data

LOCATION: Diamond Ballroom 1, Wyndham Legend Halong

09:45 *Thu Hang Phung, Duc Long Nguyen, Viet Hung Vu, Thanh Trung Huynh, Thanh Hung Nguyen and Phi Le Nguyen*

Unsupervised Air Quality Interpolation with Attentive Graph Neural Network

ABSTRACT. Rapid industrial expansion, urbanization, and traffic growth have led to a decline in air quality that significantly impacts human health and environmental sustainability, particularly in developing nations. Due to the limited number of monitoring stations, the air quality index is not gathered at numerous locations. To address the difficulty of predicting the air quality value at an arbitrary place, several studies, including statistical and machine learning approaches, have been proposed. The majority of existing research employs classic distance-based interpolation techniques. In this paper, we propose a novel attentive neural-based approach for estimating unmonitored air quality values. This method follows the encoder-decoder paradigm, with the encoder and decoder being learned independently utilizing distinct processes. In the encoder, we propose AGE, an inductive unsupervised learning methodology that integrates attention mechanisms. AGE learns a set of functions that generate spatial embeddings by aggregating features from the surrounding region. For the decoder, we utilize the Gated Recurrent Unit and a fully-connected layer to estimate the air quality index at the targeted location. We conduct extensive experiments to evaluate the performance of our proposed method and compare it to the state-of-the-art (SOTA). The experimental results show that our approach reduces the estimation error from 8.07% to 37.04% compared to the SOTA.

10:05 *Kazuhiro Ito*, *Taichi Murayama*, *Shuntaro Yada*, *Shoko Wakamiya* and *Eiji Aramaki*

Identifying A Target Scope of Complaints on Social Media

ABSTRACT. A complaint is uttered when reality violates one's expectations. Research on complaints, which contributes to our understanding of basic human behavior, has been conducted in the fields of psychology, linguistics, and marketing. Although several approaches have been implemented to the study of complaints, studies have yet focused on a target scope of complaints. Examination of a target scope of complaints is an important topic because the functions of complaints, such as evocation of emotion, use of grammar, and intention, are different when the target scope of complaints is different. We first tackle the construction and release of a complaint dataset of 6,418 tweets by annotating Japanese texts collected from Twitter with labels of the target scope. Our dataset is available at https://github.com/sociocom/JaGUCHI. We then benchmark the annotated dataset with several machine learning baselines and obtain the best performance of 90.4 F1-score in detecting whether a text was a complaint or not, and a micro-F1 score of 72.2 in identifying the target scope label. Finally, we conducted case studies using our model to demonstrate that identifying a target scope of complaints is useful for sociological analysis.

10:25 *Dao Hoang Long*, *Nguyen Hong Ngoc*, *Nguyen Thi My Binh*, *Huynh Thi Thanh Binh* and *Nguyen Khanh Phuong*

Investigate Evolutionary Strategies for Black-box Attacks to Deepfake Forensic Systems

ABSTRACT. In recent years, since the rising of deepfake generation techniques, cyber security against misinformation has become a popular topic among the research community. To improve the robustness of deepfake detection, attacks such as adversarial examples are studied with the aim to exploring weaknesses and security leaks. While most adversarial example generators are based on the assumption of white-box attack, in this paper, we review a more realistic black-box attack scenario using evolutionary approaches. A wide range of popular evolutionary strategies such as Genetic Algorithm (GA), Particle Swarm Optimization (PSO), and Differential Evolution (DE) along with their quantum-inspired versions, are evaluated. The black-box attacks are shown to be highly effective against state- of-the-art forensics, exposing a vulnerability in

current defense techniques. Analysis of the performance of different evolutionary strategies used for attacking also reveals insights on possible solutions to counter against the attacks.

10:45 *Bui Thi-Mai-Anh*, *Anh Ho* and *Nguyen Nhat Hai*

Combining Deep Learning and Kernel PCA for Software Defect Prediction

ABSTRACT. Software defect prediction aims to automatically determine the most likely location of defective program elements (i.e., statement, method, class, module etc.) in order to help quality assurance teams to prioritize testing resource allocation. Previous studies for software defect prediction mainly focus on exploring designing features such as source code complexity, object oriented design metrics etc. to classify program elements into two categories: (i) defective and (ii) non-defective. Although these approaches have obtained promising results, there exists two significant challenges in this research field: (i) removing irrelevant and redundant information from designing structures to effectively detect the defect-proneness of software components; (ii) reducing the impact of skewed data distribution on learning models as far fewer of source code files contain defects while the majority of them are clean. In this paper, we aim to address these two issues by firstly applying kernel PCA to extract essential information from designing features and secondly proposing a deep neural network model which investigates the non-linear relationship among features. In order to mitigate the class imbalance, we apply a weighted loss function combined with a bootstrapping method to handle batch training mechanism of our model. We conducted some experiments to assess the performance of our proposed approach over NASA (with five projects) and PROMISE (with 34 projects) datasets. In order to leverage the efficiency of kernel PCA technique in software defect prediction, we compared it to some traditional feature selection approaches over a high-dimensional dataset Eclipse. The empirical results showed that our proposed method has outperformed these other state-of-the-art models by effectively predicting defective source files

11:05 *Binh Nguyen Thanh*, *Minh Nguyen N. H.*, *Hanh Le Thi My* and *Binh Nguyen Thanh*

ml-Codesmell: A code smell prediction dataset for machine learning approaches

ABSTRACT. In recent years, many studies on detecting code smells in source code have published datasets with limited characteristics, such as the ambiguity of code smell definitions leads to different interpretations for each code smell, the number of samples of the datasets is small, and the features of the datasets are heterogeneous. Therefore, comparing performance between detecting code smell models is challenging, and the datasets are often not reusable in other code smell detection studies. In this work, we propose the ml-Codesmell dataset created by analyzing source code and extracting massive source code metrics with many labelled code smells. The proposed dataset has been used to train and predict code smell using machine learning algorithms. Based on the high confidential F1-score in evaluation, the ml-Codesmell dataset demonstrates a strong correlation between features and labels. Regarding these advantages, the ml-Codesmell dataset is expected to be helpful for studies on detecting code smell using machine learning approaches in software development.

11:25 *Van-Quyet Nguyen*, *Van-Hau Nguyen*, *Minh-Quy Nguyen*, *Quyet-Thang Huynh* and *Kyungbaek Kim*

Big Data Knowledge Acquisition Platform for Smart Farming

ABSTRACT. Nowadays, big data enables to discover many aspects in agriculture sector such as finding unknown crop patterns or predicting the price of products. However, these massive data are often complex and heterogeneous which includes both structured (e.g., farm information) and unstructured data (e.g., image data from drones, sensor data). It is required new techniques and tools to extract and represent valuable information in the form of human understanding to improve decision making for enhancing farm management. In this paper, we propose a big data knowledge acquisition platform which consists of efficient knowledge acquisition techniques integrated with an intuitive visualization tool supporting decision making applications. Firstly, we deploy open source big data frameworks (e.g., Flume, Storm, Sqoop, Hive, HBase) to support developing of multiple methods for collecting and storing data. Secondly, we implement distributed machine learning techniques on Hadoop and Spark to acquire knowledge from big data sources.

Finally, we provide a visualization tool on web interface which can display extracted knowledge in multiple views (e.g., charts, tables) to support decision making applications. Experiments with real datasets show that the proposed platform is efficient and effective to answer important questions in smart farming.

11:45 *Linh Trinh* and *Bach Ha*

An incorporation of deep temporal convolutional networks with hidden markov models post-processing for sensor-based human activity recognition

ABSTRACT. Utilizing inertial sensors for human activity recognition is one of the most active areas of research (HAR). Several machine learning techniques have been proposed in HAR for classifying human actions. However, these techniques require extensive feature engineering be- cause they depend so heavily on the quality of handcrafted features. Recent approaches to deep learning have made an effort to complete training from start to finish. In this paper, we present our EDTCN- based [10] deep learning model for HAR. In lieu of using random initialization, we introduce an efficient algorithm to generate very large, noisy data for training our model's weight initialization. We also propose a post-processing method for smoothing the model's prediction. Experiments demonstrate that our proposed model out- performs other state-of-the-art models on the PAMAP2 and WISDM datasets, indicating that our model is effective for recognizing hu- man activity using sensors. Our model's implementation is acces- sible to the public at github: https://github.com/khaclinh/EFTCN- HMM.

09:45-12:00 Session 8B: Image and Natural Language Processing

LOCATION: Diamond 2, Wyndham Legend Halong

09:45 *Tri Le, Nham Huynh-Duc, Chung Thai Nguyen and Minh-Triet Tran*

Motion Embedded Image: A combination of spatial and temporal features for Action Recognition

ABSTRACT. Demand for recognition of human activity from videos has increased rapidly in many real-life applications, e.g. video surveillance, entertainment, healthcare, child and old age homes, etc. The explosion of short-form videos on social networking platforms such as Tiktok, Facebook, Youtube, etc, makes this problem gain a lot more attention. In this paper, we focus on the problem of human activity recognition in general short videos. Compared with still images, clips do not only provide spatial but also temporal information, and the challenge is to capture the complementary information on appearance from still frames and motion between frames. Our contribution is two-fold. First, we propose an improved two-stream ConvNet architecture: one stream is a normal image classification ConvNet being fed still frames to classify static appearance, the ConvNet is ensembled from four base CNNs model into a robust classifier by summing their probability prediction, hence named EnsembleNet; another one is called motion stream capable of capturing and recognizing motion based on embedded batches of frames. Second, we built a brand new dataset of Southeast Asian Sports short videos, consisting of both standard videos with no effect and non-standard videos with impact - a modern factor that all currently available datasets being used for benchmarking models lack. Our model is trained and evaluated in combination with different backbone architectures and on two benchmarks: UCF-101 and SEAGS-V1. The result shows that this is a model with competitive performance compared to previous attempts to use deep nets for human activity recognition in short-form videos.

10:05 *Tuan Linh Dang*, *Sy Dat Tran*, *Thuy Ha Hoang*, *Trong Nghia Nguyen* and *Tuan Minh Vu*

Prototype of a parking system with path recommendation

ABSTRACT. With the growth of population and vehicles, parking is a significant problem people face in modern life, especially in developed countries. It is often time-consuming and inconvenient for the driver to find a parking space in the parking lot, especially during rush hour. Therefore, this paper suggested a parking prototype that uses the YOLOv5s algorithm to detect vehicles and empty slots, and the Deep SORT algorithm will track the detected cars in moving frames. In addition, this prototype may use the BFS algorithm to recommend the path to the nearest available parking space for a user through a developed user interface. Our experimental results with different video situations showed that the proposed prototype achieved 0.906 mAP

for average accuracy and an operating speed of 18 FPS for ten vehicles using Nvidia GTX 1080 GPU in the demo application.

10:25 *Sang Dinh Viet* and *Quang Do Duy*

Incremental Boundary Refinement using Self Axial Reverse Attention and Uncertainty-aware Gate for Colon Polyp Segmentation

ABSTRACT. Medical image segmentation, particularly polyp segmentation, is a pervasive and widely applicable problem. Numerous recent works have been introduced to solve the problem in various ways. In practice, however, polyps can be extremely difficult to segment when considering the boundary region, where the information is specific and complicated. This paper proposes an Incremental Boundary Refinement method that focuses on learning and refining the boundary from both inside and outside the polyp region. In contrast to lego-like approaches that design deep neural architectures by stacking well-known existing blocks to improve performance, we perform a deep insight analysis of a state-of-the-art network known as SSFormer and then propose novel effective modules to address its weaknesses. Experimental results on five benchmark datasets indicate that our method successfully refines boundary information under various challenging conditions while archiving 80% mDice in the most complex set and more than 90% mDice in the other sets. These results surpass several existing colon polyp segmentation methods.

10:45 *Cong Tran*, *Khanh Nguyen-Trong*, *Cuong Pham*, *Dat Tran* and *Tien Nguyen-Thi-Tan*

Improving text recognition by combining visual and linguistic features of text

ABSTRACT. While being studied for several decades, Optical Character Recognition (OCR) has still been attracting considerable attention from researchers. Previous studies tend to focus on visual features of optical texts, such as texture, shape, and color to build OCR models. However, linguistic features, an important factor for OCR, has not been extensively investigated, especially for Vietnamese-OCR scanned documents. Therefore, we introduce a method to improve the performance of Vietnamese OCR by combining both visual and linguistic features of the optical text. The proposed method consists of (i) a domain-specific dictionary and (ii) a modified natural language processing model termed ABCNet, employed at the training and inference step, to determine the best candidate for the visual appearance of the text. Moreover, our method can easily be integrated with existing OCR methods to further increase their performance. Experimental results on a newly collected dataset show that the proposed method achieves an accuracy of 83.61% and a F1 score of 84.1%.

11:05 *Duc Minh Le*, *Linh Quang Tran*, *Hong Thi Le*, *Hai Van-Anh Tong* and *Anh Phuong Nguyen*

Generating Multi-platform Single Page Applications: A Hierarchical Domain-Driven Design Approach

ABSTRACT. Single Page Application (SPA) is a most common approach for developing modern web applications. A chief benefit of SPA is reduced round-trip to the server and more responsive user experience. Although several well-known SPA frameworks have been developed and applied in practice, SPA developers are still facing two main challenges (i) design an SPA that would work accross the frameworks and (ii) realise this design in an intermediate high-level language that would effectively be transformed into a target framework of choice. In this paper, we propose a multi-platform, hierarchical domain-driven design method to tackle these challenges. Our method uses the domain model as the core to build the SPA. We formulate a set of essential technical SPA requirement patterns and, based on these, define a precise SPA metamodel in UML/OCL. We use an annotation-based DSL as an intermediate representational language for the SPA metamodel and from this propose an SPA generator that generates SPAs for four popular SPA frameworks (Angular, React (Native) and Vuejs). The evaluation results show that our method is very promising for building multi-platform SPAs.

11:25 *Thi Huong Giang Vu* and *Thi Hong Anh Nguyen*

An improved NSGA-II based-on project scheduling principles for workforce scheduling optimization in warehouse

ABSTRACT. In operating a warehouse, enterprises and organisations have to provide high quality of order processing: complete a greatest amount of orders at a minimum operation cost and in a shortest time. They have to deal with workforce scheduling problems, i.e., scheduling tasks and allocating human and machine resources in a warehouse. This paper presents an approach to workforce scheduling optimization in a warehouse, considering multiple constraints such as precedent constraints among tasks, skill constraints between tasks and human resources, and working time constraints of human resources. The expected result is a set of optimised schedules for three objectives: order cycle time, total labour cost, and order on-time rate. By viewing a schedule under the lens of project management, we improve the NSGA-II with a customised initial population creation, and enhanced crossover and mutation operators. The algorithm is then tested against real data from an existing Enterprise resource planning (ERP) application, including human, machine resources and tasks. The results show to perform well, thus making the algorithm applicable in the warehouse environment.

11:45 *Anna Scius-Bertrand*, *Andreas Fischer* and *Marc Bui*

Retrieving Keywords in Historical Vietnamese Stele Images Without Human Annotations

ABSTRACT. Stone engravings on Vietnamese steles are an invaluable resource for historians to study the life of the villagers in the past. Thanks to pictures taken of stampings of the steles, they can be investigated today in the form of digital images. Automatic keyword spotting is a promising means to access the textual content of the images, allowing to retrieve steles that contain a certain query term. In this paper, we present a complete pipeline for retrieving Chu Nom characters in Vietnamese steles that operates fully automatically on the original images, without the need for preprocessing, segmentation, or human annotation. It combines a self calibration approach to character detection using deep convolutional neural networks with a graph-based approach to keyword spotting that compares templates of the search term with detected characters based on structural properties.

12:00-13:30 Lunch, Blue Bay Restaurant, 1st floor, Wyndham Legend Halong

13:30-14:00 Session 9

LOCATION: Diamond Ballroom 1, Wyndham Legend Halong

13:30 *Long Bao Le*

Keynote 5: Metaverse: Towards the next-generation immersive internet

ABSTRACT. Metaverse is the term coined the first time in a science fiction novel named Snow Crash written by Neal Stephenson 30 years ago. A full-flesh metaverse, which merges the physical and digital worlds in a self-sustaining and persistent manner, is expected to provide the medium in which people not only play, work, and entertain but also perform most other real-life activities such as education, training, finance, and shopping. Metaverse, therefore, has the potential to transform every aspects of human life and the economy creating tremendous opportunities for the tech and many other industries. Metaverse research has gained tremendous interest and momentum in recent years where a great deal of efforts and resources has been invested by both academia and industry (e.g., Meta, Microsoft, Apple, etc) to build this immersive 3D internet. In this talk, I first discuss the key aspects and components of the metaverse including avatar, virtual economy, user generated content (UGC), trust, security, and privacy. Then, some initial versions of the metaverse existing today (mostly massively multiplayer online games) together with their characteristics and services are described. Important technologies and their roles in enabling the metaverse such as virtual/augmented/mixed reality, artificial intelligence, digital twin, blockchain, edge/cloud computing, 5G/6G wireless mobile networks, and Internet of things are presented. Some recent research results achieved by my research lab related to metaverse are then described. Finally, I discuss key open research challenges, which must be addressed to realize the future metaverse.

14:00-14:30 Session 10

LOCATION: Diamond Ballroom 1, Wyndham Legend Halong

14:00 *Mourad Baiou*

Keynote 6: Path disruption games in networks

ABSTRACT. Path Disruption Games study the placement of checkpoints in a network where an adversary is trying to travel from an origin s to a destination t. A cooperative game is defined where each agent owns an arc, and is able to place a checkpoint on it. Placing a checkpoint at a location yields a cost that depends upon the location. A coalition gets a reward if it can intercept all paths from s to t, and a coalition must choose a set locations of minimum cost. We study the core and the nucleolus of this game. We give polynomial combinatorial algorithms to test whether a vector belongs to the core, and to compute the nucleolus. The components of the nucleolus reflect the relative importance of each arc to detect the adversary. Our techniques also apply to the case when the players are associated with the nodes.

14:30-14:45 Coffee Break

14:45-17:25 Session 11A: Network Communication and Security

LOCATION: Diamond 2, Wyndham Legend Halong

14:45 *Hien Do Thi Thu, The Duy Phan, Hao Le Anh, Lan Nguyen Duy, Khoa Nghi Hoang and Van-Hau Pham*

A Method of Mutating Windows Malwares using Reinforcement Learning with Functionality Preservation

ABSTRACT. Recently, the development in both quantity and complication of malware has raised a need of powerful malware detection solution. The outstanding characteristics of machine learning (ML) and deep learning (DL) techniques has been leveraged in the fight against malware. However, they are proved to be vulnerable against adversarial attacks, where intended modifications in malware can flip the detection result and then evade the detector's eyes. This research area is being focused and deeply interested in many publications due to its significance in the robustness evaluation of malware detection approach. In such works, using Generative Adversarial Networks (GANs) or Reinforcement Learning (RL) can help malware authors crafting metamorphic malware against antivirus. Unfortunately, the functionality of created malware is not mentioned and verified during mutation phase, which can result in evasive but useless malware mutants. In this paper, we focus on Windows Portable Executable malware and propose a RL-based malware mutant creation approach to fool black-box static ML/DL-based detector. Specifically, we introduce a validator to confirm the functionality preservation, which is one of our requirements for a successful created malware. The experiment results prove the effectiveness of our solution on crafting elusive and executable Windows malware mutants.

15:05 *Nam-Thang Hoang*, *Cong-Son Duong*, *Tran-Le-Tuan Nguyen*, *Van Tong* and *Hai Anh Tran*

Knowledge-defined Heterogeneous Network: Use-case of QoS-based Server and Route Selection in Large-scale Network

ABSTRACT. Nowadays, Software-Defined Networking (SDN) with a separation between control and data plane, is a potential solution to overcome network issues caused by the explosive growth of network equipment and services. The two services that have attracted the most attention in the computer network research community are server selection and routing. However, this research is only limited to a single SDN network, which is not a popular inter-SDN domain network where each SDN domain is dedicated to an Internet Service Provider (ISP). This limitation is mainly due to the following two reasons: 1) First, each SDN domain does not have a global view of other SDN domains, so routing policies are not optimal for the entire network; 2) Second, without the global view, ISPs select the shortest path to forward packets in their networks, bringing over-utilization to several links and under-utilization to other links. This leads to a degradation of network performance and Quality of Service (QoS). Therefore, in this paper, we propose a QoS-based server and route selection for inter-SDN domains to optimize network performance. To overcome

the first limitation, we take advantage of our recent work, SINA, and an adaptive consistency mechanism to guarantee information consistency between controllers of inter-SDN domains and intra-SDN domains. To deal with the second one, we present a QoS-based server and route selection mechanism to select server and routing paths with optimized cost in order to optimize network performance. The experimental results illustrate that our proposal improves 15 percent of link utilization and 13 percent of loss in comparison with the first benchmark. The proposal also achieves a great reduction of overhead and good response time compared with both benchmarks.

15:25 *Khanh Nguyen Quoc*, *Tung Bui*, *Dong Le*, *Duc Tran*, *Toan Nguyen* and *Huu Trung Nguyen Nguyen*

Detecting DGA Botnet based on Malware Behavior Analysis

ABSTRACT. DGA botnet uses the Domain Generation Algorithm to establish the connection between the malware bot and malicious actor. It has become a critical threat to every Internet-connected system. Detection of DGA is a challenging task due to the complexity and performance problems when handling a great amount of data from real-time, and large-scale networks. In this paper, we develop a DGA detection scheme using the combination of the Long Short- Term Memory network (LSTM) and network traffic analysis. Such a scheme relies on a set of rules that can be used for detecting various DGA malware behaviors. It can recognize even dictionary DGAs such as suppobox and matsnu, while providing an F1-score of 0.9888.

15:45 *Thi Huong Giang Vu*, *Trung Hieu Hoang* and *Manh Tuan Nguyen*

Assessing Web Security Risks Using Dynamic Bayesian Network

ABSTRACT. This paper presents an approach to assess security risks of web systems based on its deployment scenario. First, we propose a conceptual model specifying the characteristics of the cause-effect connections in the formation of security risks. From this conceptual model, we propose a multi-layered dynamic Bayesian network (MLDBN) for integrating temporal factors into the assessment of security risks. This MLDBN allows considering the variation of risk levels and risk likelihood while threat events and vulnerabilities emerging during the deployment process of a web system. An associated mechanism for generating the structure of MLDBN is also proposed. In each deployment scenario, security risks of each asset and security risks of the whole web system are assessed according to three tenets: loss of confidentiality, loss of integrity and loss of availability. The proposed solution is implemented in the form of a risk assessment tool, providing convenient risk assessment and risk monitoring functions for the managers and the experts.

16:05 *Thi Mien Nguyen*, *Linh T. Nguyen*, *Khac-Tuan Nguyen* and *H. Chau Le*

Performance Analysis of Short-Packet Communications in Multi-RIS-based Uplink Systems

ABSTRACT. Recently, reconfigure intelligent surfaces (RISs) have emerged as one of the most promising and breakthrough technologies for enhancing energy efficiency, spectral efficiency, and coverage by altering the propagation environment while short-packet communication is considered as a key enabler to providing critical applications. In this paper, we study short-packet communications in multi-RIS-based uplink systems over Rayleigh fading channels. We consider two typical techniques of maximal-ratio-combining (MRC) or selection-combining (SC) at the base station (BS), where one optimal RIS is selected among a set of distributed RISs. To evaluate the performance of the investigated system, we derive the closed form and asymptotic for average block error rate (BLER) under the effects of two phase-shift scenarios at RISs, namely random phase-shift (RPS) and optimal phase-shift (OPS). Numerical results showed that increasing the number of distributed RIS with more passive elements helps the system overcome the disadvantages of both OPS and RPS scenarios and consequently, the BS can reduce the number of antennas while still achieving the desired BLER. Finally, Monte-Carlo simulation results are provided to verify the accuracy of the theoretical analyses.

16:25 *Minh Hai Vu*, *Giang T. T. Nguyen*, *Hai Dang Tran*, *Thanh Trung Nguyen*, *Phan Thuan Do*, *Phi Le Nguyen* and *Kien Nguyen*

An Empirical Study of MPQUIC Schedulers in Mobile Wireless Networks

ABSTRACT. Multipath QUIC (MPQUIC), an emerging multipath transport protocol (MTP) that inherits the advantages of the canonical multipath TCP (MPTCP) and the widespread QUIC, potentially plays a vital role in 5G and beyond. MPQUIC can exploit multiple networks (e.g., Wi-Fi, LTE, 5G) on a mobile device to boost the quality of services while efficiently utilizing network resources. In MPQUIC, the scheduler, which is in charge of concurrently scheduling data transmission in several paths, largely impacts the protocols' performance, especially in dynamic environments. In fact, in the literature, a considerable number of MTP schedulers for MPQUIC have been proposed. Unfortunately, their performances have been primarily evaluated in static networks without (or simply) considering mobile ones. Hence, this work attempts to investigate the performance of MPQUIC schedulers in the mobile context, aiming to fill the literature gap. Specifically, we implement and assess the performance of five MPQUIC schedulers in various mobility patterns using the Mininet-WiFi emulator. More importantly, we introduce q-ReLeS, an extension of an MPTCP scheduler called ReLeS for MPQUIC. The experimental results show that q-ReLeS reduce the download time from 11 to 20% compared to the others. Besides, the empirical investigation demonstrates that mobility and velocity patterns substantially impact the performance of MPQUIC schedulers.

16:45 *Papa Bara Diakhate*, *Tran-Tuan Chu*, *Mohamed Aymen Labiod*, *Brice Augustin*, *Hai-Anh Tran* and *Abdelhamid Mellouk*

Experimental Evaluation of Multiple Multipath Schedulers over Various Urban Mobile Environments

ABSTRACT. The use of multiple interfaces and multipath protocols for end-to-end devices, especially in a mobile environment, has recently gained much attention. At the heart of any multipath protocol lies a scheduler, whose ability to select the best path dictates the overall performance of the system. While a plethora of schedulers have been proposed so far, their evaluation was only conducted in simulated, static environments. A question remains, on their behavior in real-world, dynamic, and mobile conditions. In this paper, we design a framework and conduct various experiments to assess the performance of four state-of-the-art schedulers for the cutting-edge MP-QUIC multipath protocol. Our setup involves mobile situations within an urban area around Paris, France. We first design and implement an MP-QUIC-based modular scheduler assessment framework to compare the schedulers. We then take advantage of this framework to measure their performance in real-world scenarios involving multiple transportation modes (train and car). The collected datasets allow us to perform an in-depth analysis to find insights as well as quantify the schedulers' performances. Our experimental results confirm the dominance of the state-of-the-art learning-based multipath scheduler.

17:05 *Hoang V.Vo*, *Duong H.Nguyen*, *Tuyen T.Nguyen*, *Hoa N.Nguyen* and *Duan V.Nguyen*

Leveraging AI-Driven Realtime Intrusion Detection by Using WGAN and XGBoost

ABSTRACT. Currently, pattern-based detection is difficult to detect new network attacks with signatures. Thus, using machine learning is an approach proposed by many researchers for intrusion detection systems to deal with this issue. This paper presents a hybrid method combining a rule-based inspector with an AI-driven model, namely WGID, to improve intrusion detection performance. In this method, traffic flows that are not triggered by any rule of the rule-based inspector will be deeply analyzed by the WGID-based inspector. WGID comprises the TWGAN algorithm to generate more coherent samples based on the WGAN to tackle the imbalanced dataset. Based on the training dataset augmented by TWGAN, WGID adopts the XGBoost method to perform the deep analysis. To demonstrate the WGID performance, we conduct different rigorous experiments to evaluate WGID using three well-known datasets. The results indicate that the WGID achieves an excellent accuracy of 99.97%, 99.81%, and 98.16% with the CSE-CIC-IDS2018, NSL-KDD, and UGR datasets, respectively. It also performs better than related models using the same datasets.

Moreover, the deep inspection time for each traffic flow is also small enough to detect intrusions in the inline mode (i.e., average 1.892 us/flow).

14:45-17:25 Session 11B

LOCATION: Diamond Ballroom 1, Wyndham Legend Halong

14:45 *Nguyen Tu, Do Tri, Le Khanh, Go Seungkyu, Na Sunghyun, Kim Dukyun and Tran Duc*

A LSTM-based approach for Predicting Resource Utilization in Cloud Computing

ABSTRACT. Predicting future resource consumption has become a significant issue as large-scale cloud computing centers surpass individual servers in popularity. Public cloud service providers can proactively assign or reallocate resources for cloud services by forecasting resource needs. This research aims to forecast the usage of resources such as the central processing unit, random access memory, and hard disk across both short-term and long-term time scales. In this paper, we propose to use Long Short-Term Memory network (LSTM) with our own approach for resources' usage prediction in cloud workloads. The proposed approach has been evaluated and compared with other traditional approaches on predicting cloud workloads. The experimental results show that such approach provides more accurate predictions with at least two times lower loss values, measured in terms of median absolute error for both long-term and short-term prediction. This work helps the cloud service provider (CSP) to analyze and predict the workload accordingly to acknowledge over and under provisioning of the cloud resources.

14:55 *Thanh Nguyen Tien* and *Khanh-Van Nguyen*

Decision graph for timely delivery of multi-AGVs in healthcare environment

ABSTRACT. The availability of Automated Guided Vehicles (AGVs) in flexible manufacturing systems is becoming the norm. However, in human-aware environments, e.g. healthcare environments, the movement of both AGVs and humans would inflict mutual harm. To reduce the harmfulness and the earliness/tardiness of ill-timed arrivals, a control system needs to not only forecast the forthcoming traffic situation but also avoid abusing the emergency mode of AGVs. This system could allow AGVs to finish timely delivery and mitigate harmful effects on humans.

15:05 *Luyen Ngan Van*, *Anh Hoang Tuan*, *Duy Phan The*, *Tan-Khoa Vo* and *Van-Hau Pham*

A Privacy-Preserving Approach For Building Learning Models in Smart Healthcare using Blockchain and Federated Learning

ABSTRACT. Nowadays, the amount of data generated from Internet of Things (IoT) devices is increasing, paving the way for the development of artificial intelligence (AI) applications. However, with the traditional AI approach, users sharing their raw data causes many concerns in terms of privacy leakage. There have been reports that there are privacy violations on private data of users. In the medical field, the creation of devices to help automatically diagnose the user's disease is gradually becoming a trend in the future. These devices help users monitor their own health, thereby reducing pressure on medical facilities that are often overloaded. However, the healthcare data of individuals will often be very sensitive and rarely shared by users. In addition, the profits generated from machine learning (ML) models mostly belong to the owners of that model. It also becomes an obstacle in encouraging users to share their data. In this article, we propose PriFL-Chain, a privacy-preservation framework to take advantage of data resources of data owners for training ML-based models, while ensuring the privacy of data owners. Specifically, we apply Differential privacy (DP) to federated learning (FL) to train ML models. Users just share the ML model trained on their data instead of sharing the raw data. Furthermore, the contribution activities of users in the system are recorded to the Blockchain to ensure transparency. We also leverage Mobile Edge Computing (MEC) and InterPlanetary File System (IPFS) to reduce the pressure on the central server and reduce data communication costs, making the system more flexible. Experimental results have demonstrated that the combined strategy of FL,

Blockchain, IPFS, and MEC can help reduce the cost of training ML models, effectively protect privacy, and utilize data sources of diversity from the community.

15:15 *Nguyen Bac Trinh*, *The Duy Phan* and *Van-Hau Pham*

Leveraging Deep Learning Image Classifiers for Visual Similarity-based Phishing Website Detection

ABSTRACT. Phishing is a major cybersecurity threat that is increasingly dangerous and complicated, especially during a global pandemic when there is a great need for remote work and communication between Internet users. Moreover, the challenge is even greater when the crime of using high technology increase with the speed of development of science and technology. Machine learning-based approaches for phishing detection have been explored and applied, which have gained many significant results. Though, the problem with using visual similarity-based phishing detection techniques is the complexity of the visual feature extraction process. In this work, we propose a method that uses the transfer learning technique with pre-trained image classification models to extract features as input to machine learning algorithms for phishing website detection. Our proposed method takes advantage of the research results in the field of computer vision, opening up prospects for application in the field of information security. In the experiments, we tested five deep learning image classification models combined with eleven machine learning algorithms in the task of training to classify phishing websites based on visual similarity. Experimental results show that VGG16 is well compatible with several ML-based algorithms in the task of classifying phishing sites. Our proposed method offers promise for the problem of detecting phishing websites based on visual similarity when combining CNN image classification models and machine learning algorithms.

15:25 *Viet-Bang Pham* and *Tuan-Dat Trinh*

Analysis Model for Decentralized Lending Protocols

ABSTRACT. Decentralized Finance (DeFi) -- an ecosystem of financial applications built on top of blockchain technology -- has kept powering ahead and attracted a large amount of capital in just a few years. As the core part of the DeFi ecosystem, decentralized lending protocols allow users to become lenders or borrowers in a completely decentralized fashion, such that an individual has complete control over their funds at all times. Collecting, analyzing, and visualizing lending data are crucial as these lending protocols are growing steadily. This paper presents an analysis model for decentralized lending protocols. Our main contributions are as follows. (i) We analyze and compare the top lending protocols; (ii) We present a general model to collect and process a large amount of data from multiple lending protocols in an exact and efficient manner; (iii) We design and implement a lending visualization system with various charts divided into three categories, i.e., lending market overview, token analysis, and user analysis.

15:35 *Bui Quoc Trung*, *Bui Thi-Mai-Anh* and *Tran Van Tri*

Empirical Analysis of Filter Feature Selection Criteria on Financial Datasets

ABSTRACT. High dimensionality is one of the data quality problems that affect the performance of machine learning models. Feature selection which aims to identify and remove as many redundant and irrelevant features as possible allows to boot the overall performance of the models while reducing the computational cost. However, the choice of an appropriate feature selection method is still a big challenge as there is no the best selection criterion that fits to all datasets. It is then essential to comparative analyze the performance of feature selection criteria according to different characteristics of high-dimensional datasets, particularly large financial datasets where features are highly-correlated and redundant. In this paper, we explore ten different feature selection criteria which are typically categorized into two classes: (i) information criteria and (ii) correlation criteria over eight public financial datasets. To the best of our knowledge, no previous comprehensive empirical investigation has been carried out to demonstrate the positive effects of feature selection criteria on finalcial data. Experimental results indicate that correlation criteria do not depend on the number of attributes and outperform information approaches in terms of computational performance.

15:45 *Thi-Thu-Trang Do*, *Thai-Bao Mai-Hoang*, *Van-Quyet Nguyen* and *Quyet-Thang Huynh*

Query-based Performance Comparison of Graph Database and Relational Database

ABSTRACT. A graph database is a type of NoSQL database that uses graph structure for semantic queries with nodes, edges, and properties to represent and store data. It has been applied in many fields such as education, health, business, and social network with many famous applications such as Google, Facebook, and Twitter. One of the main advantages of the graph database is the effective performance in data queries. In this paper, we present a comprehensive comparison of the performance between the graph database and the traditional relational database based on multiple types of queries. The query types are categorized into four groups: selection/search, recursion, aggregation, and pattern matching. We examine representative questions for each group and executed them on Neo4j (representing the graph database) and MySQL (representing the relational database) using a real-life dataset named Career Village. The results show that performance in querying data of graph databases outperforms the relational databases. It demonstrates the superiority of the graph database compared to the relational database.

15:55 *Nhat-Hoa Tran*

Model Checking Techniques Enable Schedulability Analysis of Real-Time Systems

ABSTRACT. A real-time system should ensure specific timing constraints. This type of system needs to meet the deadline for its jobs. In general, the increasing lateness following how late a real-time system finishes its tasks/processes concerning the deadline may decrease the accuracy and usefulness of the system. That means violation of the deadline may cause problems for this kind of system. Thus, several scheduling policies are introduced to guide the execution of the processes. From that point, checking the schedulability for real-time systems is necessary and important. This paper presents an approach to analyzing the schedulability of real-time systems. Our method includes: First, we introduce a specification language to facilitate the description of the scheduling policies with the attributes of the processes (including the deadline for each task). Second, we consider the time taken for the tasks/processes of the system as one action taking one-time unit (using discrete time). This approach allows us to model the behaviors and realize the time taken by each action of the processes. Third, we apply model checking techniques to explore the states of the system and then check the deadline violation. The exploration is guided by the information specified in the language for the scheduling policy. The information here is generated automatically from the description of the scheduler. The experiment results show that we can handle this problem accurately and easily.

16:05 *Anh T. V. Nguyen* and *Mizuhito Ogawa*

Automatic Stub Generation for Dynamic Symbolic Execution of ARM binary

ABSTRACT. Recently, dynamic symbolic execution (DSE) tools for binary codes (mostly for x86) have been developed, e.g., McVeto, CoDisasm, MAY- HEM, KLEE-MC, BE-PUM, angr, BINSEC and CORANA. When a process stays in the uniform context, DSE simply obeys the formal semantics of an instruction set. Practical binary code like malware often uses system functions, which are beyond the user-level con- text, which requires stubs to simulate them. This paper proposed an automatic generation of Linux API Stub from the C function interface, which extends the DSE tool CORANA for ARM. The API stub is an under-approximation of a system function call by spawn- ing its execution in the real Linux environment, and its Hoare logic deduction rule is defined and justified in terms of awareness. We implement CORANA/API and its experiments on real-world IoT malware, such as Mirai, is reported.

16:15 *Hidetaro Tanaka*, *Tomoaki Tanaka*, *Ryosuke Higashi*, *Tsutomu Sekibe*, *Shuichi Takada* and *Hironori Nakajo*

Implementation of a RISC-V SMT Core in an AI processor

ABSTRACT. The RISC-V core, which supports simultaneous multithreading (SMT) on a heterogeneous virtual engine architecture, was implemented. In the architecture, multiple types of engines specialized for different purposes are used. The RISC-V SMT core has the advantage of allowing multiple threads to execute simultaneously at a lower cost than that of simply using multiple cores. The RISC-V core supports operations of other engines under the SMT mechanism to be installed in "Chichibu," which was developed by ArchiTek as a multicore chip for edge artificial intelligence. In this implementation, we reduced the hardware resource usage to less than half that of the previous implementation and exceeded the operating frequency of 100 MHz. In addition, the instructions per clock cycle (IPC) improved by approximately 66% using SMT.

16:25 *Kenji Fukumoto*, *Risa Takeuchi* and *Akiyo Nadamoto*

Method for Evaluating Quality of Automatically Generated Product Descriptions

ABSTRACT. In recent years, the accuracy of deep learning improves, and a wide variety of content has been generated automatically. With these researches of automatic content generation, the problem of evaluation methods for the generated content has become an issue. The evaluation methods differ from generated content types. In this paper, we propose the evaluation methods which is aim of motivating readers to purchase the products for automatically generated product descriptions. Specifically, we first extract and modify the 17 evaluation items from related researches. Next, we categorized the evaluation items into three axes which are the grammar axis, the content axis, and the attribute axis. Furthermore, in order to show the beneficial of the proposed axis, we conduct two types of user experiments using the results of three types of deep learning. The experiment 1 is a target on the subjects who have not decided what she/he wanted to buy. The experiment 2 is a target on the subjects have an image of the product which they want to buy. As results, we found the beneficial of the proposed method in both cases.

16:35 *Taehoon Kim*, *Kyoung-Sook Kim* and *Yijun Duan*

A Shape of Geo-tagged Media Bias in COVID-19 Related Twitter

ABSTRACT. Social media has become an essential data source for understanding many aspects of our lives, from personal opinions to local patterns. However, it also contains more subjective and biased information than traditional media due to community bubbles and echo chambers. This study aims to examine the correlation between media bias on Twitter and COVID-19-related critical events. We used an open-access dataset of COVID-19 tweets from March 2020 to July 2021. We first developed a classification model to identify media bias using an attention-based bidirectional long short-term memory (BiLSTM) model. Using this classification model, we classified 350k geo-tagged tweets into two classes: "biased" and "unbiased", focusing on four countries: the US, UK, Canada, and India. In our study, we found that critical events, such as the sharp increase of the coronavirus death toll, would exert the rise of biased information on Twitter. Additionally, we found that in the US, the states' bachelor degree per capita correlated with the ratio of biased tweets, which is consistent with the Dunning–Kruger effect. The unemployment rate was only found positively correlated with the ratio of biased tweets in the UK. Presumably, other factors (e.g., income inequality, social trust, etc.) should be introduced to understand the dissemination of biased tweets.

16:45 *Anton Agafonov* and *Andrew Ponomarev*

Localization of Ontology Concepts in Deep Convolutional Neural Networks

ABSTRACT. Deep neural networks have recently evolved into a powerful AI tool, reaching near-human performance level in many tasks, and in some tasks even surpassing it. However, a significant drawback of neural networks is the lack of explainability and interpretability — it is hard to say why a neural network arrived to a certain conclusion. This significantly limits application of neural networks in critical tasks and undermines trust in human-AI collaboration. It has been recently shown that internal representations constructed by a neural network can often be aligned with a domain ontology. This opens a promising way to provide explanations of a neural network in human terms. In this paper, we discuss the results of the

experiment aimed at understanding what layers of a neural network are the most perspective for the alignment with given ontology concept. To do so, we build concept localization maps for XTRAINS — a synthetic dataset consisting of images and their ontological annotations. The importance of such maps is that they can be used for the development of efficient concept alignment heuristics. The experiment mostly supports the intuition that high-level concepts are localized mostly in the activations of last layers of a neural network (near its head), while lower-level concepts might be better extracted from middle layers.

16:55 *Futo Yamamoto*, *Tadahiko Kumamoto*, *Yu Suzuki* and *Akiyo Nadamoto*

Methods of Calculating Usefulness Ratings of Behavioral Facilitation Tweets in Disaster Situations

ABSTRACT. When a serious disaster strikes, people transmit a variety of information about the disaster, and this information circulates on social networking services (especially Twitter). Especially, information that encourages people to take action (or not to take action) is called "behavioral facilitation information" and is known to influence many people. However, the volume of such information is enormous, and it transmitted by a large number of unspecified people is not always useful information for various victims. In this paper, we propose the usefulness of tweets posted on Twitter during an earthquake disaster (tweets that include action-promoting information). Specifically, we proposed several methods to calculate the usefulness of tweets as real values (0 to 3) according to a four-level scale of "3 (very useful), 2 (somewhat useful), 1 (not very useful), 0 (not useful at all)" and compared their accuracy. By comparing the accuracy of the methods, the most suitable method for earthquake hazards is determined. In addition, we compare the accuracy of According to an accuracy evaluation experiment using action-promoting tweets actually posted during an earthquake disaster According to the accuracy evaluation experiment using behavioral facilitation tweets actually posted during the earthquake, the method using BERT (Bidirectional Encoder Representations from Transformers) has the best accuracy (average RMSE: Root-Mean-Square Error calculated by 5-part cross-validation) of 0.39, which is sufficiently high even for unknown data. This result indicates that the method can achieve sufficiently high accuracy even for unknown data.

17:05 *Van Duc Khuat*, *Tuan Anh Tran*, *Minh Tuan Nguyen* and *Hai-Chau Le*

A Study on Machine Learning Based Gene Selection for Pediatric Sepsis Classification

ABSTRACT. Nowadays, sepsis has been known as a serious health problem which becomes one of the major causes of mortality even in developed countries' ICUs. The use of gene expression analysis and machine learning is an attractive and excellent solution to diagnose accurately the disease severity. Unfortunately, the collected dataset contains many genes among which highly correlated genes exist (redundant genes), which reduces the performance of diagnostics. Hence, efficient gene selection methods are necessary but challenging. In this paper, in order to verify the advantages of the machine learning technique and the gene expression analysis in pediatric sepsis classification, we evaluate and compare the performance of different gene selection methods combined with distinct machine learning models that are Filter, Wrapper, and Embedded approaches. In our work, a sequential gene selection procedure incorporates the differential gene expression analysis with the gene importance determined by the applied machine learning model to figure out the most informative differential gene expression. We also employ the cross-validation procedure in combination with different machine learning algorithms to verify the diagnosis performance. Numerical experiments demonstrate that the Embedded-based gene selection method incorporated with various machine learning models offers the highest diagnostic performance. In particular, the random forest-based gene selection algorithm combined with the SVM (Support Vector Machine) model that identifies a combination of 4 genes attains the best performance. The validation results have an accuracy of 89.6%, a sensitivity of 41.5%, and a specificity of 97.5%, showing the applicability of this approach in the clinic environment.

17:15 *Duc-Anh Nguyen*, *Trong-Dat Nguyen*, *Phuong-Hanh Du*, *Nam-Hai Dao* and *Hoa Nguyen Ngoc*

EnsFace: An Ensemble Method of Deep Convolutional Neural Networks with Novel Effective Loss Functions for Face Recognition

ABSTRACT. In recent years, designing new effective Deep Convolutional Neural Network (DCNN) architectures and loss functions are two crucial trends in improving face recognition (FR) accuracy. However, building an optimal DCNN and ameliorating FR performance are still the main challenges for researchers. Thus, we first investigate and analyzes the effect of several novel effective loss functions based on softmax on DCNN with the ResNet architecture. We then propose an ensemble learning, namely EnsFace, by taking advantage of recent novel FR methods based on CosFace, ArcFace, and MagFace. EnsFace elaborates on the voting mechanism that utilizes non-optimal pre-trained models to obtain better discriminative ability for FR. To prove the performance of both speed and accuracy of EnsFace, we carry out rigorous experiments using several popular benchmarks, including LFW, CFP-FP, and AgeDB-30, as well as two renovations of LFW: CALFW and CPLFW. The results of our experiments achieve state-of-the-art figures, which show the proposed method's massive potential in improving FR performance. Ablation studies and overall benchmarks undeniably prove the effectiveness of our EnsFace.

17:25 *Nhu Khoa Nguyen*, *Emanuela Boros*, *Gaël Lejeune*, *Antoine Doucet* and *Thierry Delahaut*

Utilizing Keywords Evolution in Context for Emerging Trend Detection in Scientific Publications

ABSTRACT. This paper studies the dynamic between how the representation of terms changes through time and its potential emergence as a trending topic in the future. Previous research focused on contrasting directly two of the most recent representations of detected keywords to form a basis for predicting emerging topics. We, thus, propose the Term Context Evolution approach that extends the range of comparison and analyzes multiple continuous previous representations compared to the current one to form a series that reflects the evolution of context around selected terms to evaluate potential emerging topics. We experimented with our approach on abstracts of computer science publications from 1995 to 2012 by first choosing the most frequent terms from the titles and extracting their representations using a Transformer-based pre-trained language model. Our findings reveal that the proposed method outperformed existing models in terms of recall by being able to detect critical emerging trends and points of emergence.

17:35 *Thuong Nguyen Canh*, *Quyet Bui Van* and *Trinh Van Chien*

Error Resilient Deep Compressive Sensing

ABSTRACT. Compressive sensing is an emerging sampling technology that enables reconstructing signals from a subset of measurements and even corrupted measurements. Deep learning-based compressive sensing (DCS) has improved compressive sensing performance while maintaining a fast reconstruction by a training network for each measurement rate. Also, concerning the transmission scheme of measurement lost, DCS cannot recover the original signal. Thereby, it fails to maintain the error-resilient property. In this work, we proposed a robust deep reconstruction network to preserve the error-resilient property under the assumption of random measurement loss. The measurement lost layer is proposed to simulate the measurement loss in an end-to-end framework.

17:45 *Cong Phuoc Phan*

Covid-19 Deep Clustering: A Covid-19 Ontology construction method with research documents clustering and dynamic medical labeling

ABSTRACT. This paper introduces a novel clustering-based framework for Covid-19 ontology construction using Pubmed LitCovid scientific research articles data. Our study uses a semantic approach with hierarchical clustering to construct a more effective Covid-19 documents ontology with medical labeling and search. We believe this study may initiate a future development for an advanced Covid-19 domain-specific ontology. The significant contribution from this research addresses solving the limitations in manual classification tasks of the everyday fast increasing number of scientific papers and the overloading of their unclassified

knowledge. With this research, our provision will help scholars with a better search mechanism to retrieve high relevant expert information about their favorite topics in the Covid-19-related literature. To our best knowledge, this approach is the first successful attempt to apply auto clustering with labeling and search on the Covid-19 research papers. Moreover, in the area of text processing, we also propose a systematical evaluation without dependence on the standard data collection to evaluate our methodology.

18:30-20:30 Gala dinner

LOCATION: Diamond Ballroom 1, Wyndham Legend Halong

SATURDAY, DECEMBER 3RD

14:00-16:30 Transfer to Hanoi

Year	Venue	Organizer
2010	Ta Quang Buu Library, Hanoi University of Science and Technology, Hanoi, Vietnam	Hanoi University of Science and Technology
2011	Ta Quang Buu Library, Hanoi University of Science and Technology, Hanoi, Vietnam	Hanoi University of Science and Technology
2012	Halong Plaza Hotel, located by Halong Bay, Quang Ninh city, Vietnam	Hanoi University of Science and Technology
2013	Pullman Danang Beach Resort, Danang city, Vietnam	Hanoi University of Science and Technology
2014	Ta Quang Buu Library Building at Hanoi University of Science and Technology, Hanoi, Vietnam. SoICT'14 was in conjunction with iiWAS2014 (The 16th International Conference on Information Integration and Web-based Applications & Services)	Hanoi University of Science and Technology
2015	Imperial Hue Hotel, Hue city, Vietnam	Hanoi University of Science and Technology, Hue University
2016	Rex Hotel, Hochiminh city, Vietnam	Hanoi University of Science and Technology, Nguyen Tat Thanh University
2017	Sheraton Hotel, Nhatrang city, Vietnam	Hanoi University of Science and Technology
2018	Pullman Danang Beach Resort, Danang city, Vietnam	Hanoi University of Science and Technology, Danang University
2019	Wyndham hotel, Ha Long Bay	Hanoi University of Science and Technology
2022	Wyndham hotel, Ha Long Bay	Hanoi University of Science and Technology

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School of Information and Communication Technology

Hanoi University of Science and Technology, Vietnam

Vietnam Institute for Advanced Study in Mathematics

1. Mission

The vision of VIASM is to become an excellent research center in mathematics, with good working environment same as in some developed countries. This is a place for academic exchanges to build the scientific capacity of researchers and teachers of pure and applied mathematics in Vietnam. VIASM is in charge of implementing the National Program for the Development of Mathematics from 2010 to 2020 (NPDM). This program is responsible for encouraging young students to learn mathematics, improving the quality of teaching and learning mathematics at school and university level as well as dissemination of scientific knowledge to the public.

2. Activities

The main activity of the Institute is organizing research groups to conduct research programs and projects of high quality. Scientists in the same field will gather and work together at the Institute in short-term basis. It aims to attract Vietnamese mathematicians from abroad and international mathematicians to Vietnam and participate in research and training with their colleagues in Vietnam. This activity will strengthen the research branches which have taken root in Vietnam and will incubate the formation of new branches of Mathematics. Every year, VIASM offers some Postdoctoral fellowships. These fellowships are intended for mathematicians with Ph.D awarded within 5 years. Postdoctoral Fellows must hold a Ph.D. at the time of their proposed residency. The fellowship is for one year and can be extended up to three years. The VIASM will organize conferences, workshops, seminars on topics associated with research groups working at the institute in order to implement their research projects as well as attract new students to do research. In cooperation with NPDM, the Institute will hold summer schools for math students, short-term training courses for mathematics teachers and organize other activities to disseminate scientific knowledge to the public.

3. Organization

The VIASM is managed by a Board of Directors which consists of a Scientific Director, a Managing Director and one or two Deputy Directors. VIASM invites research groups and individuals to apply for research stay. The candidates will be evaluated by the Scientific Council of the Institute. The evaluation is based on scientific achievements of candidates, the importance and feasibility of research projects, as well as cooperation ability among the proposed research groups. Outstanding researchers will be also invited by the Board of Directors for a joint research project or for giving lectures. International Advisory Board includes a number of scientists or leaders of excellent scientific institution in other countries. Besides sharing their experiences, Advisory Board will assist the Institute in promoting the Institute's image in the world mathematical community as well as periodic assessment of activities of VIASM.

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