GAIN INSIGHTS INTO THE WORLD OF AI

AI SUMMER SCHOOL

22 – 26 JULY, 2019
SINGAPORE

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Time	Day-1 [22nd July Mon]	Day-2 [23rd July Tues]	Day-3 [24th July Wed]	Day-4 [25th July Thurs]	Day-5 [26th July Fri]
Venue	LT 15, NUS	Venue: I Cube Auditorium, NUS	LT 3, 4 & 5, SUTD	LT 15, NUS	LT 15, NUS
0800 – 0845	Registration		Registration		Posters Set-up
0845 – 0900	Opening Ceremony				
0900 – 1030	Speaker: **Prof. Lee Wee Sun (NUS)** Title: *Machine Learning: From Basics to Structured*	Speaker: **Assoc. Prof. Bo An (NTU)** Title: *Introduction of Multi-agent Systems and Some Recent Research Progress*	Full Day Industry Hands-on Sessions: • **NVIDIA - Fundamentals of Deep Learning for Computer Vision** Instructors: ❖ **Mr. Ritchie Ng** ❖ **Dr. Teo Tee Hui** / Full Day Industry Hands-on Sessions: • **Ocean Protocol & ConnectedLife – Deep Learning & Model** Instructors: ❖ **Dr Franz Pfister** ❖ **Dr Kamer Yuksel**	Speaker: **Asst. Prof. Lee Gim Hee (NUS)** Title: *Deep Learning for 3D Point Clouds*	Speaker: **Prof. Leslie Kaelbling (MIT)** Title: *Doing for Our Robots What Nature Did for Us*
1030 – 1100	Tea Break & Networking	Tea Break & Networking		Tea Break & Poster Session	Tea Break & Poster Session
1100 – 1230	Speaker: **Dr. Vijay Ramaseshan Chandrasekhar (I2R, A*STAR)** Title: *The Deep Learning 2.0 Program at A*STAR: Next-generation Deep Learning Algorithms, Hardware and Untapped Enterprise Applications*	Speaker: **Asst. Prof. Wen Bihan (NTU)** Title: *Machine Learning for Imaging and Vision Applications*		Speaker: **Assoc. Prof. Pradeep Varakantham (SMU)** Title: *Multi-agent Sequential Matching for Improving Efficiency in Urban Environments*	Speaker: **Prof. Michael Wooldridge (Oxford)** Title: *Computational Game Theory through The Prisoner's Dilemma*
1230 – 1400	Lunch & Networking	Lunch & Networking		Lunch & Poster Session	Lunch & Poster Session
1400 – 1530	Speaker: **Asst. Prof. Reza Shokri (NUS)** Title: *Trusting Machine Learning: Privacy, Robustness, and Interpretability Challenges*	Speaker: **Asst. Prof. Lu Wei (SUTD)** Title: *Natural Language Processing: Fundamental Topics, Challenges and Outlook*		**Data Science Track** Speaker: **Asst. Prof. Georgios Piliouras (SUTD)** Title: *Learning in Zero-Sum Games Revisited: From von Neumann to Poincaré, Hamilton and Legendre*	**Data Science Track** Speaker: **Prof. Alon Halevy (UW)** Title: *Searching for Experiences*
1530 – 1600	Tea Break & Networking	Tea Break & Networking		Tea Break & Poster Session	Tea Break & Poster Session
1600 – 1730	Speaker: **Asst. Prof. Yair Zick (NUS)** Title: *Fair, Transparent and Collaborative Algorithms in Data-Driven Environments*	Speaker: **Asst. Prof. Shafiq Rayhan Joty (NTU)** Title: *Discourse Analysis and Its Applications*	SUTD Campus Tour	**Data Science Track** Speaker: **Prof. Wong Lim Soon (NUS)** Title: *Some Practical Advice for Bewildered Lay Data Analysts*	**Panel Discussion:** *Career paths in an AI world, and what skills and training is necessary to achieve and support them* Moderator: **Prof. Tan Kian Lee (NUS)**
1730 – 1800					**Closing Ceremony & Certificate Presentation**
1800 – 2200	Social Outing & Buffet Dinner at Singapore Night Safari				

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PROGRAMME - DAY 1

08:00   Registration

08:45   Opening Ceremony

09:00   **Machine Learning**
Title: *Machine Learning: From Basics to Structured*
Speaker: Prof. Lee Wee Sun (NUS)
We will cover the basics of machine learning to get everyone on the same page. This includes supervised, unsupervised, and reinforcement learning, together with heuristic, discriminative, as well as generative models. We discuss methods of scaling up machine learning to more complex and structured problems with the use of deep neural networks as well as graphical models. Finally, we will discuss how to neuralize structured probabilistic models to obtain more powerful approximators while retaining the dependencies, with factor graph neural networks and particle filter recurrent neural networks as examples.

10:30   Tea Break & Networking

11:00   **Machine Learning**
Title: *The Deep Learning 2.0 Program at A*STAR: Next-generation Deep Learning Algorithms, Hardware and Untapped Enterprise Applications*
Speaker: *Dr. Vijay Ramaseshan Chandrasekhar (I2R, A*STAR)*
This talk will provide an overview of ongoing research efforts at I2R: cutting edge algorithms and open research problems in deep learning, next-generation deep learning hardware and untapped applications of deep learning.

12:30   Lunch & Networking

14:00   **Privacy, Fairness and Algorithmic Transparency**
Title: *Trusting Machine Learning: Privacy, Robustness, and Interpretability Challenges*
Speaker: Asst. Prof. Reza Shokri (NUS)
Machine learning algorithms have shown an unprecedented predictive power for many complex learning tasks. As they are increasingly being deployed in large scale critical applications for processing various types of data, new questions related to their trustworthiness would arise. Can machine learning algorithms be trusted to have access to individuals' sensitive data? Can they be robust against noisy or adversarially perturbed data? Can we reliably interpret their learning process, and explain their predictions? In this talk, we will go over the privacy challenges of building trustworthy machine learning algorithms in centralized and distributed (federated) settings, and will discuss the inter-relation between privacy, robustness, and interpretability.

15:30 Tea Break & Networking

16:00 **Privacy, Fairness and Algorithmic Transparency**
Title: Fair, Transparent and Collaborative Algorithms in Data-Driven Environments
Speaker: Asst. Prof. Yair Zick (NUS)
Recent years have seen data-driven algorithms deployed in increasingly high-stakes environments. These algorithms often employ a complex infrastructure, making them effectively "black boxes"; this potentially exposes various stakeholders (such as end-users, or the agencies deploying said algorithms) to risks, such as unfair treatment or inadvertent data breaches. In response, government agencies and professional societies have highlighted fairness and transparency as key design paradigms in AI/ML applications.
We will discuss recent work on the foundations of algorithmic transparency and fairness. From the transparency perspective, we will discuss how we design transparency measures that are guaranteed to satisfy certain natural desiderata; in addition, we will discuss a recent line of work showing how some natural transparency measures may be used by an adversary in order to extract private user information. Regarding fairness, we will discuss how we apply fairness paradigms to algorithms - in particular our work on designing and deploying fair allocation algorithms; our results show that humans respond well to provably fair algorithms and are willing to collaborate effectively even in strategic domains. Finally, we will discuss how we apply learning-theoretic approaches to fairness via a novel paradigm for adapting game-theoretic solution concepts to data-driven domains.

17:30 End of Day 1

09:00   **Multi-Agent Systems**
Title: *Introduction of Multi-agent Systems and Some Recent Research Progress*
Speaker: Assoc. Prof. Bo An (NTU)
This talk will start with an introduction of the field of multi-agent systems. Then we will talk about some of our recent research in multi-agent systems in different domains such as scheduling security resources, sustainability, ad-word auction, and e-commerce. This talk will discuss key techniques behind these successes and their potential applications in other domains.

10:30   Tea Break & Networking

11:00   **Computer Vision**
Title: *Machine Learning for Imaging and Vision Applications*
Speaker: Asst. Prof. Wen Bihan (NTU)
Artificial intelligence (AI) made incredible progress in the past few years. It enables people to rethink how we integrate information, analyze data, and make decision, which used to be postulated based on theory, physical models or hypothesis. Now AI provides a much more effective way to learn the rule -- directly from the data themselves. The core technology behind the success of AI is machine learning, which aims to modal the useful data via a data-driven approach.
In this talk, we first provide an overview of why machine learning is important and critical in data modelling. Several machine learning techniques including both shallow and deep models will be introduced. We will discuss how these learning-based methods can help solve real-world challenges, in imaging, image processing, and computer vision applications.

12:30   Lunch & Networking

14:00 **Natural Language Processing (NLP)**
Title: *Natural Language Processing: Fundamental Topics, Challenges and Outlook*
Speaker: Asst. Prof. Lu Wei (SUTD)
The field of natural language processing (NLP) is currently undergoing exponential growth now. In this lecture, we begin with an introduction to the topic of NLP by looking at some fundamental tasks involved in the field. Next, we discuss some recent developments as well as some interesting trends in the field. We will then discuss some potential interesting directions to pursue.

15:30 Tea Break & Networking

16:00 **Natural Language Processing (NLP)**
Title: *Discourse Analysis and Its Applications*
Speaker: Asst. Prof. Shafiq Rayhan Joty (NTU)
Discourse processing is a suite of Natural Language Processing (NLP) tasks to uncover linguistic structures from texts at several levels, which can support many text mining applications. This involves identifying the topic structure, the coherence structure, the coreference structure, and the conversation structure for conversational discourse. Taken together, these structures can inform text summarization, essay scoring, sentiment analysis, machine translation, information extraction, question answering, and thread recovery.

The lecture starts with an overview of basic concepts in discourse analysis -- monologue vs. conversation, synchronous vs. asynchronous conversation, and key linguistic structures in discourse analysis. It then covers traditional machine learning methods along with the most recent works using deep learning and compares their performances on benchmark datasets. For each discourse structure we describe, we show its applications in downstream text mining tasks. Methods and metrics for evaluation are discussed in detail. We conclude with an interactive discussion of future challenges and opportunities.

17:30 Social Outing & Buffet Dinner at Singapore Night Safari

22:00 End of Day 2

PROGRAMME - DAY 3

08:15   Registration

09:00   Full Day Industry Hands-on Sessions:

- **NVIDIA** *- Fundamentals of Deep Learning for Computer Vision*

    Learn about the basics of Deep Learning and the latest technologies available in this one-day workshop. Suitable for beginners with no / minimal coding experience. Led by an experienced instructor, participants can expect to learn the latest deep learning techniques for designing and deploying neural network-powered machine learning across a variety of application domains.

    - Introduction & Getting Started with Deep Learning
    - Unlocking New Capabilities (Deep Neural Networks, Big Data and the GPU, Deploying DNN Models)
    - Hands-on exercise: Deployment of trained neural networks from their training environment into real-life applications
    - Measuring and Improving Performance
    - Hands-on exercise: neural network performance optimization and applying DNNs to object detection
    - Assessment Project: Train and Deploy a Deep Neural Networks

- **Ocean Protocol/ConnectedLife** *– Deep Learning & Model Developing*

    <u>Use Case hands-on application</u>
    Introducing to data
    Data cleaning and preparation
    Hands-on activity on data supply line

    <u>Knowledge Sharing</u>
    Data Collection & Model Training
    Generalization Accuracy
    Precision Medicine Calibration

PROGRAMME - DAY 3

<u>Hands on Application</u>
Model Building: High-resolution Motor State Detection /
Estimation in Patients with Parkinson's Disease
Ocean Protocol: Execute a data service supply chain
addressing trust, data privacy and value exchange

17:00   SUTD Campus Tour

18:00   End of Day 3

09:00 **Computer Vision**
Title: *Deep Learning for 3D Point Clouds*
Speaker: Asst. Prof. Lee Gim Hee (NUS)

In recent years, deep learning is increasingly applied to 3D point clouds for many important tasks in Computer Graphics, Computer Vision and Robotics. The first part of this lecture covers the basic concepts of permutation invariance, and translational and rotational equivariance that enable deep learning on 3D point clouds. These basic concepts lead us into the second part of the lecture, where we will discuss several state-of-the-art 3D point cloud-based deep learning works (including our works) on applications such as large-scale place-recognition, keypoint detection/descriptor, shape retrieval, semantic segmentation, object classification/detection, etc.

10:30 Tea Break & Poster Session

11:00 **Multi-Agent Systems**
Title: *Multi-agent Sequential Matching for Improving Efficiency in Urban Environments*
Speaker: Assoc. Prof. Pradeep Varakantham (SMU)

Rapid "urbanization" (more than 50% of worlds' population now resides in cities) coupled with the natural lack of coordination in usage of common resources (ex: bikes, ambulances, taxis, traffic personnel, attractions) has a detrimental effect on a wide variety of response (ex: waiting times, response time for emergency needs) and coverage metrics (ex: predictability of traffic/security patrols) in cities of today.

Motivated by the need to improve response and coverage metrics in urban environments, we have focused on building multiagent systems that exploit past data in making sequential decisions to continuously coordinate available supply of resources to an uncertain demand for resources. To address the main challenges of societal scale, uncertainty and dynamism, we exploit key properties of urban environments namely homogeneity and anonymity, decomposability and abstraction of supply/demand components. In this talk, we will describe our contributions and also provide results based on real data sets (and in some cases on real systems) in transportation (taxis and bike sharing), emergency response, energy, theme parks and security.

12:30 Lunch & Poster Session

PROGRAMME - DAY 4

14:00 **Algorithmic Game Theory**
Title: *Learning in Zero-Sum Games Revisited: From von Neumann to Poincaré, Hamilton and Legendre*
Speaker: Asst. Prof. Georgios Piliouras (SUTD)
We revisit one of most classic questions in game theory and online learning. How do standard learning dynamics such as multiplicative weights update, gradient descent, and follow-the-regularized-leader behave in zero-sum games? The standard textbook answer to this question is that these dynamics "converge" in a time-average sense to Nash equilibria. We provide some interesting insights about the day-to-day behavior. The continuous-time analogues of these dynamics (e.g. replicator dynamics) are Poincaré recurrent. Informally, the trajectories are "cycles" of constant Bregman distance from the Nash equilibrium which lies at the center of the "cycle". In fact, the dynamics are formally Hamiltonian with a hidden energy function that remains constant on all trajectories. This function is the summation of the convex conjugates (i.e. the Legendre–Fenchel transformations) of the regularizers of the two agents. These results extend in a natural way to all affine, network generalizations of zero-sum games. In discrete time, these algorithms move tangentially to these cycles and as a result they diverge chaotically away from Nash equilibria, contradicting the "convergence to equilibrium" paradigm.

15:30 Tea Break & Poster Session

16:00 **Data Science**
Title: *Some Practical Advice for Bewildered Lay Data Analysts*
Speaker: Prof. Wong Lim Soon (NUS)
Lay analysts often test hypotheses incorrectly. They do not know what to do next after testing an initial hypothesis. They need help to find interesting hypotheses. They do not know how to assess prediction models. They also have problems developing sound prediction models. We discuss their common mistakes and suggest some practical advice for some of their problems.

17:30 End of Day 4

PROGRAMME - DAY 5

09:00   **Reinforcement Learning**
Title: *Doing for Our Robots What Nature Did for Us*
Speaker: Prof. Leslie Kaelbling (MIT)
We, as robot engineers, have to think hard about our role in the design of robots and how it interacts with learning, both in "the factory" (that is, at engineering time) and in "the wild" (that is, when the robot is delivered to a customer). We discuss some general thoughts about the strategies for robot design and then talk in detail about the design of an overall architecture for an intelligent robot and the strategies for learning to integrate new skills into the repertoire of an already competent robot.

10:30   Tea Break & Poster Session

11:00   **Algorithmic Game Theory**
Title: *Computational Game Theory through The Prisoner's Dilemma*
Speaker: Prof. Michael Wooldridge (Oxford)
The Prisoner's Dilemma is the most famous game studied in game theory, and with good reason. On the one hand, it sets up an apparently paradoxical situation, in which choices that seem individually rational lead to outcomes that seem highly sub-optimal from the point of view of society. On the other hand, real-world Prisoner's Dilemmas abound - we encounter them every day.
In this talk, we will introduce some of the main concepts in computational game theory by way of the Prisoner's Dilemma. This sheds light both on the Prisoner's Dilemma and on the game theoretic concepts introduced.

12:30   Lunch & Poster Session

14:00   **Data Science**
Title: *Searching for Experiences*
Speaker: Prof. Alon Halevy (UW)

The rise of Artificial Intelligence introduces an important challenge: how can we develop AI that increases the well-being of its users? This talk will describe some recent research that addresses this challenge and poses interesting research problems for the AI and DB communities. A key theme of these projects is to help users record their positive experiences and to learn from these to help the user create additional experiences that make them happy. Here we address two challenges: learning from past experiences and searching for new experiences. Searching for experiences is difficult because experiences are nuanced and subjective. In addition, online search engines do not support search for experiential aspects of their services (e.g., hotels, restaurants), partially because most of this data exists only in online reviews. We describe subjective databases that attempt to model subjective data explicitly and support queries on subjective review data.

15:30   Tea Break & Poster Session

16:00   **Panel Discussion**
Careers in an AI world:

AI is impacting different industries and job functions globally. It has led to a continuously rising demand for tech jobs and skills, and in parallel a growth in what can be called "human-centric" jobs (those that depend on intrinsically human qualities). Career paths in an AI world, and what skills and training is necessary to achieve and support them.

Moderator: Prof. Tan Kian Lee
Panelists: Prof. Leslie Kaelbling (MIT), Prof. Michael Wooldridge (Oxford), Prof. Alon Halevy (UW), Mr. Mike Anderson (CTO, Dex and Founding Team Member, Ocean Protocol)

17:30   Closing Ceremony & Certificate Presentation

18:00   End of AI Summer School Program

Lee Wee Sun
Professor
Department of Computer Science
National University of Singapore (NUS)

Lecture Title: *Machine Learning: From Basics to Structured*

We will cover the basics of machine learning to get everyone on the same page. This includes supervised, unsupervised, and reinforcement learning, together with heuristic, discriminative, as well as generative models. We discuss methods of scaling up machine learning to more complex and structured problems with the use of deep neural networks as well as graphical models. Finally, we will discuss how to neuralize structured probabilistic models to obtain more powerful approximators while retaining the dependencies, with factor graph neural networks and particle filter recurrent neural networks as examples.

Biography
Lee Wee Sun is a professor in the Department of Computer Science, National University of Singapore. He obtained his B.Eng from the University of Queensland in 1992 and his Ph.D. from the Australian National University in 1996. He has been a research fellow at the Australian Defence Force Academy, a fellow of the Singapore-MIT Alliance, and a visiting scientist at MIT. His research interests include machine learning, planning under uncertainty, and approximate inference. He has been an area chair for machine learning and AI conferences such as the Neural Information Processing Systems (NeurIPS), the International Conference on Machine Learning (ICML), the AAAI Conference on Artificial Intelligence (AAAI), and the International Joint Conference on Artificial Intelligence (IJCAI). He was a program, conference and journal track co-chair for the Asian Conference on Machine Learning (ACML), and he is currently the co-chair of the steering committee of ACML.

More Information: https://www.comp.nus.edu.sg/~leews/

Vijay Ramaseshan Chandrasekhar
Scientist, Unit Head
Institute for Infocomm Research
A*STAR (I2R)

Lecture Title: *The Deep Learning 2.0 Program at A*STAR: Next-Generation Deep Learning Algorithms, Hardware and Untapped Enterprise Applications*

This talk will provide an overview of ongoing research efforts at I2R: cutting edge algorithms and open research problems in deep learning, next-generation deep learning hardware and untapped applications of deep learning.

Biography
Dr. Vijay Chandrasekhar assumed the appointment as Unit Head in the Institute for Infocomm Research in 2017. Vijay built a world class AI effort titled "Deep Learning 2.0" from scratch starting 2016: the cross-RI effort, spanning over a 100 people, covers fundamental research in deep learning algorithms, next-generation deep learning hardware and a range of untapped enterprise applications.

He completed his B.S and M.S. from Carnegie Mellon University (2002-2005), and Ph.D. in Electrical Engineering from Stanford University (2006-2013. His research contributions span deep learning and machine learning algorithms, computer vision, large-scale image and audio search, augmented reality and deep learning hardware. He has published more than 120 papers/MPEG contributions in 25+ top-tier journals/conferences, and has filed 7 US patents (4 granted, 3 pending). His Ph.D. work on feature compression led to the widely adopted MPEG-CDVS (Compact Descriptors for Visual Search) standard. He was awarded the A*STAR National Science Scholarship (NSS) in 2002.

He is an IEEE Senior Member and was nominated for the Young Scientist Award at the national level from the Singapore National Academy of Sciences in 2017.

He also holds an Adjunct Assistant Professor position in the School of Computer Science and Engineering at Nanyang Technology University.

More information: http://vijaychan.github.io/

Reza Shokri
Assistant Professor
Department of Computer Science
National University of Singapore (NUS)

Lecture Title: *Trusting Machine Learning: Privacy, Robustness, and Interpretability Challenges*

Machine learning algorithms have shown an unprecedented predictive power for many complex learning tasks. As they are increasingly being deployed in large scale critical applications for processing various types of data, new questions related to their trustworthiness would arise. Can machine learning algorithms be trusted to have access to individuals' sensitive data? Can they be robust against noisy or adversarially perturbed data? Can we reliably interpret their learning process, and explain their predictions?

In this talk, we will go over the privacy challenges of building trustworthy machine learning algorithms in centralized and distributed (federated) settings, and will discuss the inter-relation between privacy, robustness, and interpretability.

Biography
Reza Shokri is an Assistant Professor of Computer Science at the National University of Singapore (NUS), where he holds the NUS Presidential Young Professorship. His research is on adversarial and privacy-preserving computation, notably for machine learning algorithms. He is an active member of the security and privacy community and has served as a PC member of IEEE S&P, ACM CCS, Usenix Security, NDSS, and PETS. He received the Caspar Bowden Award for Outstanding Research in Privacy Enhancing Technologies in 2018, for his work on analyzing the privacy risks of machine learning models, and was a runner-up in 2012, for his work on quantifying location privacy. He obtained his PhD from EPFL.

More information: https://www.comp.nus.edu.sg/~reza/

Yair Zick
Assistant Professor
Department of Computer Science
National University of Singapore (NUS)

Lecture Title: *Fair, Transparent and Collaborative Algorithms in Data-Driven Environments*

Recent years have seen data-driven algorithms deployed in increasingly high-stakes environments. These algorithms often employ a complex infrastructure, making them effectively "black boxes"; this potentially exposes various stakeholders (such as end-users, or the agencies deploying said algorithms) to risks, such as unfair treatment or inadvertent data breaches. In response, government agencies and professional societies have highlighted fairness and transparency as key design paradigms in AI/ML applications.

We will discuss recent work on the foundations of algorithmic transparency and fairness. From the transparency perspective, we will discuss how we design transparency measures that are guaranteed to satisfy certain natural desiderata; in addition, we will discuss a recent line of work showing how some natural transparency measures may be used by an adversary in order to extract private user information. Regarding fairness, we will discuss how we apply fairness paradigms to algorithms - in particular our work on designing and deploying fair allocation algorithms; our results show that humans respond well to provably fair algorithms and are willing to collaborate effectively even in strategic domains. Finally, we will discuss how we apply learning-theoretic approaches to fairness via a novel paradigm for adapting game-theoretic solution concepts to data-driven domains.

Biography
Yair Zick is an assistant professor at the Department of Computer Science at the National University of Singapore. He obtained his PhD (mathematics) from Nanyang Technological University, Singapore in 2014, and a B.Sc (Mathematics, "Amirim" honors program) from the Hebrew University of Jerusalem. His research interests include computational fair division, computational social choice, algorithmic game theory and algorithmic transparency. He is the recipient of the 2011 AAMAS Best Student Paper award, the 2014 Victor Lesser IFAAMAS Distinguished Dissertation award, the 2016 ACM EC Best Paper award, and the 2017 Singapore NRF Fellowship.

More information: https://www.comp.nus.edu.sg/~zick/

SPEAKERS – DAY 2

Bo An
Associate Professor
School of Computer Science and Engineering
Nanyang Technological University (NTU)

Lecture Title: *Introduction of Multi-agent Systems and Some Recent Research Progress*

This talk will start with an introduction of the field of multi-agent systems. Then we will talk about some of our recent research in multi-agent systems in different domains such as scheduling security resources, sustainability, ad-word auction, and e-commerce. This talk will discuss key techniques behind these successes and their potential applications in other domains.

Biography
Bo An is an Associate Professor and the President's Council Chair in Computer Science and Engineering, Nanyang Technological University, Singapore. He received the Ph.D degree in Computer Science from the University of Massachusetts, Amherst. His current research interests include artificial intelligence, multiagent systems, computational game theory, reinforcement learning and optimization. His research results have been successfully applied to many domains including infrastructure security and e-commerce. Dr. An was the recipient of the 2010 IFAAMAS Victor Lesser Distinguished Dissertation Award, an Operational Excellence Award from the Commander, First Coast Guard District of the United States, the 2012 INFORMS Daniel H. Wagner Prize for Excellence in Operations Research Practice, and 2018 Nanyang Research Award (Young Investigator).   His publications won the Best Innovative Application Paper Award at AAMAS'12 and the Innovative Application Award at IAAI'16. He was invited to give Early Career Spotlight talk at IJCAI'17. He led the team HogRider which won the 2017 Microsoft Collaborative AI Challenge. He was named to IEEE Intelligent Systems' "AI's 10 to Watch" list for 2018. He was invited to be an Advisory Committee member of IJCAI'18. He is PC Co-Chair of AAMAS'20. He is a member of the editorial board of JAIR and the Associate Editor of JAAMAS, IEEE Intelligent Systems, and ACM TIST. He was elected to the board of directors of IFAAMAS and senior member of AAAI.

More Information: https://www.ntu.edu.sg/home/boan/

SPEAKERS – DAY 2

Wen Bihan
Assistant Professor
School of Electrical & Electronic Engineering
Nanyang Technological University of Singapore (NTU)

Lecture Title: *Machine Learning for Imaging and Vision Applications*

Artificial intelligence (AI) made incredible progress in the past few years. It enables people to rethink how we integrate information, analyze data, and make decision, which used to be postulated based on theory, physical models or hypothesis. Now AI provides a much more effective way to learn the rule -- directly from the data themselves. The core technology behind the success of AI is machine learning, which aims to modal the useful data via a data-driven approach.

In this talk, we first provide an overview of why machine learning is important and critical in data modelling. Several machine learning techniques including both shallow and deep models will be introduced. We will discuss how these learning-based methods can help solve real-world challenges, in imaging, image processing, and computer vision applications.

Biography
Dr. Wen Bihan received the B.Eng. degree in Electrical and Electronic Engineering (EEE) from Nanyang Technological University (NTU), Singapore, in 2012, the MS and PhD degrees in Electrical and Computer Engineering from University of Illinois at Urbana-Champaign (UIUC), USA, in 2015 and 2018, respectively. From 2018 to 2019, he was with Dolby Laboratories, California, USA, and YITU Technology, Singapore. He joined Nanyang Technological University as a Nanyang Assistant Professor in 2019.
His research interests span areas of machine learning, computational imaging, computer vision, image and video processing, and big data applications.

He is an elected member of the IEEE Computational Imaging (CI) Technical Committee. He served as the Area Chair and Program Committee for various machine learning and computer vision conferences. He also co-organized the CSLSC 2017 and MIPR 2019 conference as the Session Chairs. He was the recipient of the 2016 Yee Fellowship, and the 2012 Professional Engineers Board (PEB) Gold Medal. He won the 1st Place Award in the 3MT Thesis Competition at ICME 2018, the Best Presentation Award at 2018 Midwest Research Summit in USA, and the Best Talk Award at 2018 CSL Student Conference. A paper he co-authored won the 10% Best Paper Award at ICIP 2014.

More information: http://bihanwen.ece.illinois.edu/

SPEAKERS – DAY 2

Lu Wei
Assistant Professor
Information Systems Technology and Design
Singapore University of Technology and Design (SUTD)

Lecture Title: *Natural Language Processing: Fundamental Topics, Challenges and Outlook*

The field of natural language processing (NLP) is currently undergoing exponential growth now. In this lecture, we begin with an introduction to the topic of NLP by looking at some fundamental tasks involved in the field. Next, we discuss some recent developments as well as some interesting trends in the field. We will then discuss some potential interesting directions to pursue.

Biography

Wei Lu is an Assistant Professor at the Singapore University of Technology and Design (SUTD), directing the StatNLP research group. He received his Ph.D. from the National University of Singapore (NUS) in 2009. He was a visiting scholar at CSAIL, Massachusetts Institute of Technology (MIT) in 2007-2008, and worked as a postdoctoral research associate at the University of Illinois at Urbana-Champaign in 2011-2013. His research interests include developing mathematical models and machine learning algorithms for solving natural language processing problems. He is particularly interested in semantic processing (in a broad sense). His papers appeared at venues such as ACL, EMNLP, and NAACL. He served as a (senior) program committee member for conferences such as ACL, EMNLP, NAACL, EACL, AAAI, IJCAI, NIPS, ICML, AISTATS, and SIGIR, and is currently a member of the standing reviewer team for TACL. He also gave a tutorial on structured prediction with the StatNLP framework at EMNLP 2017 and served as the General Chair for the 2018 Singapore Symposium on Natural Language Processing. He also served as an area co-chair for ACL 2016 and EMNLP2019 and received the best paper award at EMNLP 2011. According to CSRankings, his StatNLP research group is ranked 1st in Asia and 5th in the world in 2018 in the field of NLP.

More Information: http://www.statnlp.org/

SPEAKERS – DAY 2

Shafiq Rayhan Joty
Assistant Professor
School of Computer Science and Engineering
Nanyang Technological University of Singapore (NTU)

Lecture Title: *Discourse Analysis and Its Applications*

Discourse processing is a suite of Natural Language Processing (NLP) tasks to uncover linguistic structures from texts at several levels, which can support many text mining applications. This involves identifying the topic structure, the coherence structure, the coreference structure, and the conversation structure for conversational discourse. Taken together, these structures can inform text summarization, essay scoring, sentiment analysis, machine translation, information extraction, question answering, and thread recovery. The lecture starts with an overview of basic concepts in discourse analysis -- monologue vs. conversation, synchronous vs. asynchronous conversation, and key linguistic structures in discourse analysis. It then covers traditional machine learning methods along with the most recent works using deep learning and compares their performances on benchmark datasets. For each discourse structure we describe, we show its applications in downstream text mining tasks. Methods and metrics for evaluation are discussed in detail. We conclude with an interactive discussion of future challenges and opportunities.

Biography
Dr. Shafiq Joty is an Assistant professor at the School of Computer Science and Engineering, NTU. He is also a senior research manager at the Salesforce AI Research lab. He holds a PhD in Computer Science from the University of British Columbia. His work has primarily focused on developing discourse analysis tools (e.g., discourse parser, coherence model, topic model, dialogue act recognizer), and exploiting these tools effectively in downstream applications like machine translation, summarization, and sentiment analysis. Apart from discourse and its applications, he has also developed novel machine learning models for question answering, machine translation, and opinion analysis. His work has appeared in major journals and conferences such as CL, JAIR, CSL, ACL, EMNLP, NAACL, IJCAI, CVPR, ECCV, and ICWSM. He is an area chair for ACL-2019 and EMNLP-2019 and a senior program committee member for IJCAI 2019. Shafiq is a recipient of NSERC CGS-D scholarship and Microsoft Research Excellent Intern award.

More information: https://raihanjoty.github.io/

Ritchie Ng
Deep Learning Institute Instructor
NVIDIA

Hands-on Session: *NVIDIA - Fundamentals of Deep Learning for Computer Vision*

Learn about the basics of Deep Learning and the latest technologies available in this one-day workshop. Suitable for beginners with no / minimal coding experience. Led by an experienced instructor, participants can expect to learn the latest deep learning techniques for designing and deploying neural network-powered machine learning across a variety of application domains.

Biography
Mr Ritchie Ng graduated from NUS where he was an NUS Global Merit Scholar, Chua Thian Poh Community Leadership Programme Fellow, Philip Yeo Innovation Associate, and NUS Enterprise I&E Praticum Award recipient. He was was awarded the IT Youth Leader of the Year Award in 2019.
Currently he is leading artificial intelligence with his colleagues in ensemblecap.ai, an AI hedge fund based in Singapore comprising quants and traders from JPMorgan. He built the whole AI tech stack in a production environment with rigorous time-sensitive and fail-safe software testing powering multi-million dollar trades daily. Additionally, he co-runs their deep learning systematic portfolio, delivering positive annual returns since 2018.
He is also an NVIDIA Deep Learning Institute instructor leading all deep learning workshops in NUS, Singapore and conducting workshops across Southeast Asia.

More information: https://www.ritchieng.com/

Teo Tee Hui
Senior Lecturer
Engineering Product Development
Singapore University of Technology and Design (SUTD)

Hands-on Session: **NVIDIA** - *Fundamentals of Deep Learning for Computer Vision*

Learn about the basics of Deep Learning and the latest technologies available in this one-day workshop. Suitable for beginners with no / minimal coding experience. Led by an experienced instructor, participants can expect to learn the latest deep learning techniques for designing and deploying neural network-powered machine learning across a variety of application domains.

Biography
Tee Hui graduated with PhD from Nanyang Technological University (2009) in Electrical & Electronic Engineering. He was in industries while pursuing his PhD. Since 1996, he has worked in industries with Sharp, ST-Microelectronics, and Intelligent Micro-Devices (Matsushita) as senior Integrated Circuit Designer, prior to joining Institute of Microelectronics, A*STAR as Principal Investigator in high-end Integrated Circuit Research & Development. In later stage, he has joined education sector in for pioneering Integrated Circuit Design programme for SIT-TUM (Singapore Institute of Technology – Technical University of Munich) in 2010 where he has set up both Analog Integrated Circuits and Digital Integrated Circuits courses as well as the laboratories.

He is currently with SUTD (Singapore University of Technology and Design) as a lecturer in the Engineering Product Development department. His research interests are low-power low-voltage mixed-signal wireless Integrated Circuit, device characterisation and modelling; as well as integrated EDA (Electronic Design Automation) flow setup. Tee Hui is a Senior Member of IEEE and IES (The Institution of Engineers Singapore), and currently serving as Treasurer / Secretary for IEEE-SSCS (Solid-State Circuit Society Singapore Chapter) and IES-EECE (IES-Electrical, Electronics & Computer Engineering) Technical Committee.
He is also serving as a committee member in IES-Q & M Committee.

More information: https://epd.sutd.edu.sg/people/faculty/teo-tee-hui

INSTRUCTORS – DAY 3

Franz Pfister
Chief Medical Officer, ConnectedLife
Board Member, Ocean Protocol Foundation

Hands-on Session: **Ocean Protocol & ConnectedLife** – *Deep Learning & Model Developing*

Use Case hands-on application: introducing to data, data cleaning and preparation and hands-on activity on data supply line
Knowledge Sharing: data collection & model training, generalization accuracy and precision medicine calibration
Hands on Application: model building (high-resolution motor state detection / estimation in patients with parkinson's disease) & Ocean Protocol (Execute a data service supply chain addressing trust, data privacy and value exchange)

Biography
Dr. Franz MJ Pfister is an entrepreneur, medical doctor, and data scientist and is recognized as a leading expert at the intersection of artificial intelligence, data, digitization and healthcare. His academic career includes medical studies at the Ludwig Maximilian University of Munich and the Harvard Medical School with a medical doctorate in neuroscience. He holds an MBA from Munich Business School and earned a Master's degree in Data Science at the LMU Munich. Franz Pfister is currently leading multiple initiatives and is building up companies in the field of Health AI, to improve the quality of patient care and the efficiency of healthcare systems. He serves as board member of the cutting-edge Blockchain firm Ocean Protocol, CMO of IoT/AI Singapore-/Germany-based company ConnectedLife, and CEO of award-winning health AI diagnostics startup deepc.

More information: http://www.digital-helix.com/about

Kamer Yuksel
Chief Data Science Officer
ConnectedLife

Hands-on Session: **Ocean Protocol & ConnectedLife** – *Deep Learning & Model Developing*

Use Case hands-on application: introducing to data, data cleaning and preparation and hands-on activity on data supply line
Knowledge Sharing: data collection & model training, generalization accuracy and precision medicine calibration
Hands on Application: model building (high-resolution motor state detection / estimation in patients with parkinson's disease) & Ocean Protocol (Execute a data service supply chain addressing trust, data privacy and value exchange)

Biography
Kamer Ali Yuksel is the Chief Data Scientist at ConnectedLife GmbH, a global All-in-One Smart Living and Health solution provider that is headquartered in Singapore. He previously co-founded two startups (LivingRooms GmbH and OTA Expert Inc) and also worked in internationally reputable research institutes including Socio-Digital Systems (Human Experience & Design) Group in Computer Mediated Living Laboratory of Microsoft Research Cambridge (MSRC) and Quality & Usability Group of Deutsche Telekom Innovation Laboratories (T-Labs), besides the Computer Vision & Pattern Analysis (VPALAB), Computer Graphics (CGLAB) and Distributed Artificial Intelligence (DAI-Labor) laboratories of Sabanci University and Technical University of Berlin (TU-Berlin); where he was funded by the Technological and Scientific Research Council of Turkey (TUBITAK) and the German Federal Ministry of Education and Research (BMBF). His research includes (Deep) Machine Learning, Artificial Intelligence, Data Mining, Information Retrieval, Computer Vision and HCI; where he co-authored more than thirty publications in international conferences and journals, in addition to two book chapters.

More information:
https://scholar.google.com/citations?user=1V7nXG4AAAAJ&hl=en

Lee Gim Hee
Assistant Professor
Department of Computer Science
National University of Singapore (NUS)

Lecture Title: *Deep Learning for 3D Point Clouds*

In recent years, deep learning is increasingly applied to 3D point clouds for many important tasks in Computer Graphics, Computer Vision and Robotics. The first part of this lecture covers the basic concepts of permutation invariance, and translational and rotational equivariance that enable deep learning on 3D point clouds. These basic concepts lead us into the second part of the lecture, where we will discuss several state-of-the-art 3D point cloud-based deep learning works (including our works) on applications such as large-scale place-recognition, keypoint detection/descriptor, shape retrieval, semantic segmentation, object classification/detection, etc.

Biography
I am currently an Assistant Professor at the Department of Computer Science in the National University of Singapore (NUS), where I head the Computer Vision and Robotic Perception (CVRP) Laboratory. Prior to NUS, I was a researcher at Mitsubishi Electric Research Laboratories (MERL), USA. I did my PhD in Computer Science at ETH Zurich, and received my M.Eng and B.Eng (1st Class Honors) degrees from the Department of Mechanical Engineering at NUS.

More Information: http://www.comp.nus.edu.sg/~leegh

Pradeep Reddy Varakantham
Associate Professor
School of Information Systems
Singapore Management University (SMU)

Lecture Title: *Multi-agent Sequential Matching for Improving Efficiency in Urban Environments*

Rapid "urbanization" (more than 50% of worlds' population now resides in cities) coupled with the natural lack of coordination in usage of common resources (ex: bikes, ambulances, taxis, traffic personnel, attractions) has a detrimental effect on a wide variety of response (ex: waiting times, response time for emergency needs) and coverage metrics (ex: predictability of traffic/security patrols) in cities of today.

Motivated by the need to improve response and coverage metrics in urban environments, we have focused on building multiagent systems that exploit past data in making sequential decisions to continuously coordinate available supply of resources to an uncertain demand for resources. To address the main challenges of societal scale, uncertainty and dynamism, we exploit key properties of urban environments namely homogeneity and anonymity, decomposability and abstraction of supply/demand components. In this talk, we will describe our contributions and also provide results based on real data sets (and in some cases on real systems) in transportation (taxis and bike sharing), emergency response, energy, theme parks and security.

Biography
Pradeep Varakantham is an Associate Professor in the School of Information Systems at Singapore Management University. He is coordinator for the BSc Artificial Intelligence track. Prior to his current position, Pradeep received his PhD from University of Southern California and was a post-doctoral fellow for two years at Carnegie Mellon University. His research is at the intersection of Artificial Intelligence, Operations Research and Machine Learning with specific focus on solving sequential matching problems in urban environments. Pradeep has published more than 100 research papers in top tier conferences (AAAI, IJCAI, NIPS, AAMAS, ICAPS, UAI) and journals (AIJ, JAIR, JAAMAS) in Artificial Intelligence and Machine Learning. He gave the "early career spotlight" invited talk at International Joint Conference on Artificial Intelligence, IJCAI 2016 and he won the best-demo award at AAMAS-2018. Furthermore, his paper was nominated for the best student paper award at AAMAS-10. He sits on the board of directors for IFAAMAS, a governing body for multi-agent Artificial Intelligence.

More Information: http://www.mysmu.edu/faculty/pradeepv/

Georgios Piliouras
Assistant Professor
Engineering Systems and Design
Singapore University of Technology and Design (SUTD)

Lecture Title: *Learning in Zero-Sum Games Revisited: From von Neumann to Poincaré, Hamilton and Legendre*

We revisit one of most classic questions in game theory and online learning. How do standard learning dynamics such as multiplicative weights update, gradient descent, and follow-the-regularized-leader behave in zero-sum games? The standard textbook answer to this question is that these dynamics "converge" in a time-average sense to Nash equilibria. We provide some interesting insights about the day-to-day behavior. The continuous-time analogues of these dynamics (e.g. replicator dynamics) are Poincaré recurrent. Informally, the trajectories are "cycles" of constant Bregman distance from the Nash equilibrium which lies at the center of the "cycle". In fact, the dynamics are formally Hamiltonian with a hidden energy function that remains constant on all trajectories. This function is the summation of the convex conjugates (i.e. the Legendre–Fenchel transformations) of the regularizers of the two agents. These results extend in a natural way to all affine, network generalizations of zero-sum games. In discrete time, these algorithms move tangentially to these cycles and as a result they diverge chaotically away from Nash equilibria, contradicting the "convergence to equilibrium" paradigm.

Biography
Dr. Piliouras is an assistant professor at the Singapore University of Technology and Design (SUTD). He received his PhD in Computer Science from Cornell University in 2010. He has held postdoc positions at the Georgia Institute of Technology (GaTech, ECE Dept.) and California Institute of Technology (Caltech, Dept. of Computing and Mathematical Sciences). He has held visiting positions at UC Berkeley and DeepMind and he is a collaborator of the Ethereum Foundation. He is the recipient of a Singapore NRF Fellowship (2018) and a Simons/UC Berkeley Fellowship (2015).

More Information: https://people.sutd.edu.sg/~georgios/

Wong Lim Soon
Professor
Department of Computer Science
National University of Singapore (NUS)

Lecture Title: *Some Practical Advice for Bewildered Lay Data Analysts*

Lay analysts often test hypotheses incorrectly. They do not know what to do next after testing an initial hypothesis. They need help to find interesting hypotheses. They do not know how to assess prediction models. They also have problems developing sound prediction models. We discuss their common mistakes and suggest some practical advice for some of their problems.

Biography
Wong Limsoon is Kwan-Im-Thong-Hood-Cho-Temple Chair Professor in the Department of Computer Science at the National University of Singapore. Limsoon was inducted as an ACM Fellow in 2013, for his past contributions to database theory and computational biology. Currently, he works mostly on knowledge discovery technologies and their application to biomedicine.

More Information: https://www.comp.nus.edu.sg/~wongls/

SPEAKERS – DAY 5

Leslie Kaelbling
Professor
Department of Computer Science and Engineering
Massachusetts Institute of Technology (MIT)

Lecture Title: *Doing for Our Robots What Nature Did for Us*

We, as robot engineers, have to think hard about our role in the design of robots and how it interacts with learning, both in "the factory" (that is, at engineering time) and in "the wild" (that is, when the robot is delivered to a customer). We discuss some general thoughts about the strategies for robot design and then talk in detail about the design of an overall architecture for an intelligent robot and the strategies for learning to integrate new skills into the repertoire of an already competent robot.

Biography
Leslie Pack Kaelbling is the Panasonic Professor of Computer Science and Engineering at the Computer Science and Artificial Intelligence Laboratory (CSAIL) at the Massachusetts Institute of Technology. She has made research contributions to decision-making under uncertainty, learning, and sensing with applications to robotics, with a particular focus on reinforcement learning and planning in partially observable domains. She holds an A.B in Philosophy and a Ph.D. in Computer Science from Stanford University, and has had research positions at SRI International and Teleos Research and a faculty position at Brown University. She is the recipient of the US National Science Foundation Presidential Faculty Fellowship, the IJCAI Computers and Thought Award, and several teaching prizes; she has been elected a fellow of the AAAI. She was the founder and editor-in-chief of the Journal of Machine Learning Research.

More Information: http://people.csail.mit.edu/lpk/

SPEAKERS – DAY 5

Michael Wooldridge
Professor
Department of Computer Science
University of Oxford (Oxford)

Lecture Title: *Computational Game Theory through The Prisoner's Dilemma*

The Prisoner's Dilemma is the most famous game studied in game theory, and with good reason. On the one hand, it sets up an apparently paradoxical situation, in which choices that seem individually rational lead to outcomes that seem highly sub-optimal from the point of view of society. On the other hand, real-world Prisoner's Dilemmas abound - we encounter them every day.

In this talk, we will introduce some of the main concepts in computational game theory by way of the Prisoner's Dilemma. This sheds light both on the Prisoner's Dilemma and on the game theoretic concepts introduced.

Biography
Michael Wooldridge is a Professor of Computer Science and Head of Department of Computer Science at the University of Oxford, where he is a Fellow of Hertford College. He has been an AI researcher since 1989 and has published more than 400 scientific articles on the subject. He is a Fellow of the Association for Computing Machinery (ACM), the Association for the Advancement of AI (AAAI), and the European Association for AI (EurAI). From 2014-16, he was President of the European Association for AI, and from 2015-17 he was President of the International Joint Conference on AI (IJCAI). He is also the author of two popular science introductions to AI: The Ladybird Expert Guide to AI (Michael Joseph, 2018), and The Road to Conscious Machines (Pelican, in press).

More Information: http://www.cs.ox.ac.uk/people/michael.wooldridge/

SPEAKERS – DAY 5

Alon Halevy
Affiliate Professor
Computer Science and Engineering
University of Washington (UW)

Talk: *Searching for Experiences*

The rise of Artificial Intelligence introduces an important challenge: how can we develop AI that increases the well-being of its users? This talk will describe some recent research that addresses this challenge and poses interesting research problems for the AI and DB communities. A key theme of these projects is to help users record their positive experiences and to learn from these to help the user create additional experiences that make them happy. Here we address two challenges: learning from past experiences and searching for new experiences. Searching for experiences is difficult because experiences are nuanced and subjective. In addition, online search engines do not support search for experiential aspects of their services (e.g., hotels, restaurants), partially because most of this data exists only in online reviews. We describe subjective databases that attempt to model subjective data explicitly and support queries on subjective review data.

Biography
Alon Halevy was the CEO of Megagon Labs until December, 2018. Previously, Alon led the Structured Data Research Group at Google for 10 years and before that he was a professor of computer science at the University of Washington. Alon is a founder Nimble Technology, and of Transformatic, Inc., which was acquired by Google in 2005. Alon is the author of two books: "The Infinite Emotions of Coffee" and "Principles of Data Integration." Alon is an ACM Fellow, received the Sloan Fellowship and the PECASE Award. He received his Ph.D. in Computer Science from Stanford University in 1993.

More Information: https://homes.cs.washington.edu/~alon/

Tan Kian Lee
Professor
Department of Computer Science
National University of Singapore (NUS)

Moderator

Biography

Kian-Lee Tan is a Professor of Computer Science at the School of Computing, National University of Singapore (NUS). He received his Ph.D. in computer science in 1994 from NUS. His current research interests include query processing and optimization in multiprocessor and distributed systems, database performance, data analytics, and database security. Kian-Lee has published over 300 research articles in international journals and conference proceedings, and co-authored several books/monographs.

Kian-Lee was a recipient of the NUS Outstanding University Researchers Award in 1998, and the NUS Graduate School (NGS) Excellent Mentor Award in 2011. He was a co-recipient of Singapore's President Science Award in 2011. He is also a 2013 IEEE Technical Achievement Award recipient.

Kian-Lee is an associate editor of the ACM Transactions on Database Systems (TODS) and the WWW Journal. He has also served in the editorial board of the Very Large Data Base (VLDB) Journal (associate editor: 2007-2009; editor-in-chief: 2009-2015) and the IEEE Transactions on Knowledge and Data Engineering (2009-2013). He was a member of the VLDB Endowment Board (2013-2017)and PVLDB Advisory Committee (2014-2017). Kian-Lee was the Technical Program Committee co-chair for the 27th International Conference on Data Engineering (ICDE 2011), the 36th International Conference on Very Large Data Bases (VLDB 2010), the 11th International Conference on Database Systems for Advanced Applications (DASFAA 2006) and 3rd International Conference on Mobile Data Management (MDM 2002). Kian-Lee is a member of ACM and IEEE (and IEEE CS).

More Information: https://www.comp.nus.edu.sg/~tankl/

Mike Anderson
CTO, Dex
Founding Team Member, Ocean Protocol

Biography

Mike Anderson is Chief Technology Officer of DEX and Founding Team Member of Ocean Protocol.

A technology consultant and entrepreneur with extensive experience in software development, data science, and AI, Mike is driving the development of the ecosystem of solutions built around Ocean Protocol, including the DEX reference marketplace for the exchange of data and AI algorithms. Mike is also the co-founder of Datacraft, a specialist firm focused on data science, machine learning and analytics. Before taking the entrepreneurial path, Mike was an Associate Partner at McKinsey & Company, where he was recognised as a global thought leader in software development and in the specific domain of healthcare IT. His projects included advising governments on health data governance, transforming software development processes at major banks, and supporting one of the world's largest telco outsourcing deals.

As a passionate open source software developer, Mike develops and maintains a number of software libraries and tools, including the core.matrix library for numerical computing. When not coding, Mike is an enthusiastic dancer who particularly enjoys bachata and modern jive. Mike graduated with a double first in Mathematics and Economics from Cambridge University in the UK, and also holds an MBA from INSEAD.

SPONSORS' DETAILS

Sea

Sea is an internet platform company. We focus on in Greater Southeast Asia, a region that includes Indonesia, Taiwan, Vietnam, Thailand, the Philippines, Malaysia and Singapore.

We operate three industry-leading platforms across digital entertainment, e-commerce and digital financial services.

Our Garena digital entertainment platform is the largest online game ecosystem in our region by revenues and operates in all seven markets. It offers consumers and global game developers a unique combination of localized game operations, payments, eSports events, video streaming, content sharing, user chat, and online forums.

Shopee is one of our region's fastest growing e-commerce marketplaces, with operations across all seven markets and a mobile-centric approach. It empowers small businesses and buyers by offering a safe and trusted shopping environment, supported by integrated payment and third-party logistics capabilities. Shopee has achieved over US$ 4.1 billion of GMV for the full year of 2017.

AirPay, our digital financial services platform, provides e-wallet services to consumers via the AirPay mobile App and to small businesses through the AirPay counter application. This has scaled to become one of the largest e-wallet service providers in our region by gross transaction volume, bringing about greater convenience for customers, efficiency for merchants, and broad financial inclusion for a large number of historically unbanked consumers.

Our three platforms share substantial common capabilities across talent, technology development, marketing, and infrastructure, creating a true multi-platform company, Sea.

Sea has a global group of investors from over 10 countries, including several of our region's most respected sovereign funds and business families and a distinguished group of international partners from Asia, North America, and Europe. Sea is also publicly listed on the NYSE under the ticker SE.

More information: https://www.seagroup.com/home

SPONSORS' DETAILS

Ocean Protocol

Ocean Protocol is a decentralized data exchange protocol to unlock data for AI. Through blockchain technology, smart contracts, and tokens, Ocean Protocol connects data providers and consumers, allowing data to be shared while guaranteeing traceability, transparency, and trust for all stakeholders involved. It allows data owners to give value to and have control over their data assets without being locked-in to any single marketplace. By bringing together decentralized blockchain technology, a data sharing framework, and an ecosystem for data and related services, Ocean Protocol is committed to kick-starting a new Data Economy that touches every single person, company and device, giving power back to data owners, enabling people to reap value from data to better our world.

More information: https://oceanprotocol.com/

ConnectedLife

ConnectedLife is a digital health diagnostics company using Artificial Intelligence and Internet of Things Technologies to facilitate early diagnosis of chronic disease and enable objectively geared, long-term personalized monitoring and treatment of people living with chronic conditions.

ConnectedLife's unique capabilities to address chronic conditions:

- End-to-end clinical research & development - six clinical test sites in Singapore, Germany and Turkey
- IoT hardware medical device development – designing devices able to train and execute complex deep learning models on premise
- AI and health data exchange infrastructure – built on Ocean Protocol and optimized for healthcare a decentralised data exchange protocol to unlock data for AI. Through blockchain technology, smart contracts and tokens, data can be shared while guaranteeing traceability, transparency and trust for all stakeholders
- Applications – leveraging the same technology stack to enable prevention, early diagnosis and long-term monitoring and precision medicine treatment

More information: https://connectedlife.io/

SPONSORS' DETAILS

NVIDIA

NVIDIA's (NASDAQ: NVDA) invention of the GPU in 1999 sparked the growth of the PC gaming market, redefined modern computer graphics and revolutionized parallel computing. More recently, GPU deep learning ignited modern AI — the next era of computing — with the GPU acting as the brain of computers, robots and self-driving cars that can perceive and understand the world.

More information: http://nvidianews.nvidia.com/

Venue: **Lecture Theatre 15** (LT15)
11 Computing Drive (Block AS6)
Singapore 117416

Download NUS Kent Ridge Campus Map (PDF file) [here](#)

By Public Transport

From Buona Vista MRT Station (EW21/CC22)
• Take Exit B from the station and cross North Buona Vista Road to the bus stop in front of Ministry of Education (MOE) building [Stop no. 11369].
• Board bus 95 (towards Kent Ridge Terminal).
• Alight 9 stops later at NUS Central Library [Stop no. 16181].
• Follow this guide (Annex A) from Central Library to the LT15 (Block AS6).

From Clementi Bus Interchange (EW23)
• Take Exit A from the station and walk to the bus interchange behind Clementi Mall.
• Board bus 96 (towards Clementi Interchange).
• Alight 7 stops later at NUS Computer Centre [Stop no. 16189].
• Cross the road to the Central Library and follow this guide (Annex A) from Central Library to LT15 (BlockAS6).

From Kent Ridge MRT Station
• Take Exit A from the station and walk to the bus stop directly in front of the exit.
• Board NUS Internal Bus Shuttle A1 and alight 5 stops later at Central Library.
• Follow this guide (Annex A) from Central Library to LT15 (Block AS6).

By NUS Internal Shuttle Bus
- Take services A1 or A2.
- Alight at Central Library bus stop, Computer Centre bus stop, or COM 2 bus stop.
- Follow the guide from Central Library to LT15 (Block AS6).

By Driving
From the city
- Drive along the Ayer Rajah Expressway (AYE) towards Jurong.
- Exit at Clementi Road (AYE Exit 9).
- Travel southward along Clementi Road for another 500m.
- Turn left into Kent Ridge Crescent (after passing the School of Design & Environment on your left).
- After 100m, turn right into Kent Ridge Drive.
- Turn left into Computing Drive, and proceed along it to *Carpark 13 (for passengers to alight).
- Follow this guide from Carpark 13 to the LT15 (Block AS6).

From Jurong
- Drive along Clementi Road towards Pasir Panjang Road.
- Turn left into Kent Ridge Crescent (after passing the School of Design & Environment on your left).
- After 100m, turn right into Kent Ridge Drive.
- Turn left into Computing Drive, and proceed along it to *Carpark 13 (for passengers to alight).
- Follow this guide from Carpark 13 to LT15 (Block AS6).

Please take note that Carpark 13 has been designated for staff parking, external parties using it will have to pay a much higher fee. You may wish to park at Carpark 15, the nearest visitors' carpark. More about parking on campus may be found here.

Direction: from Central Library to Lecture Theatre 15 (Block AS6, Level 1)

1. Walk toward NUS Central Library building

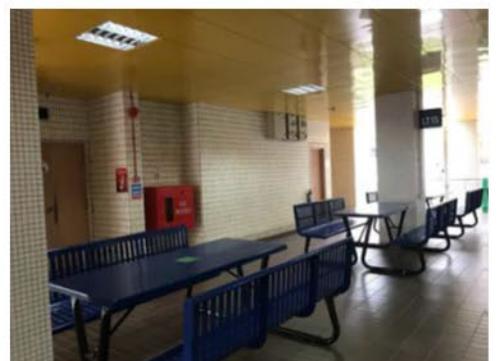2. Walk through the atrium and take the lift to level 4 (Central Library Level)

3. Turn left after exiting the lift

4. Take the stair down

5. Continue walking straight

6. LT15 is located on the left.

Direction: from Carpark 13 to LT15

Please take note that Carpark 13 has been designated for staff parking, external parties using it will have to pay a much higher fee. You may wish to park at Carpark 15, the nearest visitors' carpark. More about parking on campus may be found here.

1.From Carpark 13, you will see the white building that stated "AS6" next to COM 1

2. Walk up the slope.

3. Enter the building from this pathway.
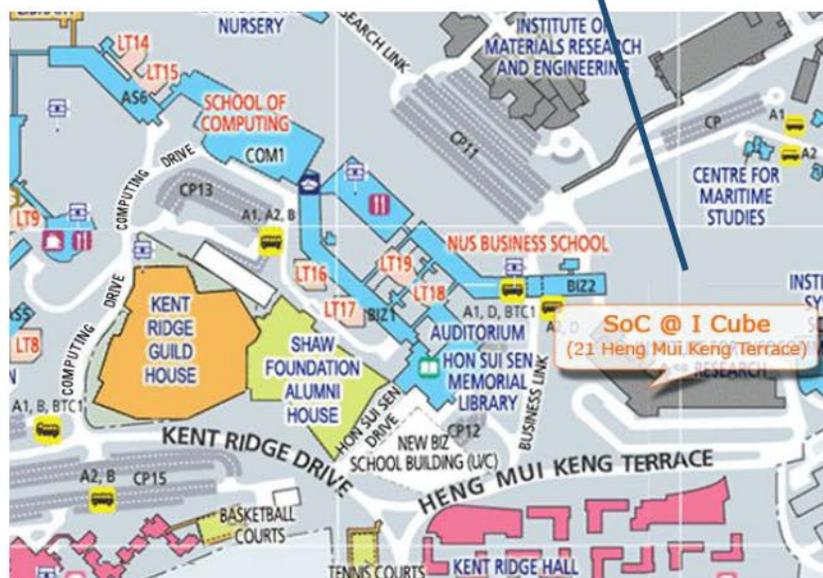

4. Continue walking straight

5. LT15 is located on the right.

DIRECTIONS

DAY 2 (23 July 2019)

Venue: **ICube Auditorium**
Level 1, 21 Heng Mui Keng Terrace
Singapore 119613

DIRECTIONS

DAY 2 (**23** July 2019)

By Public Transport (MRT)
From Kent Ridge MRT Station
- From Kent Ridge MRT station, take Exit A and turn right to walk along the covered walkway to Bus Stop 3 (do not cross to the other side of road through underpass).
- Take the NUS free internal shuttle bus service A1 or A1E and alight at NUS Business School (BIZ 2 stop). Click here to view the shuttle bus route.
- Cross the road and walk towards the bus stop opposite the bus stop which you alighted. Continue walking in same direction as the traffic along the covered walkway till you reach a staircase going up on your left.

By Public Transport (Bus)
- Take SBS Service 95, 96 or 151 and transfer to A1 NUS Internal Shuttle Bus on campus at NUS Central Library or other A1 bus stops.
  Please refer to the map in previous page.

By Driving
From the City, Ayer Rajah Expressway (AYE)
- From the city, take Ayer Rajah Expressway (AYE) West Bound, exit left into Clementi Road.
- Continue down Clementi Road for around 1km till you reach entrance B.
- Turn left from Clementi Road into entrance B. It is also called Kent Ridge Crescent.
- Make an immediate right turn into Kent Ridge Drive.
- Continue down the road, you will see on your right NUSS Guild House, Shaw Foundation Alumni House and NUS Business School Mochtar Riady Building and a junction.
- Continue straight after this junction and Kent Ridge Drive will be renamed Heng Mui Keng Terrace after the junction.
- Immediately after the junction, I3 or ICube Building is on your left on a little hill.
- Turn left again to enter Carpark 12 B in front of I3 or ICube Building.
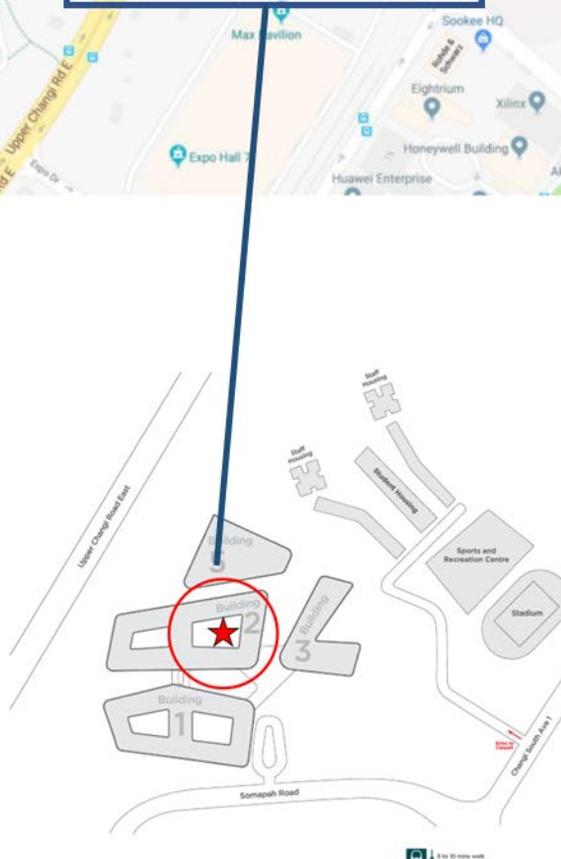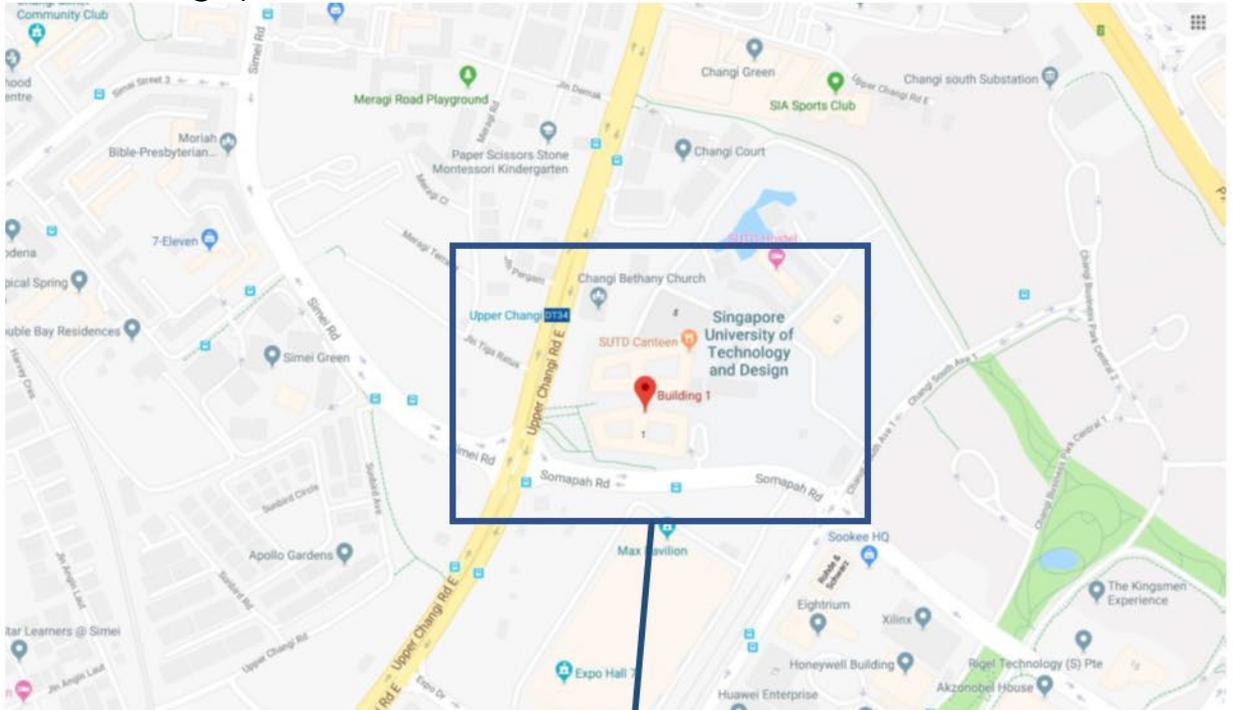
From Pasir Panjang Road
- From Pasir Panjang Road, turn into Heng Mui Keng Terrace.
- Turn right and continue on Heng Mui Keng Terrace. Immediately after the right turn, I3 or ICube Building is on your left on a little hill.
- Turn left again to enter Carpark 12 B in front of I3 or ICube Building

- **Parking**: Please park at nearest Carpark 12B in front of I3 or ICube Building.

DIRECTIONS 🚗
DAY 3 (**24** July 2019)

Venue: **Lecture Theatre 3, 4 & 5** (Building 2, Level 4 & 5)
Take lift from **Lobby E Lift session**
Singapore University of Technology and Design
8 Somapah Road
Singapore 487372

By Public Transport (MRT)
From Upper Changi MRT Station (DT34)
- Alight at Upper Changi MRT Station (DT34) and take Exit B our campus will be on your left when you exit the station

From Expo MRT Station (DT35 / CG1)
- Alight at Expo MRT Station (DT35 / CG1) and walk to our campus along Changi South Avenue 1 in the direction of Max Pavilion/ Somapah Road

By Public Transport (Bus)
From Somapah Road
- Alight at one of the bus stops along Somapah Road and walk to our Campus:
  - B96449: SUTD. Service No: 20
  - B96441: Opposite SUTD. Service No: 20

From Upper Changi Road East
- Alight at one of the bus stops along Upper Changi Road East and walk to our Campus:
  - B96041: Upper Changi Road East, Before Tropicana Condo. Service No: 2, 5, 24
  - B96049: Upper Changi Road East, Opposite Tropicana Condo. Service No: 2, 5, 24

From Changi Business Park Bus Terminal
- Alight at Changi Business Park Bus Terminal and walk to our Campus:
  - Service No: 47, 118

By Driving
From ECP
- Take Exit 2B on ECP (Xilin Ave towards Tampines)
- Turn right to Changi South Ave 1
- Turn left into the Campus carpark (before the sports complex), after the traffic junction of Somapah Road and Changi South Ave 1

From PIE
- Take Exit 4A on PIE (Simei Ave)
- Turn left to Upper Changi Road East
- Turn right to Somapah Road
- Turn left to Changi South Ave 1
- Turn left into the Campus carpark (before the sports complex)

About Night Safari

The world's first nocturnal wildlife park, is a 13-time winner of the Best Attraction category awarded by Singapore Tourism Board. This internationally acclaimed leisure attraction embodies innovation and creativity in products and services, and service quality, thus attracting approximately 1.3 million visitors annually. Close to 900 animals from approximately 100 species (of which almost 41 per cent are threatened) inhabit the 35-hectare park.

In line with its mission to promote biodiversity, the park focuses on the captive breeding of threatened species. Over the years, it has bred Malayan tigers, Asian elephants, fishing cats, red dholes, anoas, markhors, bantengs, Malayan tapirs and Asian lions, among other threatened species.

Attractions

Safari Adventure Tour
Led by our expert guide, enjoy a private buggy-and-walking tour with your companions to learn more about our nocturnal wildlife.

Thumbuakar Show
Be enthralled by a fiery performance from our flame-twirling pyro warriors who'll get you into the safari vibe!

Creatures of the Night Show
Catch our animal superstars demonstrate their natural talents in this popular show. Be sure to get there early as seats fill up fast!

An Evening in the Wild
Spend an unforgettable evening by experiencing the lush rainforest, getting up close to fascinating animals and enjoying a gourmet dinner in Singapore's first tipi tent.

More information: https://www.wrs.com.sg/en/night-safari.html

INFORMATION ABOUT SINGAPORE

Language

You will be able to speak English to Singaporeans, most of whom are fluent in it. Many Singaporeans also speak an additional language, usually Mandarin Chinese, Malay or Tamil.

Weather

Weather in Singapore in general is hot and humid. Temperature in July may range from 25°C to 30°C. Be prepared for frequent rain since July is in the middle of the Northeast Monsoon season.

Currency

The currency used in Singapore is Singapore dollar (SGD). No other currency is accepted. If necessary, you can change your currency to Singapore dollar at Changi Airport or in the city. The exchange rate between Singapore dollar and US dollar is 1USD|1.3SGD, and that between SGD and Chinese Yuan is 1SGD|5CNY.

Tax Refund

Tourists can claim a refund on the 7% Goods and Services Tax (GST) paid on your purchases if you spend more than $100 at any participating shops.

Power Plug

The standard electrical current used in Singapore is 220-240 volts AC (50 cycles) and you can use power plugs with three square prongs here.

More information

https://www.visitsingapore.com/travel-guide-tips/

DRESS CODE

Participants are to observe the University's rules (NUS and SUTD) regarding proper and decent attire when they are on campus. **Improper attire** includes the following:

- Sleeveless T-shirts
- Singlets
- Shorts
- Clothes with indecent words or pictures
- Very short blouses e.g. crop top
- Slippers

It is recommended that participant wear **semi-formal attire** on Day-5 (26 July 2019) for the closing and certificate awarding ceremony

CONTACTS

During Conference Period

If you need any help during the conference period, please approach any of the student helpers or the programme manager. They can be easily identified by the name badges with a green highlights.

- Dr. MA
  Programme Manager of AI Summer School
  Email: aisummerschool@aisingapore.org

- Prof. Stefan Winkler
  Chair of Organizing Committee of AI Summer School
  Email: aisummerschool@aisingapore.org

Emergency Contacts

Below is a list of emergency contact numbers for your reference:

SUTD Campus Security	**6303 6600**
NUS Campus Security	**6874 1616**
Ambulance (emergency)	**995**
Ambulance (non-emergency)	**1777**
Fire Brigade	**995**
Police	**999**
Police Hotline (For Crime & Police Info)	**1800 255 0000**
Samaritans of Singapore (SOS) – 24 hr	**1800 221 4444**

AI SUMMER
SCHOOL
22 – 26 JULY 2019
SINGAPORE