FORUM 2021

Math for Industry

Mathematics for Digital Economy

DECEMBER 12-16
HANOI, VIETNAM

VIASM
VIETNAM INSTITUTE FOR ADVANCED STUDY IN MATHEMATICS

Institute of Mathematics for Industry
Kyushu University

Asia Pacific Consortium of Mathematics for Industry

Dear Colleagues,

Welcome to the Forum 'Mathematics for Industry' 2021 in Hanoi, Vietnam!

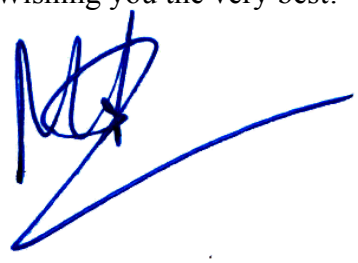
Mathematics plays a central role in the fourth industrial revolution. Applied mathematics and industrial mathematics in particular are rapidly growing with many advances and applications across the world. This year we are thrilled to be running the FMfI2021 themed "Mathematics for Digital Economy" while the process of digital transformation has dramatically accelerated. The FMfI2021 will feature a comprehensive program with lectures and industrial talks from experts in the fields and brilliant scientists. It will also include a special session 'Mathematics of Covid-19', with various modelling insights into the fight against the pandemic.

Vietnamese mathematics is known for strength in many areas of pure mathematics, and our education tradition is highly regarded for mathematical education. However, in recent years, there has been a growing demand from the industry in Vietnam for workers with strong mathematical science skills. Our institute would like to foster the interaction of mathematics with a broad range of science and technology, build new interdisciplinary research communities, especially in applied and industrial mathematics. I very much hope that this Forum will enable new scientific collaborations and help promote the important role of mathematics in business and industry in Vietnam.

Understanding that the uncertainty surrounding the Covid-19 and restrictions on both domestic and international travel in Vietnam may affect your ability to attend the event in person, we have made the decision to run the FMfI2021 as a virtual meeting. This virtual format actually brings about great benefits as it allows speakers and participants from all around the world to gather and exchange great insights to the topics. We are certain that all of you will find the FMfI2021 stimulating, rewarding and meaningful.

Looking forward to seeing you (online!) at the Forum.

Wishing you the very best!



Le Minh Ha

Managing Director of the Vietnam Institute for Advanced Study in Mathematics (VIASM)

On behalf of the FMfI2021 organizer

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The Asia-Pacific Consortium of Mathematics for Industry (APCMfI)

Mathematics for Industry (MfI) aims at the development of mathematics and its applications to enhance the quality of life on the planet by creating new technologies, improve industrial mathematical research and stimulate the two-way interaction between mathematics and industry. In Industrial Mathematics, it is the questions spawned by real world applications that drive the resulting two-way interaction between a particular application and the associated mathematics that is utilized and developed, and that sometimes involves, quite unexpectedly, deeper aspects and new areas of mathematics than initially anticipated.

Though its significance has often been overlooked, industrial mathematics has always been an essential aspect of the history, culture, traditions and development of mathematics, including much of modern theoretical mathematics. Directly and indirectly, developments in mathematics can be traced to the initial attempts to answer quite practical questions. The development of Galileo's telescope and the design of clocks represent early stimuli. Harmonic analysis and Fourier analysis have their origins in the study of heat transfer in metals. The conservation and minimization of energy engendered in the study of thermodynamics and fluid motion underlie much of the foundations of modern theoretical mathematics, as well as applied and industrial mathematics.

The increasing sophistication of modern industry, reflected in, for example, medical measurements, game theory applications in economics, psychology, behavioral science and biology, computer-controlled instrumentation, the efficient development of geothermal energy, the microbial treatment of waste water, Ito calculus in finance, etc., has generated a need and demand for mathematical expertise to stimulate, foster and implement the associated innovations. Even the theoretical areas of algebraic geometry, abstract algebra, topology, differential geometry and group theory are playing an increasingly important role in industrial endeavors connected with entertainment (such as games and movies), architecture, analysis of protein structure and error-correcting codes.

There is general agreement and support in the Asia-Pacific region to have regular industrial mathematics exchanges, conferences, internships, etc., which build on the activities already occurring. In fact, over the years since the concept of an Asian Consortium of Mathematics for Industry was first proposed and more recently when planning to formalize possibilities, there has been strong support and encouragement from colleagues in China, Hawaii, Korea, Malaysia and Singapore as well as Australia, New Zealand and Japan.

A small group, with the encouragement of various colleagues throughout the Asia-Pacific region, met in Canberra, March 31 to April 2, 2014, to do the initial planning for the formation and launch of APCMfI, with the emphasis being fundamentally Mathematics-for-Industry. Those directly involved in the discussions in Canberra were Bob Anderssen (Australia), Zainal Aziz (Malaysia), Frank de Hoog (Australia), Yasuhide Fukumoto (Japan), Alexandra Hogan (Australia), Geoff Mercer (Australia), Masato Wakayama (Japan) and Graeme Wake (New Zealand).

In any endeavours that involve the initiation and implementation of a new opportunity, the situation is similar to planting and nurturing a seed which will grow into a strong and robust tree. The meeting and deliberations of this group represented the preparation of the ground for the planting of the seed. The subsequent planting and nurturing involves the wide distribution of this initiative throughout the Asia-Pacific region; the seeking of seed funding from various mathematics departments, societies, agencies and industry; the establishment of a website; the launch of APCMfI under the MfI banner.

Planned Activities for APCMfI

An important component of the plans for APCMfI is a number of activities through which it interacts directly with the Asia-Pacific MfI communities and indirectly with the various international industrial mathematics consortia, organizations and individuals.

The underling goal is to stimulate the development of mathematics and its applications to enhance the quality of life on the planet by creating new technologies, improve industrial mathematical research and stimulate the two-way interaction between mathematics and industry.

The planned activities include:

1. Internships for graduate students to work on industrial and governmental research projects. In particular, in this scheme, the student will spend several months at both their home institute and the industrial partner. Within the APCMfI framework, the goal is to make it easier for students to undertake internships with industry in other countries in the Asia Pacific region

2. Regular Mathematics-for-Industry Study Groups (MfISG) which involve a strong Asia Pacific involvement with regard to problems proposed and scientists' participation. The implementation of this activity will take advantage of various study group meetings already operating in Japan, Malaysia, Australia and New Zealand.

3. Regular Math-for-Industry Forums and Workshops building on the successful annual Forums organized by the Institute of Mathematics for Industry (IMI) at Kyushu University.

4. The exchange of information and publicity material about industrial mathematics activities in the Asia Pacific region, such as electronic newsletter, publications, websites, etc.

5. The organization of joint lectures and programs such as Summer and Winter schools which foster a strong student participation which takes advantage of the similar times in the Asia Pacific region.

6. Fostering a strong two-way interaction with (i) mathematical and statistical colleagues and institutions, and (ii) the needs and opportunities of industrial mathematics.

History of the Forums "Math-for-Industry"

The Forums now have a decade-long history. Initiated by the Institute of Mathematics for Industry (IMI) at Kyushu University in Japan in 2010, the Forums have provided a meeting place for mathematical minds, and also to provide insights that enable the endeavors of industry-focussed researchers to be shared within the region.

2010 Oct 21–23	Fukuoka, Japan Information Security, Visualization, and Inverse Problems, on the basis of Optimization Techniques
2011 Oct 24–28	Honolulu, US TSUNAMI - Mathematical Modelling Using Mathematics for Natural Disaster: Prediction, Recovery and Provision for the Future
2012 Oct 22–26	Fukuoka, Japan Information Recovery and Discovery
2013 Nov 4–8	Fukuoka, Japan The Impact of Applications on Mathematics
2014 Oct 27–31	Fukuoka, Japan Applications + Practical Conceptualization + Mathematics = Fruitful Innovation

In 2014, the Asia-Pacific Consortium of Mathematics for Industry (APCMfI) was formed, and the forums started to move around the Consortium's member countries, with themes that reflected each country's interests.

2015 Oct. 26–30	Fukuoka, Japan The Role and Importance of Mathematics in Innovation
2016 Nov. 21–23	Brisbane, AU Agriculture as a Metaphor for Creativity in all Human Endeavors

2017 Oct. 23–26	Honolulu, US Responding to the Challenges of Climate Change: Exploiting, Harnessing and Enhancing the Opportunities of Clean Energy
2018 Nov. 17-21	Shanghai, PRC Big Data Analysis, AI, Fintech, Math in Finance and Economics
2019 Nov. 18–21	Auckland, NZ Mathematics for the Primary Industries and the Environment
2021 Dec 13-16	Hanoi, Vietnam Mathematics for Digital Economy

It is clear that the Forums traverse a wide range of topics, and that the abilities of mathematicians to address these affirm the importance of such specialists in the increasingly-complex ways in which society operates. The value that quantitative scientists and engineers provide to all communities cannot be under-estimated. While most people appreciate effective and efficiently-operating systems, they often do not realize how these come about, and who is providing the sophisticated processes that underlie their efficiency.

While the speakers are experienced in their fields, the students who present posters and give talks about their work are the future leaders in APCMfI; they are valuable members of the "Math-for-Industry" community, and are particularly welcome at this Forum.

Information about the APCMfI and FMfI is extracted from the APCMfI website and the FMfI2019

The Vietnam Institute for Advanced Study in Mathematics

The Vietnam Institute for Advanced Study in Mathematics (VIASM) was established in late 2010 and officially came into operation on June 1st, 2011. The scientific director of the Institute is Professor Ngo Bao Chau, the 2010 Field Medalist.

Since then our institute has become the meeting point for international and Vietnamese mathematicians, exchanging ideas, initiating new research projects, collaborating and connecting with young Vietnamese researchers and students.

We aim to promote and initiate basic research activities in mathematics and mathematical education in Vietnam, collaborating with other academic and research institutes around the world to strengthen the research and education ecosystem.

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 on a 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 up to 5 Postdoctoral fellowships, and organizes 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.

Our institute is also responsible for the implementation of the National Program for the Development of Mathematics in Vietnam, now in the second phase from 2021 to 2030. Under this program, we help organize many teacher training seminars, and outreach activities to encourage young students to learn mathematics, improve the quality of teaching and learning mathematics, as well as disseminate scientific knowledge to the public.

Organizers

Organizing Committee

Le Minh Ha (Chair), Vietnam Institute for Advanced Study in Mathematics

Trinh Thi Thuy Giang, Vietnam Institute for Advanced Study in Mathematics

Shizuo Kaji, Kyushu University, Japan

Nguyen Ha Nam, Vietnam Institute for Advanced Study in Mathematics

Ta Hai Tung, Hanoi University of Science and Technology, Vietnam

Melanie Roberts, Griffith University in Brisbane, Australia

Osamu Saeki, Kyushu University, Japan

Masato Wakayama, Tokyo University of Science, Japan

Invited Speakers Committee

Ho Tu Bao (Chair), Vietnam Institute for Advanced Study in Mathematics

Alona Ben-Tal, Massey University, New Zealand

Philip Broadbridge, La Trobe University, Australia

Jin Cheng, Fudan University, China

Yasuhide Fukumoto, Kyushu University, Japan

Nguyen Xuan Hung, Ho Chi Minh City University of Technology, Vietnam

Kenji Kajiwara, Kyushu University, Japan

Vu Hoang Linh, Vietnam National University, Hanoi

Vu Ha Van, Yale University, USA and Vingroup Big Data Institute, Vietnam

Administrative Assistants

Le Thi Lan Anh, Vietnam Institute for Advanced Study in Mathematics

Pham Thi Phuong Cuc, Vietnam Institute for Advanced Study in Mathematics

Seiko Sasaguri, Kyushu University

Program FMfI2021 Vietnam

December 12-16

Theme: **Mathematics for Digital Economy**

Sunday 12 Dec
8.00. IMI IAB
9.00. APCMfI Board
10.00. APCMfI AGM
11.00. Journal Boards

Monday 13 Dec	
08.30–09.00	Registration
09.00-09.30	**Welcome and Opening**
09.30-10.10	Nathan Kutz USA
10.10-10.30	*Refreshment break*
10.30-11.10	Washio Takashi Japan
11.10-11.50	Ngo Duc Thanh Vietnam
11.50-12.30	Graham Williams Australia
12.30-13.30	*Lunch*
13.30-14.10	Alexander Lipton Israel
14.10-14.20	*Break*
14.20-15.00	Julian Jang-Jaccard New Zealand
15.00-15.40	Volkan Cevher Switzerland

Tuesday 14 Dec	
08.30-09.10	Kazue Sako Japan
09.10-09.50	Lim Ee-Peng Singapore
09.50-10.00	*Break*
10.00-10.40	Hien Nguyen Australia
10.40-11.20	Yu Jiang China
11.20-12.00	Takashi Tsuchiya Japan
12.00-13.30	*Lunch*
13.30-14.00	**Short communication** Aung Zaw Myint Myanmar Jessada Tanthanuch Thailand
14.00-16.00	**Poster Session**

Wednesday 15 Dec	
Mathematics of Covid-19	
08.30-09.10	Stefan Canzar Chile
09.10-09.50	Michael Lydeamore Australia
09.50-10.00	*Break*
10.00-10.40	Emily Harvey New Zealand
10.40-11.20	Nguyen Ngoc Doanh Vietnam
11.20-12.00	Shingo Iwami Japan
12.00-13.30	*Lunch*
13.30–14.10	Mai Anh Tien Singapore
14.10–14.20	*Break*
14.20-15.00	Vincent Y. F. Tan Singapore
15.00-15.40	Amir Mosavic Hungary

Thursday 16 Dec	
08.30-09.10	Yaniv Gal New Zealand
09.10-09.50	Caleb Moses New Zealand
09.50-10.00	*Break*
10.00-10.40	Xiaoping Lu Australia
10.40-11.20	Kohei Hatano Japan
11.20-12.00	Nguyen Dinh Hoa Japan
12.00-13.30	*Lunch*
13.30–14.10	Jin Cheng China
14.10–14.20	*Break*
14.20-15.00	Trinh Anh Tuan Hungary
15.00-15.20	**Closing** **Osamu Saeki**
17.00-20.00	Banquet

Session Chairs	
Mon 9.30-10.10	Osamu Saeki
10.30-12.30	Yasuhide Fukumoto
13.30-15.40	Ho Tu Bao
Tue 8.30-9.50	Zainal Aziz
10.00-12.00	Hoang Linh Vu
13.30-14.00	Hung Nguyen Xuan
14.00-16.00	Shizuo Kaji
Wed 8.30-9.50	Philip Broadbridge
10.00-12.00	Alona Ben-tal
13.30-15.40	Jin Cheng
Thu 8.30-9.50	Melanie Roberts
10.00-12.00	Kenji Kajiwara
13.30-15.00	Le Minh Ha

Opening Ceremony *Mon, Dec 13*	
08:30 - 09:00	Registration
09:00 - 09:05	Introduction
09:05 - 09:10	Welcoming Remarks *Le Minh Ha* *VIASM Managing Director*
09:10 - 9:15	Remarks by *Philip Broadbridge* *APCMfI Vice President*
09:15 - 09:20	Remarks by *Osamu Saeki* *IMI Director*

Closing Ceremony *Thu, Dec 16*	
15:00 - 15:05	Poster Awards Announcement *Philip Broadbridge* *APCMfI Vice President*
15:05 - 15:10	Presentation of the FMfI2022 *Philip Broadbridge* *APCMfI Vice President*
15:10 - 15:15	Announcement *Osamu Saeki* *IMI Director*
15:15 - 15:20	Closing remarks *Le Minh Ha* *VIASM Managing Director*

Abstracts

Short Communications

- Tuesday 14 December -

Aung Zaw Myint

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A mathematical model for COVID-19 transmission dynamics with a case study of Myanmar

We propose a compartmental mathematical model to predict and control the transmission dynamic of COVID-19 disease in Myanmar. We compute the basic reproduction number, threshold. We perform local and global stability analysis for infection equilibrium in terms of basic reproduction number, and we conduct a sensitivity analysis in our corona-virus model to determine the relative importance of model parameters to epidemic transmission. Moreover, numerical simulation demonstrates that the disease transmission rate more than effective to mitigate the basic reproduction number.

Jessada Tanthanuch

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Some Applications of Mathematics in Medical Works

Mathematics, often called the “Queen of the Sciences”, is one of the basic sciences. However, this major role of the basic science is able to apply to many medical works. This presentation shows the applications of mathematics research to biomedical engineering applications. The overall concepts of some research by school of mathematics and school of biomedical innovation engineering, Suranaree University of Technology, Nakhon Ratchasima, Thailand, are given. The research works are the modelling of knee shape, the modelling of the blood flow to heart, the modelling to predict the patients’ postoperative WOMAC score after total knee replacement, the applications of support vector machine, twin parametric support vector machine for the medical image classification problems, the development of image processing technique to enhance quality of ultrasound and x-ray images and teeth classification, and the case study of using 3D printing in the preoperative planning for the surgery.

Special Session: *Mathematics of Covid-19*

- Wednesday 15 December -

Stefan Canzar

Gene Center, Ludwig Maximilian University of Munich

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Engineered algorithms for large-scale single-cell RNA sequencing and multimodal data analysis

Experimental methods for sequencing DNA or RNA of single cells have transformed biological and medical research. The throughput of this technology has dramatically increased over the last few years, such that today the expression of genes in millions of cells can be measured in a single experiment. The computational interpretation of the produced data, however, often exceeds the capacity of existing algorithms. We have therefore developed method Sphetcher, an efficient algorithm that computes a much smaller set of cells that represent the transcriptional space of the original data as accurately as possible. Sphetcher can compute such a so-called sketch of millions of cells in minutes and facilitates the identification of rare cell types.

Single-cell sequencing in addition allows to reconstruct trajectories that describe dynamic changes in gene expression that occur during the differentiation of cells. We have developed method Trajan that allows to compare such trajectories of, e.g., differentiating immune cells that are involved in the response to an infection.

In algorithm Specter we combine measurements of multiple types of molecules to refine cell types. We showed that Specter is able to resolve subtle transcriptomic differences between subpopulations of memory T cells based on their combined expression of mRNAs and surface proteins. For the joint visualization of such modalities, we extended t-SNE and UMAP, the most popular methods for the visualization of biomedical data.

Michael Lydeamore

and COVID-19 Modelling and Analytics team, Government of Victoria

Department of Econometrics and Business Statistics, Monash University

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Mathematical modelling for COVID-19 in the Victorian Public Service

The COVID-19 pandemic has put infectious diseases modelling in the spotlight. Many institutes and governments globally have very suddenly had a desire and need for accurate modelling and analytics on a rapidly evolving situation. During 2020, I was seconded to the Victorian Department of Health, and formed a modelling and analytics team which regularly provided situational reporting, analysis and policy relevant advice to high level decision makers and ministers.

I will discuss three pieces of work which were influential at very different stages of the Victorian COVID-19 experience. The first was a model that was created in a time of little knowledge, but was inclusive of many operational details that normally would not be considered in model construction. This model was used in numerous decisions, including Victoria's PPE planning and hospital equipment procurement.

The second model contains much more detail, including age and complex contact patterns, and was used to inform the gradual easing of restrictions before Victoria's second wave including school and workplace re-opening.

The final piece of work is a data visualisation dashboard known as the "Mystery Case Tracker". This tool brings together infection timelines, contact patterns and geographical coding into a dashboard utilised by the outbreak team to rapidly understand and classify places of risk.

As well as the pieces of work, I'll discuss how analytics and modelling are broadly thought of in these settings, and how approaching issues with an analytics mindset can be helpful in solving problems rapidly.

Emily Harvey
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and
James Gilmour - Department of Physics, University of Auckland
Oliver MacLaren - Department of Engineering Science, University of Auckland
Dion O'Neale - Department of Physics, University of Auckland & Te Pūnaha Matatini
Frankie Patten-Elliott - Department of Physics, University of Auckland & Te Pūnaha Matatini
Steven Turnbull - Department of Physics, University of Auckland & Te Pūnaha Matatini
David Wu - Department of Engineering Science, University of Auckland

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Modelling COVID-19 on a bipartite contact network of 5 million individuals for the Elimination Strategy in Aotearoa New Zealand

Many of the models used for rapid policy advice during the COVID-19 pandemic rely on simplifying assumptions about the homogeneity of populations and the impact of non-pharmaceutical interventions on transmission. In the context of an elimination strategy, with small case numbers, such approximations become increasingly poor representations of reality. We have built a stochastic model of infection dynamics that runs on an empirically-derived, bipartite contact network that explicitly represents each of the ~5 million people in Aotearoa NZ. This model includes mechanistic representation of testing, contact tracing, and isolation processes, as well as targeted 'Alert Level' changes. The model has been used to inform government responses to SARS-CoV-2 outbreaks in Aotearoa NZ during 2020 and 2021. We find that the heterogeneity and network structure in our model leads to qualitatively different behaviour, compared with a "well-mixed" model, in a number of scenarios. We highlight some key differences between this model and such well-mixed ODE and branching process models.

Doanh Nguyen-Ngoc

and Alexis Drogoul, UMMISCO, IRD/France

and in collaboration with other colleagues

UMMISCO & ACROSS, IRD/France and Thuyloi University

Vietnam

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SEIR network models for Coronavirus disease (COVID-19) in Vietnam

In this talk, we will introduce some SEIR network models incorporating different spatial scales from province, district and ward levels to cell level to explore the spread of different waves of Coronavirus disease (COVID-19) in Vietnam and to support the Rapid Response Team, Vietnam National Committee Against Covid-19.

Shingo Iwami

Division of Biological Science, Graduate School of Science

Nagoya University, Japan

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Mathematical model based prediction and application to COVID-19

If it becomes possible to capture the nonlinear dynamics behind phenomena with a mathematical model and its numerical analysis, it will be possible to predict the future which might be limited. For example, when applied to medical data, it can be expected to evaluate and predict treatment effects and prognosis with high accuracy. In this talk, I will present an example of how the development of a mathematical model that explains clinical data of COVID-19 patients has essentially made it possible to propose treatments and design clinical trials based on predictions.

Mai Anh Tien

and Arunesh Sinha, School of Computing and Information Systems, Singapore Management University

School of Computing and Information Systems, Singapore Management University

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Securing Vaccine Delivery Against Physical Threats

Vaccine delivery in under-resourced locations with security risks is not just logistically challenging but also life threatening. The current COVID pandemic spread and the need to vaccinate has added even more urgency to this issue. In this paper, we propose a framework to plan vaccination drives that balance physical security and desired vaccination coverage with limited resources. We set up the problem as a Stackelberg game between a defender and adversary, where the set of vaccine centers is not fixed a priori. This results in a mixed combinatorial and continuous optimization problem. As part of solving this problem, we provide a novel contribution by identifying general duality conditions of switching max and min when discrete variables are involved. We perform experiments to show effects of various parameters on the problem and show that the solution proposed is scalable in practice.

Vincent Y. F. Tan

and Junwen Yang, National University of Singapore

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Towards Minimax Optimal Best Arm Identification In Linear Bandits

We study the problem of best arm identification in linear bandits in the fixed-budget setting. By leveraging properties of the G-optimal design and incorporating it into the arm allocation rule, we design a parameter-free algorithm, Optimal Design-based Linear Best Arm Identification (OD-LinBAI). We provide a theoretical analysis of the failure probability of OD-LinBAI. While the performances of existing methods (e.g., BayesGap) depend on all the optimality gaps, OD-LinBAI depends on the gaps of the top d arms, where d is the effective dimension of the linear bandit instance. Furthermore, we present a minimax lower bound for this problem. The upper and lower bounds show that OD-LinBAI is minimax optimal up to multiplicative factors in the exponent. Finally, numerical experiments corroborate our theoretical findings.

Amir Mosavi

and Sina Ardebili, Annamaria R. Varkonyi-Koczy

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Global and Local Prediction Methods of COVID-19 Time Series with Machine Learning

This presentation is devoted to the advancement of the machine learning-based methods for accurate prediction of the Covid-19 outbreak prediction. Advancement of the novel models for time-series prediction of COVID-19 is of utmost importance. Machine learning (ML) methods have recently shown promising results. The present study aims to engage an artificial neural network-integrated by grey wolf optimizer for COVID-19 outbreak predictions by employing the global and local dataset. For the case study, the training and testing processes have been performed by time-series data related to January 22 to September 15, 2020 and validation has been performed by time-series data related to September 16 to October 15, 2020. Results have been evaluated by employing mean absolute percentage error (MAPE) and correlation coefficient (r) values. ANN-GWO provided a MAPE of 6.23, 13.15 and 11.4% for training, testing and validating phases, respectively. According to the results, the developed model could successfully cope with the prediction task.

Invited Talks

- Monday, December 13 -

J. Nathan Kutz

Applied Mathematics, University of Washington

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Learning Dynamical Systems Models from Data

A major challenge in the study of dynamical systems is that of model discovery: turning data into reduced order models that are not just predictive, but provide insight into the nature of the underlying dynamical system that generated the data. We introduce a number of data-driven strategies for discovering nonlinear multiscale dynamical systems and their embeddings from data. We consider two canonical cases: (i) systems for which we have full measurements of the governing variables, and (ii) systems for which we have incomplete measurements. For systems with full state measurements, we show that the recent sparse identification of nonlinear dynamical systems (SINDy) method can discover governing equations with relatively little data and introduce a sampling method that allows SINDy to scale efficiently to problems with multiple time scales, noise and parametric dependencies. For systems with incomplete observations, we show that the Hankel alternative view of Koopman (HAVOK) method, based on time-delay embedding coordinates and the dynamic mode decomposition, can be used to obtain a linear model and Koopman invariant measurement systems that nearly perfectly captures the dynamics of nonlinear quasiperiodic systems. Neural networks are used in targeted ways to aid in the model reduction process. Together, these approaches provide a suite of mathematical strategies for reducing the data required to discover and model nonlinear multiscale systems.

Takashi Washio

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Rare Event Search and Fast Data Assimilation for Industry in the Digital Twin Era

Modern society has now entered the digital twin era, where simulation models of many systems are constructed, and highly reliable and efficient designs and operations of the systems are expected to be carried out using simulations. Under this movement, enormous research activities on developing simulation techniques and models are currently underway in various fields. However, generic techniques to efficiently construct high quality designs and operation plans of the systems using the simulations have not been sufficiently studied. Such techniques must be developed by fusing mathematical optimization and simulation approaches in elaborating manners.

In this talk, first, we show techniques to efficiently discover rare events, which occur under very special conditions with extremely low probabilities, using simulations guided by mathematical search principles. We demonstrate an efficient scheme to design highly reliable products in industry using the techniques. Second, we show techniques for data assimilation which automatically and efficiently tune the simulation model parameters to reflect real system dynamics. Particularly, our techniques enable to find the accurate parameter values using only a few observations of the real system. We demonstrate quick monitoring of dynamics changes of an industrial factory and its prompt operation alteration to maintain the productivity.

This talk suggests an important R&D direction of applied mathematics for future industry.

Thanh NGO-DUC

and CORDEX-SEA's team & Quentin DESMET, LEGOS, France

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Climate change modelling in Southeast Asia and future climate information for the society

Today, 8.6% of the world population is living in Southeast Asia (SEA). Any change in the climate system can have unequivocal impacts on the region's socio-economic structures and living conditions. Given the high exposure and vulnerability of the region to extreme events, countries in SEA need to implement adaptation measures to lower their risk. Detailed information on future climate scenarios is thus needed. However, such information is still lacking in the region or generally based on global climate models (GCMs) that may have large uncertainties in a complex region such as SEA. In order to fill the gap, the Coordinated Regional Climate Downscaling EXperiment - Southeast Asia (CORDEX-SEA) project was established and had successfully gathered members from several countries to carry out a high resolution multi-model regional climate downscaling experiment.

In this presentation, an overview of climate change modeling activities in Southeast Asia and the recent findings of the CORDEX-SEA downscaling activities with the Coupled Model Intercomparison Project Phase 5 (CMIP5) are first introduced. We address how simulation of present-day extremes is influenced by the choices of various physical parameterizations to determine which schemes are well suited to simulate the climate extremes over the region. Future projected rainfall, extremes, and surface wind in association with tropical cyclone activities in SEA are subsequently analyzed. Lastly, we focus on a regional evaluation of 26 CMIP6 GCMs over SEA by introducing a novel ranking method based on temperature, rainfall, and wind distributions. The evaluation provides the CORDEX-SEA community with a reduced number of CMIP6 models with better performance over the region, which can be used in a further downscaling experiment.

Graham Williams

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Deploying the Latest AI and ML in Industry

With the extraordinary growth in research outputs in artificial intelligence, machine learning, and data science, industry struggles to keep pace. Developers in industry generally have limited time to explore and experiment with new algorithms coming out of our research labs at their current pace. Trialling a new technique can take considerable effort, even when the developers in industry have solid experience and data at the ready. The MLHub.ai initiative is a fully open source framework that aims to facilitate the exploration of new algorithms with minimal initial overhead. This presentation will set the scene and introduce a framework for easing our access to the latest research, illustrating its utility with industry collaborators.

Alexander Lipton

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Forex Trading Utilizing Consensus as a Service on Blockchains

We present an automated market-making (AMM) cross-settlement mechanism for digital assets on interoperable blockchains, focusing on central bank digital currencies (CBDCs) and stable coins. We develop an innovative approach for generating fair exchange rates for on-chain assets consistent with traditional off-chain markets. We illustrate the efficacy of our approach on realized FX rates for G-10 currencies.

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Artificial Intelligence (AI) for Intrusion Detection and Math

Cybersecurity Lab at Massey University, founded in 2016, has been one of the fastest-growing research labs in NZ dedicated to providing cutting-edge research theory, tools, and methodologies to improve the cybersecurity posture. With generous funds awarded from the NZ government, the lab has been dedicated to developing a set of novel cyber-resilient systems using the advancement of the latest AI techniques, both including machine and deep learnings, that can rapidly detect and classify various intrusions including malware. In this presentation, I will present a set of AI-based techniques (e.g., Autoencoder, Multi-Layer Perceptron, Deep Q-learning based Reinforcement Learning, Generative Adversarial Network) we have developed in the last few years and discuss the type of math skills demanded in these areas.

Volkan Cevher

and Panayotis Mertikopoulos, Thomas Pethick, Ya-Ping Hsieh, Nadav Hallak, Ali Kavis

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Optimization challenges in adversarial machine learning

Thanks to neural networks (NNs), faster computation, and massive datasets, machine learning (ML) is under increasing pressure to provide automated solutions to even harder real-world tasks beyond human performance with ever faster response times due to potentially huge technological and societal benefits. Unsurprisingly, the NN learning formulations present a fundamental challenge to the back-end learning algorithms despite their scalability, in particular due to the existence of traps in the non-convex optimization landscape, such as saddle points, that can prevent algorithms from obtaining "good" solutions.

In this talk, we describe our recent research that has demonstrated that the non-convex optimization dogma is false by showing that scalable stochastic optimization algorithms can avoid traps and rapidly obtain locally optimal solutions. Coupled with the progress in representation learning, such as over-parameterized neural networks, such local solutions can be globally optimal.

Unfortunately, this talk will also demonstrate that the central min-max optimization problems in ML, such as generative adversarial networks (GANs), robust reinforcement learning (RL), and distributionally robust ML, contain spurious attractors that do not include any stationary points of the original learning formulation. Indeed, we will describe how algorithms are subject to a grander challenge, including unavoidable convergence failures, which could explain the stagnation in their progress despite the impressive earlier demonstrations. We will conclude with promising new preliminary results from our recent progress on some of these difficult challenges.

Invited Talks

- Tuesday, December 14 -

Kazue Sako

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Cryptography and Transparency

In a digitalized society, we everyday use computers to receive messages from our friends, buy tickets online, and receive personal ads for attractive products on sale. However, as these are represented as digital data, it is difficult to verify whether these data sent from other computers are trustworthy. In this talk, we will discuss some tools using cryptography that makes the procedures occurring on the other computer transparent, thus increasing trustworthiness.

Keywords: verifiability, digital signature, zero-knowledge proofs, blockchain.

Ee-Peng Lim

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Data Mining for Labor Market Intelligence

Global economy and technology disruptions have created major impacts to labor markets in recent years. To fully understand these impacts to companies and rank-and-file people, we need to introduce new labor market intelligence capabilities using data mining. In this talk, we will review labor market intelligence and the underlying data mining problems. We will also illustrate how data mining can be used to analyse trends in job supply as well as patterns in job seeking behavior from big data. Finally, we will cover the challenges in labor market intelligence research and how one may overcome these challenges.

Hien Duy Nguyen

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Finite sample inference for generic autoregressive models

Autoregressive stationary processes are fundamental modeling tools in time series analysis. To conduct inference for such models usually requires asymptotic limit theorems. We establish finite sample-valid tools for hypothesis testing and confidence set construction in such settings. Examples of our approach are provided to demonstrate its applicability.

Yu Jiang

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Inversion Analysis for Medical Imaging

Inversion analysis for medical image is one of the important fields in the field of inverse problem research. The main purpose of solving this kind of inverse problem is to reconstruct the information that can be used for disease diagnosis from the information obtained from medical images. This talk will mainly cover the latest progress of some medical imaging technologies, such as magnetic resonance elastography, optical tomography related inversion analysis technologies.

Takashi Tsuchiya

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A simple mathematical model on spread of Covid-19 with the effect of vaccination and its application to Japan

The spread of Covid-19 causes serious damages to Japanese society since 2020. However, the number of new cases is decreasing drastically with the progress of vaccination reaching 70\% to 80\% in ratio as of November 2021. In this talk, a simple mathematical model is presented to describe the spread of Covid-19 used to predict the number of day-by-day new cases in Tokyo taking the effect of vaccination into account. The dynamics of infection are described with a simplified version of SIR model, where the period of infection of a patient is assumed to be a constant instead of obeying to an exponential distribution in SIR model. Another feature is it takes account of potential spreaders without symptom. The model works fairly well in spite of its simplicity.

In Japan, the timing of the next (sixth) wave of Covid-19 is of great public interest. We discuss the possibility of herd immunity relying on vaccination, and predict the future based on the model and data.

Invited Talks

- Thursday, December 16 -

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Deep learning in diagnostic applications: the good, the bad, and the ugly

Artificial Intelligence (AI) in general, and deep learning (DL) in particular, have recently gained popularity in both academic and commercial applications due to its ability to automatically identify meaningful features in the data and calculate a complex decision boundary between in the constructed feature space.

The medical device industry has recognised the potential of deep learning to support clinicians' diagnosis and gradually integrate deep learning into the clinicians' workflow to enforce their decisions and significantly reduce the likelihood of human error. Skin cancer diagnosis, for instance, is an example of such application, where dermatologist rely purely on visual inspection in order to diagnose suspicious skin lesion. Deep learning, which can extract subtle features from dermoscopic images, can hence provide accurate diagnosis to support the clinicians in their decision and reduce error rates.

While the question of whether AI will ever replace the clinician's decision making is still in debate, it is undeniable that the diagnostic performance of these algorithms is continuously getting better and in some case is comparable or even surpasses human specialists. Moreover, advances in deep-learning network architectures now allow training these models with less data and yet, lower risk of overfitting, which makes these algorithms even more approachable and increases their attractiveness. However, once a model is trained on labelled data, it is impossible to explain its decisions on new data, in a way that will be meaningful for the user (i.e. clinician). This lack of "explainability" in deep learning creates a landscape where

clinical decisions that are supported by AI require the clinician to either blindly trust the trained model or monitor the automated decision to a level that diminishes the utility that it brings, until enough trust is gained.

Furthermore, when a trained AI model is requested to diagnose a sample that it was not trained on (i.e. unknown class), it is impossible to predict the output of the system and such cases often lead to a wrong diagnostic result that is presented by the AI model with high score, suggesting that the result should be trusted.

In this talk we will discuss some benefits, pitfalls, and challenges of using modern AI models in real-world diagnostic applications. We will use the AI technology that is currently developed by Kāhu, New Zealand, for skin cancer detection as a case study, and will try to describe how far are we from finding a useful solution to the above challenges and how a desired solution may look like.

Caleb Moses
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Language models in industry and around the world

Language Models have been a strong focus for research in the AI industry following the publication of the Bidirectional Encoder Representations from Transformers (BERT) neural network architecture published by Google in 2018. More recently, major tech companies have been engaged in an arms race to build ever more complex language models trained on increasingly massive text datasets, also aimed at as many languages as possible.

I will discuss the latest language model trends and their implications for the digital economy, as well as their ethical implications. In addition, I will discuss non-English language models and their differences as well as the current situation for under-resourced minority languages around the world.

Xiaoping Lu

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Option pricing with transaction costs -- mathematical modelling in new digital economy

Mathematics plays an important role in modern finance, particularly in pricing options, which are financial derivatives with complicated structures. When transaction costs are considered, there is no longer a unique fair price between the buyer and the writer of an option, as both parties wish to recover the costs incurred in trading the underlying stocks from the prices that they are willing to pay or receive for the option. Mathematically, transaction costs make option pricing problems much more complicated, especially for American options and options under stochastic volatility. In this talk, we shall discuss the valuation problems for options with transaction costs, and examine how transaction costs affect option prices and the optimal exercise policy for American options.

Kohei Hatano

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Blackwell game and its applications in online prediction tasks

We review the Blackwell game, which is a classical game and a multi-objective extension of the Von Neumann's min-max game, online convex optimization(OCO), the standard framework of online prediction in the machine learning literature, and discuss their relationship. Then we will show some examples of online prediction tasks such as online load balancing, which seemingly do not fit to OCO, can be reduced to Blackwell games and resulting algorithms.

Nguyen Dinh Hoa

International Institute for Carbon-Neutral Energy Research & Institute of Mathematics for Industry

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Mutuality between AI and Optimization

AI and optimization are often considered from different perspectives by different research communities. However, it is undeniable that they are closely related to each other, where optimization is a core part of many machine learning algorithms, while AI can be employed to support optimization schemes. This talk presents examples of such mutuality with illustrations in energy systems. Moreover, directions for future research are also introduced.

Jin Cheng

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What can we find from Big Data with random Noise?

The rapid development of science and technology has produced a large amount of data with random noise. How to extract useful information from big data effectively is one of the fundamental problems in artificial intelligence, machine learning and other fields. From the perspective view of mathematics, there are some essential difficulties to be overcome. We consider the following two kinds of problems, Problem 1: How to use a large number of data with “large” random errors to construct more accuracy functions; Problems 2: How to obtain useful information in some areas that cannot be observed or difficult to observe data.

To solve these two difficult problems, we obtain that: 1. Tikhonov regularization based theory and algorithms for big data with random noise. The “more” data can be used to reduce the noise level of the data; 2. Theory and algorithms of how to use the physical mechanism “differential equation”; to reconstruct the unknown function in the place where the data may not be observed or is difficult to observe. We can also construct the indicator functions which can be used to describe the accuracy between the approximate solution and the true solution.

Tuan Anh Trinh

ICT Association of Hungary, Director of FinTech working group

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Digital Assets: Mathematics, Technologies and Applications

This talk gives an overview on Digital Assets and the underlying technologies as well as the mathematical backgrounds of those technologies. We will address industry attitudes toward cryptocurrencies, stablecoins, central bank digital currencies (CBDCs), tokenised securities, and non-fungible tokens (NFTs) from the perspectives of banking, insurance, asset management, fintechs, regulatory bodies and emerging digital assets companies. Underlying technologies such as distributed computing, blockchain technology and the mathematical backgrounds of those technologies will also be discussed. Last but not least, we will address the impacts on Digital Economy and the future prospects of digital assets.

Poster Session

- Tuesday, December 14 -

1. On the non-connectivity of moduli spaces of line arrangements

Poster: [click here]

Benoît GUERVILLE-BALLÉ
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I'm a post-doctorant at IMI - Kyushu University. My research area is currently low-dimensional topology. More precisely, I study the topology of algebraic curves in the complex projective plane. I am interested in the relations between the combinatorial data (local type of singularities, incidence relations, etc.) and the topology of the embedding of the curve in the plane or of its complement.

2. Flat families of cyclic covers

Poster: [click here]

Huy DANG
Vietnam Institute for Advanced Study in Mathematics, Vietnam
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I am a postdoc researcher at the Vietnam Institute for Advanced Study in Mathematics (VIASM). Before joining VIASM, I was an IM-Simons postdoc at the Institute of Mathematics, Vietnam Academy of Science and Technology. I obtained my Ph.D. in algebraic geometry at the University of Virginia in May 2020 under the supervision of Andrew Obus. Before that, I was a Master student in Mathematics at Louisiana State University. I am interested in arithmetic geometry. Specifically, I have been studying the lifting and the reduction of wildly ramified Galois covers of curves.

3. The impact of extreme weather events on calorie intake – income relationship: Semiparametric estimates for Vietnam

Poster: [click here]

Huong Thi TRINH

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Joint work with
Michel SIMIONI, INRA, UMR 1110 MOISA, Montpellier, France, France
Huyen Thi Ngoc NGUYEN, Thuongmai University, Vietnam
Loan Thi Thanh NGUYEN, Hanoi National University of Education, Vietnam
Anh Thi Van TO, Ministry of Education and Training, Vietnam

Dr. Huong Thi TRINH obtained a doctorate in mathematics from The University of Toulouse in France in 2018. She is a lecturer at Thuongmai University and a postdoc at VIASM. Her research interests focus on applied statistics, applied econometrics, Compositional Data Analysis (CoDa), and non-parametric methods. Her work covers both theoretical models and empirical studies, which have been published in several high-impact journals. Huong has also proactively supported many activities of the probability and statistics field in Vietnam, including conferences and a series of courses, supported by VIASM, on basic and advanced statistics for mathematical lecturers since 2019.

4. Optimality conditions based on the Fréchet second-order subdifferential

Poster: [click here]

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Joint work with

NGUYEN Dong Yen, Institute of Mathematics, Vietnam Academy of Science and Technology, Hanoi, Vietnam

DUONG Thi Viet An is a lecturer at Thai Nguyen University of Sciences, Vietnam. She received her Ph.D. degree from Institute of Mathematics, VAST, in 2018. Duong was a postdoctoral fellow at Institute of Mathematics, VAST(Vietnam) for the 2019/2020 academic year. Now, she is a postdoctoral fellow at Hangzhou Dianzi University (China).

5. An algorithm for counting the number of solutions for brick Wang tiling

Poster: [click here]

Yang HANG

Graduate School of Math. D1, Kyushu University, Japan

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I am a doctoral student at Kyushu University, enrolled in 2021. Prior to that, I received my master's degree in China. I am interested in graph theory. I worked on tree and lattice path in the past years. My current research topic is Wang Tile and I focus on counting the number of valid solutions.

6. The ground state of the semi-relativistic Pauli-Fierz Hamiltonian

Poster: [click here]

Takeru HIDAKA

Kyushu University

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I am a postdoctoral researcher at the Institute of Mathematics for Industry, Kyushu University. I obtained a PhD from the same university. My research focuses on spectral analysis of particle-field interaction models in quantum field theory.

7. FEM study on the elastic deformation process of materials in industry

Poster: [click here]

Phuong Cuc HOANG

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Joint work with

Thi Thanh Mai TA, School of Applied Mathematics and Informatics, HaNoi University of Science and Technology.

My name is Phuong Cuc. I come from Hai Phong city. I am a four year student at HaNoi University of Science and Technology. My major is Mathematics and Informatics. I love math. My favorite quote: Mathematics is always around us.

8. The complexity of the parity argument with potential

Poster: [click here]

Takashi ISHUZUKA

Institute of Mathematics for Industry, Kyushu University, Japan

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I’m a doctoral student at Graduate School of Mathematics, Kyushu University. Also, I have been a JSPS Research Fellow DC2 since 2021.

My research interests include Computational Complexity Theory and (Algorithmic) Game theory. I’m especially interested in the complexity of search problems around PPAD, PLS, and EOPL.

9. Differential Geometry Formulation of Hanging Membranes

Poster: [click here]

Yoshiki JIKUMARU
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Joint work with
Prof. *Yohei Yokosuka*, Department of Architecture and Architectural Engineering, Kagoshima University, Japan

Dr. Yoshiki Jikumaru is a postdoctoral researcher at Institute of Mathematics for Industry in Kyushu University. I got my Ph.D. at Kyushu University in 2020 under the supervision of Prof. Miyuki Koiso. I am a member of CREST ED3GE (Evolving Design and Discrete Differential GEometry). Recently, I am interested in the differential geometric analysis for the shell membrane theory and its application to structural engineering for architecture.

10. Reeb graphs of smooth functions with prescribed preimages

Poster: [click here]

Naoki KITAZAWA
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Naoki Kitazawa is a postdoctoral researcher at Institute of Mathematics for Industry, Kyushu University. He is interested and specialized in the singularity theory of differentiable maps, differential topology and algebraic topology of manifolds and related topics of geometry. Today`s poster concerns one of his related studies

N. Kitazawa, On Reeb graphs induced from smooth functions on 3-dimensional closed orientable manifolds with finitely many singular values, accepted for publication in Topol. Methods in Nonlinear Anal. after a refereeing process, arxiv:1902.08841.

11. Strategic delegation in bilateral environmental agreements under heterogeneity

Poster: [click here]

Qian LI
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I am a postdoctoral researcher in the Institute of Mathematics for industry, Kyushu University. Before that, I have finished my doctoral course in the department of Economics, in the same university. My research focuses on game theory and environmental economics, especially on using non-cooperative game theory to model the formation of international environmental agreements between developed and developing countries.

12. Modelling Housing Feature Impacts on Sale Price in Newly Developed Suburbs

Poster: [click here]

Christina Yin-Chieh LIN
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Joint work with
Andreas W. KEMPA-LIEHR, Department of Engineering Science, University of Auckland, New Zealand
Andrew MASON, Department of Engineering Science, University of Auckland, New Zealand

I am a PhD student currently in my third year of study at the University of Auckland. I also completed my undergraduate and master's degree in engineering science at the University of Auckland. My masters research was focused on improving healthcare pipelines through process mining techniques. My current project, supported by MADE Group Limited, aims to analyze housing feature impacts on sale values in newly developed suburbs.

13. Homotopifying abstraction of abstraction of algebra

Poster: [click here]

Yuki MAEHARA
Institute of Mathematics for Industry, Kyushu University, Japan
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Yuki Maehara is a postdoctoral researcher at the Institute of Mathematics for Industry, Kyushu University. He is interested in developing the foundations for algebraic methods in geometry. More specifically, category theory allows one to extract essential features of usual algebra in an abstract manner, and Yuki's research studies homotopical variants of such features. Yuki particularly enjoys untangling combinatorial intricacies arising from seemingly innocent algebraic statements.

14. Non-log liftable log del Pezzo surfaces of rank one in characteristic five

Poster: [click here]

Masaru NAGAOKA
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Masaru Nagaoka is a postdoctoral researcher at the Institute of Mathematics for Industry, Kyushu University. His research area is algebraic geometry. Recently, he is interested in phonomena which cannot be observed in algebraic varieties over the field of complex numbers, but occurs in those over the field of positive characteristic.

15. Zeros of random power series with finitely dependent Gaussian coefficients

Poster: [click here]

Kohei NODA
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Kohei Noda is a PhD student currently in his first year of study at Kyushu University. And he is also in Graduate Program of Mathematics for Innovation, GPMI. He completed my undergraduate and master's degree in mathematics at Kyushu University. His research interest is probability theory and mathematical physics. Specifically, he has been studying the generalization of zeros of Gaussian analytic function and signal processing. His aim is to apply zeros of Gaussian analytic function theory into engineering problems and to find a new connection among probability theory, complex analysis and engineering problems.

16. Augmented Lagrangian Method for Convex Piecewise Linear-Quadratic Optimization Problems

Poster: [click here]

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Joint work with
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2011 - Present: Researcher at Institute of Mathematics, VAST, Vietnam
2021: Ph.D. in Applied Mathematics at Wayne State University, Michigan, USA
2011: MSc in ACSYON Program at University of Limoges, Limoges, France
2009: BS in Pedagogy of Mathematics at Hanoi National University of Education, Hanoi, Vietnam

17. Optimal control problem in linear elasticity

Poster: [click here]

Quang Huy NGUYEN

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Joint work with

Thi Thanh Mai TA, School of Applied Mathematics and Informatics, Hanoi University of Science and Technology, Vietnam

Quang Huy Nguyen is a fourth-year student at Hanoi University of Science and Technology. At the university, he has learned the importance of applying mathematics theories to model many modern Industrial problems from experts in the field, including his teacher, PhD. Thi Thanh Mai Ta. He's recently been interested in the inverse problem in linear elasticity. Huy is nearing the end of his Bachelor of Management Information Systems degree and plans to continue his research soon.

18. New methods of life expectancy estimation

Poster: [click here]

Nga Thanh NGUYEN

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Ph.D. Nga Thanh NGUYEN is working on her thesis about survival analysis and life expectancy estimation, under the supervisor of Associate Professor Phuc Dang HO. Recently, her research interests focus on problems about life expectancy estimation, i.e Chiang method. She is also a maths lecturer at Banking Academy, Ha Noi. She has presented at several seminars on probability and applied statistics. In addition, she has supported activities of the probability and statistics field at VIASM, such as the Seminar on Applied Statistics.

19. SVM Classifications for Insurance Data Processing

Poster: [click here]

Irfan NURHIDAYAT

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Irfan Nurhidayat is a Ph.D. student at King Mongkut's Institute of Technology Ladkarabang, Thailand that is interested in insurance research. He is working under Prof. Dr. Busayamas Pimpunchat this moment to construct research abilities in insurance using mathematics tools. His Master's degree is from National Taiwan Normal University, Taiwan in 2019 with a thesis in continuous optimization. More details: https://irfannurhidayat09.wordpress.com/.

20. Asymptotic limit of fast rotation for the incompressible Navier-Stokes equations in a 3D layer

Poster: [click here]

Hiroki OHYAMA

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21. Asymptotic behavior of the Hurwitz-Lerch multiple zeta function at non-positive integer points

Poster: [click here]

Tomokazu ONOZUKA

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Since 2017, I have been a postdoctoral fellow at Kyushu university. In 2016, I worked as a postdoctoral fellow at Toyota technological institute. In 2014, I obtained my PhD degree in mathematics from Nagoya university. I mainly study number theory, especially zeta

functions. I am interested in the relation between the Riemann zeta function and multiple zeta functions.

22. Complex symmetry in Fock space

Poster: [click here]

PHAM Viet Hai
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Pham Viet Hai received his Ph.D degree in Mathematics (2017) from Nanyang Technological University, Singapore and M.S in Mathematics (2010) and B.S degree in Mathematics (2008) from Vietnam National University, Hanoi, Vietnam. He spent time as Research Fellow at the National University of Singapore (2017-2019). His main research interests include operator theory and dynamical systems.

23. Modeling the duration of reaching the risk tipping point in the Covid-19 outbreak: A survival analysis approach

Poster: [click here]

Thi Huong PHAN
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My name is Phan Thi Huong. In March of 2019, I successfully defended my PhD thesis in the Department of Statistical Sciences at University of Padova in Italy. My PhD thesis title is "spatial survival models for analysis of exocytotic events on human beta-cells recorded by TIRF imaging" which was supervised by Prof.ssa Giuliana Cortese . After that, I worked as a post-doctoral researcher at the University of Padova's Department of Information Engineering for about a year. I am currently a lecturer and researcher at the Faculty of

Applied Science, Ho Chi Minh City University of Technology - VNUHCM, Vietnam. My research interests are on survival models, particularly in biological applications.

24. Harmonic analysis of quantum Laplacian on quantum Riemannian space

Poster: [click here]

Masafumi SHIMADA
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I am a master course student at Kyushu University. My supervisor is Prof. Hiroyuki Ochiai at IMI- Kyushu University. My research focuses on quantum group theory of noncommutative geometry, especially quantized Laplacian in quantum Riemannian structure.

A short biography: When I was an undergraduate student, in weekly seminars I gave presentations on spherical harmonics, representation theory of Lie group and of Lie algebra. As an application of these theories, through online seminars and workshops, I launched the project for harmonic analysis of quantum Laplacian.

25. Density estimates for jump diffusion processes

Poster: [click here]

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Ngoc Khue TRAN is a lecturer at Pham Van Dong University. I got my PhD at Université Paris 13 in 2014 under the supervision of Prof. Eulalia Nualart and Prof. Arturo Kohatsu-Higa. I am a postdoctoral researcher at Vietnam Institute for Advanced Study in Mathematics. My research interests include: stochastic analysis, Malliavin calculus and statistical inference for stochastic differential equations with jumps.

26. Risk score of the Covid-19 outbreak in Hanoi: An evaluation at cell and commune levels

Poster: [click here]

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Dr. Huong Thi TRINH obtained a doctorate in mathematics from The University of Toulouse in France in 2018. She is a lecturer at Thuongmai University and a postdoc at VIASM. Her research interests focus on applied statistics, applied econometrics, Compositional Data Analysis (CoDa), and non-parametric methods. Her work covers both theoretical models and empirical studies, which have been published in several high-impact journals. Huong has also proactively supported many activities of the probability and statistics field in Vietnam, including conferences and a series of courses, supported by VIASM, on basic and advanced statistics for mathematical lecturers since 2019.

27. Evaluation of Hanoi Policies during Covid-19 lockdown 2021

Poster: [click here]

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DAO Thi Thanh Binh obtained her Doctorate in Finance at University of Paris Dauphine, France in 2005 from where she also received a Master degree in Finance in 2000. She also obtained another Master degree in Economics at EHESS in 2001. Her research is in the field in Default Risk & Modeling, Banking Risks, Corporate Governance, and Securities Valuation. She gives lectures in Corporate Finance, Bank Management, Investment and Portfolio Management, Asset and Liability Management, Statistics and Econometrics in various Bachelor and Master programs.

28. Optimal Food Intake of Pre-weaning Dorper Lamb

Poster: [click here]

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My name is Nurzahirah binti Mohd Yussof and I am currently doing my masters in the program of Master of Science in Applied Mathematics at the Universiti Teknologi MARA, Shah Alam Campus, Selangor, Malaysia.

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