School of Data Science
香港城市大學
City University of Hong Kong

Hong Kong Institute for Data Science
香港城市大學
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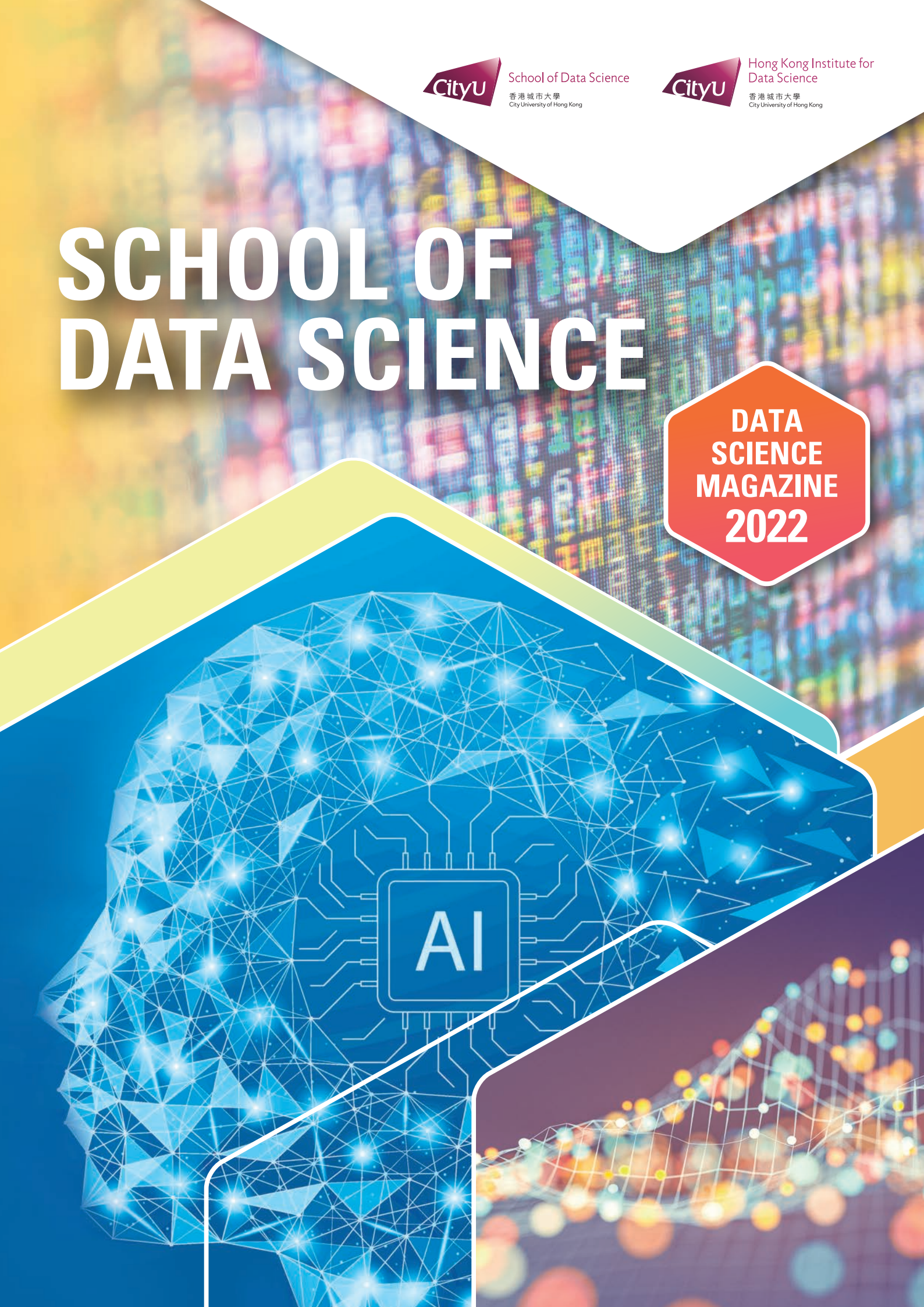
SCHOOL OF DATA SCIENCE

DATA SCIENCE MAGAZINE 2022



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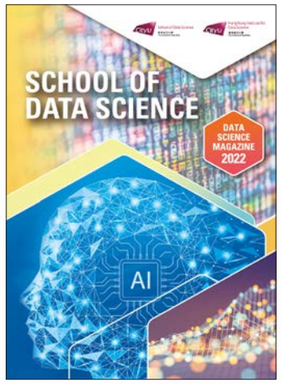

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MESSAGE FROM THE PRESIDENT

I take great pleasure in writing for the *Data Science Magazine 2022* published by the School of Data Science (SDSC) at CityU. It seemed like yesterday when I was interviewed by the magazine a year ago for a feature profile on "Building Appreciation for Data Science".

Over the one-year period, we have witnessed rapid development in the pioneering School, as we get back on our feet almost fully in the post-pandemic era. SDSC accelerated more than ever, seeing a fast surge in student numbers and an increase of faculty size as well as expansion of external grants, international recognition and corporate collaborations. SDSC's diverse environment, both in faculty and student bodies, mirrors the CityU community which stands proud in support of diversity and harmony, inclusive of every necessary perspective for study and research. We are also gaining prominence in the world. Recently, I am proud to share with you, the SDSC Dean, Professor S. Joe QIN, received the Computing in Chemical Engineering Award (2022 AIChE CAST Division Awards), the first person educated in mainland China to have received such a prestigious award.

Big Data analytics has become one of the most powerful technology trends and is changing the way the world uses business information. We saw this trend and responded to it dynamically. In Hong Kong and the Greater Bay Area, we work hand in hand with corporate and government organizations, aiming to be leaders in data science and AI, at the same time, attracting and nurturing talents. Together, we are doing what data scientists should do – serve the community with the best digital solutions and human resources.

Among the handful of energetic schools at CityU, SDSC has always invoked amazement because of its nature as an emerging, eclectic discipline that draws from several other academic traditions. At the same time, it is also a valuable and fundamental technology that empowers other fields, from Social Sciences to Sciences. This is the reason why I deem data science to be indispensable in a word-leading university. We had our HK Tech Forum on Data Science and AI cum Data Science Day in July 2022. This annual occasion does not only signify our awe in data science, but also the School's ambitions in the discipline. SDSC represents CityU's cutting-edge lead on Tech, AI and Informatics. Our Forum this year has gathered the foremost researchers and leading scholars from all over the world to address challenging issues in these two fields.

As we celebrate the fourth anniversary of SDSC and Hong Kong Institute for Data Science, it is notable that the School, the Institute, together with CityU, are continuously gaining momentum to excel further. As a young but progressive institution, our aim is to sustain an innovative approach to integrating teaching and research. *"We're entering a new world in which data may be more important than software. Who has the data has the power."— Tim O'Reilly.* Cultivating leaders for our fast-changing, globalised world is the key to accomplishing our mission to be a world-class university. I look forward to seeing more of SDSC's new heights in research.

Way KUO
President and University Distinguished Professor
Faculty Member, School of Data Science
July 2022

DEAN'S FOREWORD

It is a true delight to share with you CityU's data science endeavours over the last academic year with the development of the School of Data Science (SDSC) and the Hong Kong Institute for Data Science (HKIDS). SDSC cultivates multidisciplinary education, with BS, MS and PhD degrees offering impactful research in multiple domains of applications and theoretical development. As the Dean, I am honoured to have witnessed its fast expansion in students, faculty, international recognitions, extramural research funding, and industrial collaborations. HKIDS has been spearheading cross-disciplinary research on campus, harvesting extramural research grants, as well outreaching to industrial partners in Hong Kong and mainland China.

Starting this September, we will have enrolments of all four years of undergraduates reaching 400 students, over 100 MS students, and over 100 PhD students. I am delighted to see the thrust of young talents devoting their studies to Data Science. In the coming year, we are commencing the two-semester long capstone projects for Year 4 undergrads and opening new courses in financial data analysis to meet the demand of Hong Kong as a regional finance hub. Our students are very popular among the intern hosts regionally. We strive to continuously improve our curricula as we are pioneering the development of this new and fast-growing discipline.

Over the last year, our faculty has also strengthened in size and diversity. We are proud to be home for our five women faculty, who are specially highlighted in this magazine. You will also see the many international recognitions received by our faculty and students. All sectors have been innovating and experimenting with creative ideas while we live through the pandemic. Now as we see a possible ending, we envision the beginning of an increase in industrial collaborations.

As a young and pioneering School, our uttermost mission is to contribute to society. We position ourselves in rooting in Hong Kong and providing talents to the Greater Bay Area. With the collaborative effort between HKIDS and SDSC, I am pleased to report that talents and innovations in data science and AI are increasingly welcomed by the local industrial and government sectors. We have strengthened our collaborations with the local industrial leaders and the government sectors in developing Hong Kong into a smart city with smart living. We are fully geared to prepare the talents and innovations needed for the city's digitalized and high-tech future.

This annual magazine presents to you our exemplary teaching and research activities as the first School of Data Science in the region. It is our honour to recap and document these successes from the past to guide us through the future. I hope you will enjoy reading this publication and welcome your suggestions and ideas to work with us together in shaping the process of digitalization.

S. Joe QIN, Chair Professor
Dean, School of Data Science
Director, Hong Kong Institute for Data Science
July 2022

OUR PEOPLE–DISTINCTION THROUGH DIVERSITY

People with diverse perspectives constitute an excellent academy—just like how bits of data contribute to a mega picture. The School of Data Science (SDSC)'s outstanding performance and high academic standards are driven by a diversified and multicultural faculty. Collectively, we leverage the best in our faculty, staff and students to stimulate learning, create influence and innovate research.

ACADEMIC EXCELLENCE

SDSC, housed in one of the world's fastest-growing universities this decade, bears the vision to bring on leading-edge education and research. We achieve such goal with the power of people. Over the last four years, our faculty has grown to 38 members, including 12 affiliate members.

FACULTY MEMBERS

Professor S. Joe QIN is our Dean and Chair Professor of Data Science, as well as the Directors of the Hong Kong Institute for Data Science (HKIDS) and Centre for Systems Informatics Engineering (CSIE). His research interests include Data Analytics, Statistical Learning, System Data Science, Latent Variable Methods, High-dimensional Time Series Latent Variable Modeling, Data-driven Control and Optimization.

Professor Ding-Xuan ZHOU, our Associate Dean and Chair Professor has conducted cutting-edge research on Learning Theory, Wavelet Analysis and Approximation Theory.

Professor Way KUO, President of CityU as well as University Distinguished Professor has conducted research on Modeling, Evaluating and Estimating Reliability of Modern Systems, with emphasis on Optimal System Design, Reliability Design for Microelectronics and Nano Products.

Professor Alain BENSOUSSAN is our Chair Professor of Risk and Decision Analysis. His research areas include Stochastic Control, Risk Management, Inventory Control, Real Options, and more.

Professor Jun WANG, our Chair Professor of Computational Intelligence, explores areas like Neural Computation, Optimization Methods, Data Processing and Intelligence Control.

Professor Jonathan ZHU is our Chair Professor of Computational Social Science. His research revolves around Structure, Diffusion, Use and Effect of New Media, Network Analysis of Online Communications, Web Mining, e-Social Science, Quantitative Research Methodology, Statistical Analysis, and Social Computing.

Professor Minghua CHEN covers a wide array of research topics, including: Online Optimization and Algorithms, Capitalizing the Benefit of Data-driven Prediction in Algorithm/System Design, Machine Learning in Networked and Societal Systems, Energy Systems (such as smart power grids and energy-efficient data centers), Intelligent Transportation Systems and Delay-constrained Networking.

Professor Junhui WANG is specializes in researching Statistical Machine Learning.

Dr. Lishuai LI, Associate Professor, has the following research interests: Intelligent Transportation Systems, Air Transport and Operations, Data Mining and Computational Intelligence.

Dr. Matthias TAN, Associate Professor, covers Statistical Modeling and Inference for Engineering, Uncertainty Quantification in Computer Simulations, Design and Analysis of Experiments, and Statistical Quality Improvement.

FACULTY MEMBERS

Dr. Qi WU, Associate Professor, conducts research on: Quantitative Finance, Financial Technology and Business Analytics.

Dr. Qing KE, Assistant Professor, has conducted research on Innovation, Entrepreneurship, Venture Capital, Intellectual Property, Patents, Science and Technology Policy, Economic Geography, China, Network Science, Social Computing, and Social Media.

Dr. Li ZENG, Associate Professor, explores areas like Statistical Machine Learning, Quality Engineering, and Data Analytics in Manufacturing and Biomedical Engineering.

Dr. Alec William KIRKLEY, Assistant Professor, works mainly on theory of Complex Networks and Statistical Physics of Urban Systems.

Dr. Qingpeng ZHANG, Associate Professor, focuses on Healthcare Data Analytics, Medical Informatics, Network Science, Social Computing and Artificial Intelligence.

Dr. Jizhou LI, Assistant Professor, focuses on advancing the capabilities of a broad range of imaging techniques to accelerate interdisciplinary research and discovery in natural science.

Dr. Zijun ZHANG, Associate Professor, has the following research interests: Data Analytics, Computational Intelligence, System Modeling and Optimization and Renewable Energy.

Dr. Linyan LI, Assistant Professor, is an expert on Spatial Analysis, Healthcare Data Analytics, Environmental Health, Smart City, and Real World Evidence (RWE).

Dr. Xiang ZHOU, Associate Professor, is an expert on Applied and Computational Mathematics, Rare Event, Stochastic Modelling and Simulation, Energy Landscapes and Machine Learning.

Dr. Xinyue LI, Assistant Professor, has research interests such as Wearable Device Data Analysis, Statistical Genetics, Electronic Health Record Analysis, Precision Medicine, Scalable Statistical Learning and Machine Learning Methods for Large Data Sets.

Dr. Yining DONG, Assistant Professor, researches on Process Data Analytics, Multivariate Time Series Modeling, Statistical Machine Learning, Smart Manufacturing and New Material Design.

Dr. Xiao QIAO, Assistant Professor, has research scopes on Financial Economics, Asset Pricing, Financial Data Analytics and Risk Management.

Dr. Long FENG, Assistant Professor, focuses primarily on Statistical Machine Learning, Image Data Analysis, and Variable Selection.

Dr. Yu YANG, Assistant Professor, works mainly on Large-scale Graph Mining, Data Mining and Processing, Stochastic and Combinatorial Optimization, Influence/ Information Diffusion in Networks, Dense Subgraph Detection and Graph Representation.

Dr. Clint HO, Assistant Professor, researches on: Decision Making under Uncertainty, Robust Optimization, Computational Optimization, and Operations Research.

Dr. Xiangyu ZHAO, Assistant Professor, focuses on Machine Learning and Data Mining, Reinforcement Learning/AutoML/Multimodal, Information Retrieval (Recommender Systems, Online Advertising, Search Engine), Urban Computing and Spatio-Temporal Data Analysis, AI for Social Computing /Finance /Education /Ecosystem /Healthcare.

AFFILIATE MEMBERS

Professor Ian W. MCKEAGUE is a Chair Professor and Head of the Department of Biostatistics. His research interests cover post-selection inference, functional data analysis, empirical likelihood, non-standard asymptotics, statistical methods for trajectory analysis in life course epidemiology, survival analysis, Bayesian inverse problems in physical oceanography, statistical aspects of quantum physics and relativity, Markov chain Monte Carlo, competing risks models for HIV/ AIDS data, inference for stochastic processes, simultaneous inference, efficient estimation for semiparametric models, counting process and martingale methods in survival analysis.

Professor Min XIE is a Chair Professor of Industrial Engineering at the Department of Advanced Design and Systems Engineering. His research focuses on Reliability Engineering, Quality Management, Software Reliability and Applied Statistics.

Professor Chuangyin DANG is a Professor at the Department of Advanced Design and Systems Engineering. His research interests cover Game Theory and Applications, Systems Modeling and Optimization, Computational Economics and Finance, Data Analytics and Statistical Learning.

Professor Xin LI is a Professor at the Department of Information Systems. His research focuses on Digital Economy, Data Science/Machine Learning, Social Network, and Applied Econometrics.

Professor Yanzhi David LI is a Professor at the Department of Marketing and Department of Management Sciences. His research focuses on Business Analytics, Supply Chain Management, OM/ Marketing Interface, and Perishable Inventory Management and Pricing.

Professor Tze-Kin Alan WAN is a Professor at the Department of Management Sciences. He conducts research on Model Averaging and Selection, Varying-Coefficient Semi-parametric Models, Missing and Censored Data, and Quantile Regression.

Dr. Siyang GAO is an Associate Professor at the Department of Advanced Design and Systems Engineering. His researches mainly focuses on Simulation Modeling and Optimization, Applied Probability, Discrete Event Dynamic Systems, and Healthcare Management.

Dr. Guanhao Gavin FENG is an Assistant Professor at the Department of Management Sciences. His research interests cover Financial Econometrics, Empirical Asset Pricing, Machine Learning and Quantitative Finance.

Dr. Jingyu HE is an Assistant Professor at the Department of Management Sciences, words on the following research: Machine Learning, Tree Ensembles, Bayesian Statistics and Empirical Asset Pricing.

Dr. Jun LI is an Assistant Professor at the Department of Infectious Diseases and Public Health. His research interests include Big Data Mining in Biology, Predictive Modelling, and Dynamics and the Complex Adaptive System in Ecology.

Dr. Zhixin ZHOU is an Assistant Professor at the Department of Management Sciences. His research covers Network Analysis, High-dimensional Statistics, Information Theory, Adaptive Experimental Design, Stochastic Process and Efficient Search in Recommendation System.

Dr. Inez M. ZWETSLOOT is an Assistant Professor at the Department of Advanced Design and Systems Engineering. She covers the scope of Statistical Process Monitoring, Industrial Statistics, Lean Six Sigma and Operational Excellence.

HONORARY PROFESSORS

Professor John E. HOPCROFT is an IBM Professor of Engineering and Applied Mathematics, Cornell University A. M. Turing Award (1986). His research focuses on theoretical aspects of computing.

Dr. Kai-Fu LEE is Chairman and CEO of Sinovation Ventures and President of Sinovation Ventures Artificial Intelligence Institute. His specialism covers Artificial Intelligence, Machine Learning, Speech, Natural Language.

WORLD-LEADING SCIENTISTS

Six Professors at SDSC are among the top 2 per cent of scientists in the world, according to a list compiled by the prestigious Stanford University in 2021. These elite global scientists are Dean Professor Joe QIN, Associate Dean Professor Ding-Xuan ZHOU, CityU President Professor Way KUO, Professor Jun WANG, Professor Minghua CHEN and affiliate member Professor Min XIE. Stanford's rankings are based on six important metrics and are scientifically adjusted for several factors, including the number of years spent in a particular research field. In 2021, more than 170 scientists from CityU made the list, and the rankings of professors QIN and WANG were among the top 10 in the university's history.

GLOBAL EXPERTISE

SDSC faculty are leading experts in their fields from across the world. Most are doctoral graduates of elite universities, including Oxford University and Imperial College London in the UK; Harvard University, Princeton University, Yale University, the University of Chicago, Columbia University, and the University of Pennsylvania in the US; and Tsinghua University and Peking University in China.

RESEARCH THAT BENEFITS THE WORLD

SDSC faculty are one of the world's leading communities of data scientists. Working across the field, both in-house and affiliated faculty conduct cutting-edge research on data science theory and algorithms. We are committed to practically applying our research to benefit society, as demonstrated by applications ranging all the way from Industry 4.0, smart city development, and intelligent transportation to renewable energy, new media, quantitative finance, and medical informatics.

- Data Visualization
- Data Mining
- Optimization and Control
- Approximation Theory
- Modeling of Time Series
- System Analytics
- Statistical Learning/Modeling
- Machine Learning
- Reliability Engineering
- Social Computing
- Computational Intelligence
- Computational Mathematics
- Industry 4.0
- Risk Management
- Financial Technology
- Predictive Maintenance

POSTGRADUATES: THE NEXT GENERATION OF DATA SCIENTISTS

Students as well as faculty are flocking to SDSC, which is receiving more applications from high-quality candidates. Postgraduate applicants are particularly keen to join the School.

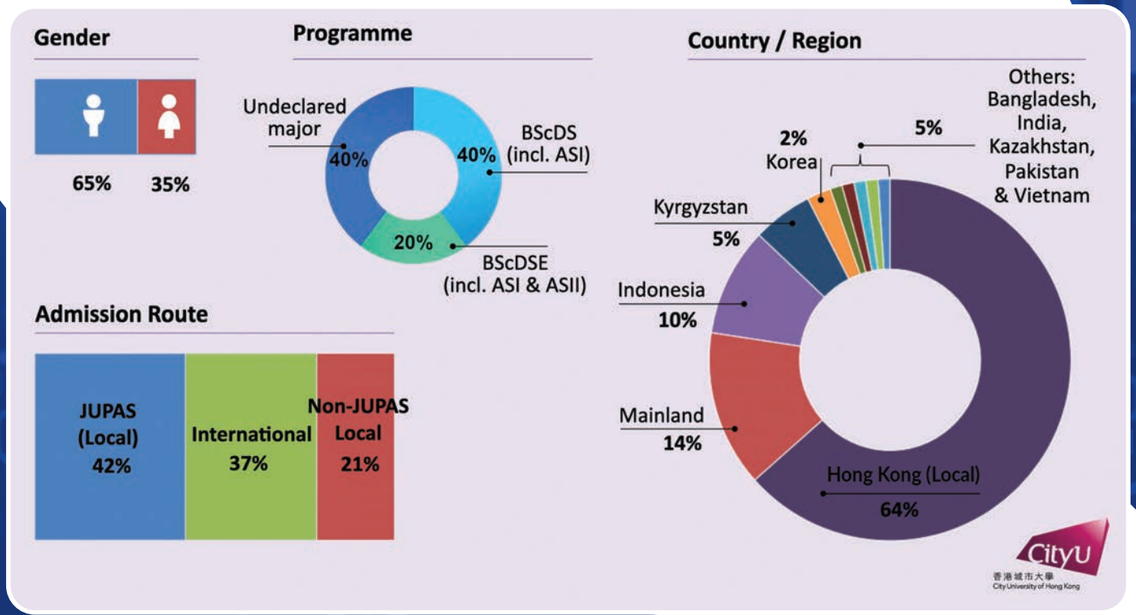
As of September 2022, SDSC will have admitted approximately 120 PhD students. These candidates hold undergraduate degrees from prestigious universities such as the University of Texas at Austin; the University of British Columbia; Johns Hopkins University; New York University; the University of California, Davis; Pennsylvania State University; the University of California, San Diego; University College London; the University of Edinburgh; the University of New South Wales; Tsinghua University; Peking University; Xi'an Jiaotong University; and Nanjing University.

We are also accepting a growing number of master's students. SDCS is currently home to approximately 110 Master of Science in Data Science students and will receive more than 120 new students in September 2022. All of our forthcoming master's students graduated from world-class universities (Project 985, THE Top 200, ARWU Top 200, Project 211 or QS Top 200).

A DIVERSE UNDERGRADUATE BODY

The diversity of SDSC's student body reflects the highly international nature of data science. In 2021, 37 percent of our undergraduate students came from overseas, including mainland China, Indonesia, Kyrgyzstan, and South Korea. More information on our undergraduates' backgrounds can be found below.

DIVERSE BACKGROUND FOR 2021 INTAKE



THE POWER OF WOMEN IN DATA SCIENCE

At CityU's School of Data Science (SDSC), five extraordinary women faculty members have paved the way in their respective science fields. These female academic researchers have emerged from the modest beginnings from where they were born and bred, to have attended some of the most prestigious universities in the world, including MIT and Harvard.

Data science is a growing discipline within the University and its School offers undergraduate students an interdisciplinary curriculum that not only provides a solid foundation in data science but also offers a state-of-the-art spectrum on relevant subjects. Students here are offered the opportunity to take part in projects and courses that touch on FinTech, the Internet of Things (IoT), artificial intelligence (AI), industrial AI, statistical learning, social media analysis and Smart City applications, among many other topics.

The School's extensive industry networks and partnerships allow students to partake in open-ended projects and even realise their dream data science products. It is therefore important that the School facilitates future data science professionals with the academic support of diverse and highly respected researchers and professors in the data science field.

Dr. Li ZENG is an Associate Professor who earned her MSc in Statistics and PhD in Industrial Engineering from the University of Wisconsin-Madison. Her years in the field of statistical machine learning and quality engineering with applications in manufacturing and biomedical engineering have led to her research in better modelling and prediction of domain science that integrates data analytics.

Dr. Li ZENG expects Industry 4.0 to lead to many new developments.

Five female faculty members have forged a path in the discipline of Data Science. Now, as dedicated scholars at CityU, they continue their endeavors.

Growing up, Dr. ZENG said she was rather different from the rest of her family who are outgoing and expressive, whereas she was shy and sensitive. The Sichuan-born Dr. ZENG's research attempts to understand the systems that converge in the realm of integrating domain science and data science. "We need to understand the system or topic to identify problems and solve the problem by using data science techniques," she explains. The interest she cultivated for her field didn't come instantly. Dr. ZENG says that it took her some time to realise what she wanted to do.

"At the beginning, no one told me what topics I should work on," she says, referring to her junior faculty years. "I read a lot of papers in the field of biomedical engineering. I talked with researchers; I was collaborating with them and participated in the experiments they were working on. And I really understood their field and what they were doing." She continued to attend conferences and immersed herself in papers. Eventually she would contribute to identifying problems and develop systematic, data science methodologies to solve these problems.

"This is something I'm proud of. It's not just applying data science technologies, but also identifying problems, a problem which is meaningful even to the domain experts," Dr. ZENG adds.

As we enter Industry 4.0—explained as a revolution in ways that companies manufacture, improve and distribute their products by integrating new technologies such as AI, cloud computing and analytics and IoT throughout the entire operations and production facilities—Dr. ZENG sees a lot of potential and many new developments to come.

"These days with big data and IoT, we will generate a lot of data," the Associate Professor says. "And people will need data to help them make better decisions."

Specialising in this field is Associate Professor Dr. Lishuai LI, whose research in the interdisciplinary field of intelligent transportation systems and data science has seen her developing analytical methods for large-scale operational data in airline safety management and operations improvement.

She also came up with analytical methods for air traffic management and health monitoring of train systems. Her research group recently developed path-finding methods for drone delivery networks to overcome infrastructural challenges in urban air mobility.

Dr. Lishuai LI takes great pride in enabling her students to become independent researchers.

Dr. LI obtained her MSc and PhD from the Department of Aeronautics and Astronautics at the Massachusetts Institute of Technology (MIT) after earning her BEng in Aircraft Design and Engineering from Fudan University.

Born and raised in Jiangsu province, Dr. LI had always been fascinated by aeroplanes growing up and this led her to join one of the most prestigious programmes at MIT. The Associate Professor would explain her career trajectory as a part of an evolution of disciplines.

She elaborates: "Even when I was in the Department of Aeronautics and Astronautics, the research that I was doing was already very data science related. I was using machine learning algorithms to do my research. I didn't exactly choose data science, it was more like the evolution of the technologies itself that pushed me to this area."

In addition to her research and the strides she has made in her field, Dr. LI's pride of late has been in setting her students on a path that enables them to become independent researchers working across industries—whether they join research institutions or technology companies.

As we are reminded in recent years, healthcare is an area of big concern for the global populace. Dr. Xinyue LI is an Assistant Professor with a PhD in Biostatistics from Yale University. Before that, the Beijing native spent one year at Peking University and three years for her BA and MS in Statistics at the University of Chicago.

She developed a research interest in statistical methods for wearable device data, electronic health records, large population studies, genetics and precision medicine.

However, the analysing of data remains challenging in her field. "We have a vastly growing number of datasets, but still we leverage only a small proportion of the data. There is still plenty we can score and we can know from the data."

Her interest in leveraging data in the field of health came almost haphazardly—a moment that a switch was turned on. During an introduction of courses in her BA, Dr. LI became aware that statistics is an interesting and useful tool that can be applied to health and biological fields. "So I decided to deepen my knowledge in statistics to help solve a problem," she says.

This would be the defining factor for Dr. LI, as she had always been interested in solving health- and biology-related problems. To her, contributing to the improvement of public health and society has always been a deep-rooted motivation.

"To have my studies and projects contribute towards obtaining novel biological insights, and also developing the necessary tools and packages to proceed with the analysis of health and biomedical data—we always hope that our study knowledge will be of service," she adds.

And it has been rewarding so far. "I am happy when we can use the data to make some new discoveries and also for myself, I always collaborate with health researchers and domain experts. When they don't have the necessary methods and tools to analyse data, I can help develop those tools and help them uncover new biological insights and understand disease aetiology."

Health is also the research keyword for Assistant Professor Dr. Linyan LI, who was encouraged to pursue a career in science after encountering a visiting professor at Tsinghua University where she did her undergraduate degree.

This visiting professor of Swedish origin would be the catalyst as well as facilitator to launch Dr. LI's career toward the sciences.

"My first year with that professor taught me how the home environment can affect asthma," she explains, noting this was a condition she suffered from as a child. "Traditionally people have focused more on the energy efficiency of building design, but the health aspect has been overlooked. Today we spend over 90% of the time indoors, and our health is closely linked to indoor environments."

Dr. Linyan LI completed her PhD at Harvard.

Dr. Xinyue LI and her PhD students at the Lion Rock.

Dr. LI went on to finish her MSc and PhD degrees in the School of Public Health at Harvard University. For her thesis, she returned to her hometown in China to study indoor and built environment that impact school-age children's health. Her research interest has developed into the areas of spatial analysis, healthcare data analytics, and environmental health.

After her doctorate, it wasn't a straight into academia career path for Dr. LI. "I worked in industry for a few years," she says. Dr. LI joined a healthcare consulting firm where she gained hands-on experience in real-world healthcare data analytics. She still had passion for research, which propelled her to a faculty position at CityU, where she aims to combine her expertise and experience in both academia and industry to leverage powerful data science tools in public health research.

As part of her curriculum, Dr. LI introduced a new course in which she teaches human context and ethics in data science.

"It's very important to understand ethics-related challenges in this area, because technology is developing very fast, while it takes time for laws and regulations to catch up," she says. "We really need to be forward-thinking to avoid unethical behavior in data collection, analysis and usage. It is crucial to help the students develop the right ethics framework and mindset, so that when they do research, they will make sure things are ethically sound from the start."

Equipping students with the right tools and mindset is important, and so is recruiting a new generation of future scientists with the right motivations.

This is a sentiment shared by Assistant Professor Dr. Yining DONG who is on the lookout for motivated PhD students with an interest in smart manufacturing, high-dimensional time series modelling, new material design and statistical machine learning among others.

Dr. DONG received her PhD in Electrical Engineering from the University of Southern California. Prior to her CityU appointment, she was doing her post-doctorate in Electrical Engineering at Stanford University.

A Beijing native, Dr. DONG spent her childhood in the massiveness that is the capital city of China. Her parents—both with higher education backgrounds—provided a very comfortable learning environment, according to Dr. DONG. "They gave me a lot of freedom to do what I like to do. That allowed me to do a lot of things with a high degree of confidence." And she always had an affinity with numbers.

"When I was in primary school and middle school, I participated in many maths competitions," Dr. DONG says. "So I always liked numbers. And I thought, what attracted me the most? It is what you can do with numbers and what you can discover. Or what you can mine from them and doing data analysis that allows you to unlock a lot of information that cannot be simply obtained from instruments or equipment."

Dr. DONG's main research focus and results are the development of a series of law and survival methods to analyse high-dimensional time series data. Large amounts of data generated from natural processes need to be modelled, analysed, visualised, interpreted, and made into predictions for such data to be useful, she says. All for the purpose of process optimisation, monitoring and diagnosis, and decision making.

"Throughout my research, we have developed a series of modelling methods to analyse the high dimensional time series data. As such, we are able to perform dimension reduction and low dimensional latent variables wearable prediction at the same time. This gives our algorithms a very good interpretability as a predictability."

Dr. Yining DONG has always had an affinitity for numbers.

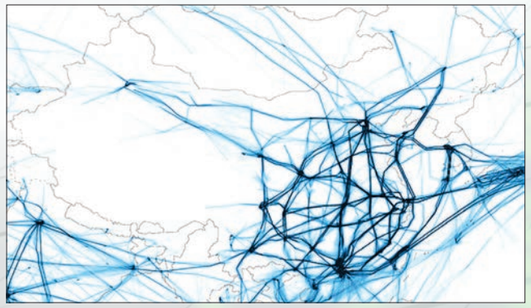
Referring to Industry 4.0, Dr. DONG emphasises the changes in the mode of production at this moment in time, such as unmanned driving robots as intelligent transportation systems. "All of these are changing people's lifestyles right now, people's quality of life. Those are all like applications of data science, right? I definitely think these are key factors that will affect people's lives in the 21st century." ⬢

DATA SCIENCE FOR AIR TRANSPORTATION SYSTEMS

The aviation sector has always been technology driven. With the advancement of sensor and data technologies, more and more data becomes available which contains rich information about aircraft conditions, airline operations, aircraft maintenance, air traffic management, etc. Yet the aviation sector has not been able to harness the power of big data, artificial intelligence (AI) and other emerging technologies as much as some other sectors. Targeting this opportunity, my team focuses on the interdisciplinary research of intelligent air transportation systems and data science, developing analytical methods and practical algorithms for the design, management, and operations of air transportation systems, via collaborations with industrial partners from flag carrier airlines to tech start-ups. *By Dr. Lishuai LI*

USING AIRCRAFT TRACKING DATA FOR NETWORK ANALYSIS AND FLIGHT DELAY MODELLING

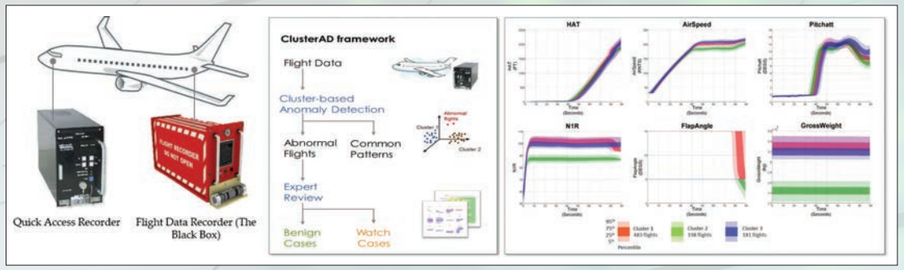
En-route congestion causes flight delays in air traffic networks and will become more prominent as air traffic demand will continue to increase yet airspace volume cannot grow. This research develops novel methods to analyse airspace congestion in a national air traffic network using real-time aircraft tracking data, which can be used to identify current bottlenecks and evaluate improvement strategies and policies. Novel data analytics were developed to characterise the operational structure and dynamics of an air traffic network using actual tracking data. The network analysis conducted by Pan REN (former PhD student) revealed distinctive characteristics of the air traffic network in China and the one in the US. Then, a new flight delay model, Multi-layer Air Traffic Network Delay (MATND) model, was developed by Yu LIN (Postdoc) to capture the impact of en-route congestion on flight delays over an air traffic network. This model is developed by a data-driven approach, taking aircraft tracking data and flight schedules as inputs to characterise a national air traffic network, as well as a system-level model approach, modelling the delay process based on queueing theory. The two approaches combined make the network delay model a close representation of reality and easy-to-implement for what-if scenario analysis, which allows decision-makers to predict risks of flight delays under various operational scenarios, such as network structure modifications, infrastructure improvements, or changes in air traffic management.



Flight Tracks in China Airspace in Nov, 2016

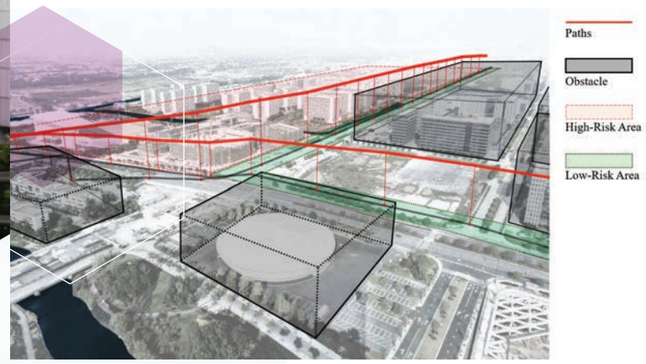
MINING FLIGHT DATA RECORDER DATA FOR PROACTIVE SAFETY MANAGEMENT AT AIRLINES

To improve safety, airlines initiated proactive monitoring of flight operations, aided by the Flight Data Recorder (FDR) and Quick Access Recorder (QAR). Traditional data analytics are quickly becoming obsolete in light of the abundance of data. Existing methods such as the widely used Exceedance Detection by the airline industry can monitor hazards from a pre-defined list, or "known issues", while remaining blind to emerging and previously unidentified risks such as hazardous pilot behaviors. Dr. LI's team developed a novel cluster-based anomaly detection approach for abnormal flights. The aim is to support domain experts in detecting anomalies and associated risks from routine airline operations. The new approach, enabled by data from QAR, a heterogeneous dataset collected by ubiquitous sensors on aircraft, applies clustering techniques, i.e. DBSCAN, GMM, and the new incremental GMM method developed by Weizun ZHAO (PhD student), to detect abnormal flights with unique data patterns. These flights may indicate an increased level of risks under the assumption that normal flights share common patterns, while anomalies do not. Safety experts can then review these flights in detail to identify risks, if any. Expert



Proactive flight operations monitoring using onboard recorded flight data

Dr. Lishuai LI led a PhD team to help advance air transportation systems through applying data technologies.



Network design and planning of drone delivery routes in urban environment.

"My team works with airlines to exploit AI technologies to improve current fuel planning practice which may significantly reduce fuel consumption and emissions"

reviews and case studies are conducted to validate the proposed methods. Results show that the new breed of data driven approaches can identify "common patterns" as well as anomalies, allowing airlines to examine the consistency of current operations while focusing efforts on investigating unusual behaviors to look for latent risks.

DATA INTELLIGENCE AND FUEL EFFICIENCY: A DATA-DRIVEN APPROACH TO MANAGE UNCERTAINTIES IN FLIGHT FUEL PLANNING

Under increasing economic and environmental pressure, airlines are constantly seeking new technologies and optimising flight operations to reduce fuel consumption. However, the current practice on fuel loading, which has a significant impact on aircraft weight and fuel consumption, has yet to be thoroughly addressed by existing studies. Excess fuel is loaded by dispatchers and (or) pilots to handle fuel consumption uncertainties, primarily caused by flight time uncertainties, which cannot be predicted by current Flight Planning Systems (FPS). In this project, Dr. LI's team works with airlines to exploit AI technologies to improve current fuel planning practice which may significantly reduce fuel consumption and emissions. Xinting ZHU (PhD student) is building a predictive model that can better estimate each flight's fuel consumption by combining multiple data sources (e.g. traffic conditions, Flight Data Recorder data, etc.) which are not typically included under current practice. Preliminary results show that, with the improved flight time prediction, fuel loading can be optimised and resulting fuel consumption reduced by 0.016%–1.915% without increasing the fuel depletion risk.

Aircraft fuel-loading.

TRANSPORT NETWORK PLANNING FOR URBAN AIR MOBILITY

Towards the future: urban air mobility, particularly package delivery via drones, is a rapidly emerging field with prospects to ease existing urban traffic congestion and to connect remote areas with great agility. A key challenge lies in the traffic management of a large number of drones operating in high-density urban areas. Dr. LI's research focuses on the design and planning of Unmanned Aerial Systems (UAS) transport networks. Through collaborations with Antwork Technology, a leading drone logistics technology company based off Hangzhou, China, Dr. LI's team (Fang HE and Xinyu HE, PhD students) is developing a set of path planning algorithms for the design of urban UAS transport networks by considering the airspace and air traffic control constraints and how to integrate with other urban air mobility services. New algorithms were developed to design drone routes in the sky in order to minimise airspace conflicts, reduce operational cost, and ensure both air and ground safety. The algorithms are tested and implemented at Antwork Technology to support one of the first operationalised package delivery services via drones in a dense city. ⬢

PCCW Solutions' Managing Director Jerry LI perceives many similarities between Hong Kong now and Silicon Valley during the dotcom era.

SPEARHEADING HONG KONG'S DIGITAL TRANSFORMATION

The CityU-PCCW Solutions collaboration aims to nurture young talent, and turn Hong Kong from a technology consumer into an innovator.

The City University of Hong Kong (CityU) School of Data Science (SDSC) signed two Memorandum of Understanding (MoUs) with PCCW Solutions in May—a move that solidified the two institutions as being amongst the most innovative and forward-thinking in all of Hong Kong.

The agreement came together in just a matter of weeks thanks to leadership—specifically, the partnership between SDSC Dean and HKIDS Director Professor S. Joe QIN and PCCW Solutions' Managing Director Jerry LI. Both men have had illustrious tech careers in the US and mainland China—the world's leading tech hubs—and hope to bring that culture of innovation to their new organisations, and Hong Kong as a whole.

CITYU AS A FORWARD-THINKING HIGHER EDUCATION INSTITUTION

At just 28 years old, CityU has always kept itself at the forefront of innovation in order to uphold its uniqueness in a city packed with world-leading universities. Now already firmly established as one of the city's best, the School completed its most forward-thinking move yet four years ago, by opening the SDSC, the first data-science school in the city.

Their next great move was hiring one of the most sought-out data scientists in all of academia in Professor QIN, who recently became the first scholar educated in mainland China to receive the CAST Computing in Chemical Engineering Award, presented by the American Institute of Chemical Engineers.

"What attracted me to CityU was the opportunity to lead and define this very fast-growing discipline of data science in Hong Kong," said Professor QIN, who previously served as Vice Dean and the Fluor Professor at the prestigious Viterbi School of Engineering at the University of Southern California. "CityU made a very visionary decision to amass the resources and start a standalone school around data science. I don't think anyone else in Hong Kong is more determined to develop data science than CityU, and I felt very lucky to have been selected as their first Dean."

Around the same time that CityU opened the SDSC, leading technology and innovation oriented American universities like the University of California Berkeley, Columbia University, and the Massachusetts Institute of Technology began opening up schools for data science. "I think CityU was able to capture that forefront and now we really have the momentum to spring things forward," Professor QIN said.

The MoU with PCCW Solutions is a big part of that forward momentum and is also part of Professor QIN's desire to help the SDSC emulate the US model, something which he had in mind when he first started his Deanship.

"In the US we always work with the biggest technology companies, and the universities have partnerships with companies like Google or Amazon," he explained. "But when I first started out as Dean it was difficult to know who the equivalent players were in Hong Kong."

"That's why PCCW Solutions came out as a very pleasant surprise to me," he continued. "I didn't realize they had already been offering a lot of great technology solutions to their clients, and their clients are very diverse covering many domains and industry sectors. I think this shows that Hong Kong does have some technical tech-driven companies, but they're somewhat hidden and we hope to get them more exposure."

With all of that being said, he believes one area which Hong Kong does not trail the US or mainland China is academic research. Recent examples of this include the Electrical and Mechanical Service Department winning an award at the highly prestigious International Exhibition of Inventions of Geneva thanks to the SDSC's innovative AI research, and a group of SDSC students winning the coveted Microsoft AI Influencer Award.

"For the last two decades or so, Hong Kong has been like an ivory tower in academia, and Hong Kong universities including CityU are really at the forefront with other top universities—there is not much of a gap between Hong Kong and the rest of the world," he said. "We believe that we can help PCCW Solutions with our research and help them beef up their expertise in artificial intelligence and data science—and by having direct access to their clients, we can really help solve their critical needs."

Professor QIN believes working with PCCW Solutions will provide exposure to Hong Kong's tech-driven companies.

After all, the MoU's main purpose is to "bridge the gap between research and real-world work experience, and real-life application of research." To that end, the SDSC and PCCW Solutions have begun an extensive internship programme - giving students their first taste of real-world experience in the space as well as potential long-term job opportunities - all in an effort to effectively nurture new tech talent - a shared goal and vision of both Professor QIN and Jerry.

Furthermore, it is also part of an effort by the SDSC to further Data Science as a discipline. Professor QIN said that it is one of the fastest growing industries with an incredibly high demand for young talent.

"Nowadays most major US companies will have a Vice President in charge of Data Analytics and Digitalization," he explained. "We didn't have that even 10 years ago. And if you don't have a significant number of staff focused on big data, you'll be asked by customers or by Wall Street 'why not?'"

"This is why Data Science is becoming such a lucrative field, because the demand is all of a sudden so huge due to technological developments, and the traditional way of educating data scientists and analysts is not enough."

CityU's SDSC leads data science programmes further by allowing for undergraduate degrees and minor programmes, as well as robust partnerships with other schools within the University.

"It is undergraduate programmes that really define what is a new discipline—particularly in science or STEM fields, having an undergraduate programme is very critical to call it a discipline," Professor QIN explained. "We have also created minor programmes for students from other schools. This allows students studying things like creative media or business analytics to become much more data-savvy in their own industries. We also allow our students to take courses from other disciplines, to learn how to apply their skills and knowledge in different domains."

PCCW SOLUTIONS AS HONG KONG'S LEADING TECH INNOVATOR

Despite working at the company for less than a year, Jerry has already begun spearheading PCCW Solutions' ambitious effort to become a global tech innovation giant. He worked in Silicon Valley during the "dotcom era" of the early 2000s, and would go on to hold several prestigious tech consulting and system integration roles around Asia.

Jerry spent over 11 years at Accenture as a Managing Director. After that, he was the Deputy Director of the MTR Corporation, where over the course of three years, he helped the railway giant integrate several important integral technology and data-driven solutions.

"There is a great combination of traditional and exciting new things in this company," Jerry said of PCCW Solutions. "We are in a very unique place in Hong Kong as there is a lot of technology investment, but also a bit of a talent shortage. The client-market situation is perfect for us to take it further and I'm excited for the challenge, and my team has been excellent."

Jerry sees a lot of similarities between Hong Kong and Silicon Valley during the dotcom era, which was arguably the greatest period of technological innovation in human history.

"There was a lot of excitement back then as well as uncertainty, but uncertainty breeds innovation," he explained. "When everything

is stable you sometimes lack the edge to be disruptive. So that innovative spirit that I felt in Silicon Valley, I feel a similar vibe in Hong Kong right now—especially in areas like fintech and smart-city digitalization."

Jerry is an ardent believer in the importance of nurturing young talent, particularly in fast-growing technology-based fields like data science and artificial intelligence. He was delighted to learn that Professor QIN felt the same way, and it was this shared belief that ultimately led to the signing of the MoU.

"I met Professor QIN and thought he was awesome and we hit it off right away," Jerry said. "I think one thing led to another, which led to hours of conversation and soon we found that we share a very similar vision of where the world is going from a technology and enabling perspective, and we share similar values in the sense that to make all these great things happen, talent and future talent are essential."

"It was only a matter of time before we decided to do something together and despite COVID, we made this collaboration really quickly."

After just a few weeks, they would sign two papers for the MoU: The first revolving around HKIDS's research being adopted into real-world use cases, and the second offering exclusive internship placements for SDSC students. And despite being in the very early stages, the partnership has been a massive success on both ends.

For Jerry, this partnership is about more than just helping Hong Kong catch up with the US and mainland China; it's about helping the city capitalize on the next wave of technology which may bring about even more significant societal shifts.

"The next wave is going to be even more exponential in terms of the value created by technology," he said. "This is because for the first time in history, we have enough systems in place to capture all of the necessary data, and enough knowhow and computing power to turn academic theories into real-life models that can be implemented. So the collision of these two trends makes it a very unique opportunity to build this relationship."

Jerry believes that there is a lack of nurturing and development of young talent in the tech world and that it's not just a Hong Kong problem, but a global one. The reason being that the pace of technological acceleration is far greater than any government or organisation ever predicted.

Jerry believes more needs to be done to help nuture young talent in the tech industry – not just in Hong Kong but around the world.

"I think in many ways it's a good problem to have, as it means opportunity for young talents, and even people not necessarily in school today," he explained. "I think education is not just for the youth, it's a real-time thing, so it's an exciting opportunity for the whole population to participate in this exciting change."

Additionally, Jerry hopes to take a page out of the books of other major tech hubs like Silicon Valley, London, New York as well as Shenzhen and Beijing, who all have robust diversity and inclusion initiatives to help bring in global talent, as well as people from all kinds of different socioeconomic backgrounds.

"One amazing thing about tech is that it's relatively borderless," he said. "You don't even have to speak the same languages if you know how to code, so you see all these amazing collaborations in the fintech arena where some people don't even know each other but are exchanging ideas and sharing source codes, and sharing profits when things go well."

"So the inclusive nature of it all, I strongly encourage and promote as part of my job. And with CityU, we will work together to help bring new talent into this collaboration, not only internally—we will utilize the global playing field."

PCCW Solutions is already thriving, with around 2,000 employees in Hong Kong and another 2,000 globally with branches in mainland China, Taiwan, Singapore, Malaysia and the Philippines. And they recently announced a strategic alliance with tech giant Lenovo, which will bring incredible opportunities to everyone involved.

"This partnership will give our company and Hong Kong a much bigger playing field, as it's essentially a tech investment in Hong Kong to have greater regional ambition. So I find it very exciting and it's actually a great platform for our staff, team, and the students in Hong Kong," Jerry said.

And with the expected influx of new talent, Jerry hopes to turn PCCW Solutions into an even more innovative company by focusing on more contemporary fields like AI solutions, blockchain technology and Web3.

Finally, while Jerry and Professor QIN are both technological optimists, both of them hope to educate young people on the possible dangers and pitfalls associated with advanced technologies, and the MoUs will have a focus on topics like cybersecurity, AI safety, digital addiction, and confirmation bias brought on by social media algorithms.

MOU INTERNSHIP HIGHLIGHTS

PCCW Solutions' Vice President of HR, Winsome LO stressed that PCCW Solutions is "in the people business". To that end, a big focus on the MoU internship programme is helping the student interns strengthen their people skills.

"In the IT profession this can sometimes be challenging—people can be so good at things like analytics and data management but in real life, we always emphasise that communication is so important," Winsome said. "We are trying to build their core competencies as in their jobs they will have to work with different people—not only the project team but customers as well. These skills will help them no matter what they choose as future professions."

Winsome, who has been in HR her entire career across different industries, has been working for PCCW Solutions for three years.

Young professionals need to learn personal skills, like communication, as well as tech skills, according to Winsome LO.

> *"We are so confident and excited about the MoU. Students from the School of Data Science at CityU demonstrate high standards and high quality."*

"I am very proud to work here because this company is not purely commercial, we have a lot of projects in public sectors that are really helpful to Hong Kong and its global infrastructure," Winsome said. "Our SDSC interns have already been involved with two key projects like a healthcare-related government department, which is a very hot topic right now because of COVID. So already, the students are working on things that will make a real difference."

She noted that the students have also been quickly learning new skills and knowledge related to things like Software As A Service (SAAS) programme management. More importantly, they have been learning even more vital skills like in-person communication, teamwork and collaboration.

"The students have been extremely fast learners and have performed tremendously well so far," said Winsome, who added that the outstanding performers will receive full-time employment after graduation.

Out of the company's 100 plus fresh graduate hires this year, approximate 35% were from CityU, which according to Winsome, "is why we are so confident and excited about the MoU, and demonstrates the high standard and high quality of students from the SDSC."

"Our main role as HR is to foster the atmosphere and environment for students to learn, and we invest a lot of time into nurturing tech talent in our internship programmes, and put students into projects with different IT experts, not just project managers but also other data analysts and scientists," she explained. "We try to check in on students and ensure that everything runs smoothly and that they are enjoying themselves."

"So far, a lot of students told me they prefer a combination of on-the-job training and classroom learning."

A WORD FROM THE INTERNS

Tanya CHAN is a Data Science major who chose to participate in the PCCW Solutions internship programme because of the company's status as an international enterprise; and cheekily noted what a boost it would be to her CV. She believes this experience will introduce her to a number of potential career paths, and is currently working on a project with a healthcare-related organisation.

"In half a month, I've already gained some new experiences and technical programming skills and gotten the opportunity to apply some of the knowledge we have learned and acquired in university," said Tanya, who added that she may want to pursue a career in machine learning.

Ellen WONG is a third-year data and system engineering student with a minor in accountancy who is interested in possibly bringing her data science prowess to a traditional business industry.

"The reason I chose to participate in this internship is because I believe PCCW Solutions is a leading and innovative IT Business Solutions company that will give me a great opportunity to learn from the many talents here," said Ellen, who is working with Tanya on the same project. "I would also like some hands-on experience in the industry and I believe this company will have a huge data set and more than enough resources for us to learn great new knowledge."

Renee YEUNG is a Year 3 Data Science major with a focus on service operation management. She is currently working with a government department and assisting them on building a cutting-edge data integration system.

"This is a big company with a lot of interesting projects related to IT, and it has been extremely well-structured. I have been able to learn from and work with different professionals," said Renee, who is interested in machine learning models and how they can improve our lives.

Alex CHAN is a third-year student majoring in Data Systems Engineering. He is working on a data integration system project along with Renee. Unlike the classmates, he is not a data scientist, but a data analyst, particularly interested in the business sector.

"I enjoy processing historical data, then identifying trends and root causes, and helping companies make data driven decisions to help their growth," he said. "I chose to do this internship because I expected to gain more understanding and knowledge on how a business operates—what tools do they use to manage their data, how do they use data to make business decisions? Especially in a firm as large and successful as PCCW Solutions."

"I have also learned skills such as communication and time management. The project requires interacting and meeting with the stakeholders and project members frequently. Learning how to communicate is also an essential skill." ⬢

VISION AI: A NEW ANALYTICS PARADIGM FOR ADVANCING CLEAN ENERGY, URBAN TRANSPORT SAFETY, AND MEDICAL SERVICES

The research team led by Dr. Zijun ZHANG.

Data science has the great potential of developing the "brain" for automating data analytics from the vision perspective for various processes of different fields. The research effort of my group is dedicated to discovering the new horizon of leveraging advantages of data to power services in multiple fields, such as clean energy, urban transport safety and medical diagnosis. Our recent results reported the multiple facets of knowledge discovery via a new analytics paradigm, the machine vision assisted artificial intelligence. *By Dr. Zijun ZHANG*

LET AI AUTOMATE THE PERFORMANCE CURVE VISUAL IDENTIFICATION FOR RENEWABLE ENERGY SYSTEMS

Wind turbines represent the typical characteristics of today's renewable energy systems. They are sparsely distributed over a broad region that are difficult to access. Their dynamics are complex and heterogeneous, making the assessment of their performances difficult. Yet, as emerging energy systems, wind turbines are fully instrumented to enable a continuous collection of conditional data. Collected data has served as critical media for experts in the domain of turbine health conditions and the evaluation of their efficiencies.

Yet, data analytics of wind turbine performances and their efficiency evaluations nowadays are still conducted in the back office. Data pre-processing for excluding noisy elements in developing clean curves describing wind turbine efficiencies has been a cumbersome routine in analytics. Domain knowledge and experiences are heavily involved, which make domain experts busy at the front of the massive volumes of collected data. Dr. Zijun ZHANG's research group is thus motivated to explore the feasibility of developing an artificial intelligence (AI) model, which can enable computers to follow a human's mindset in data pre-processing and identifying the wind turbine performance curves from a visual analytics perspective.

Dr. ZHANG's research group has recently successfully verified such a hypothesis and developed probably the first version of an AI model in the renewable energy research field. The model allows computers to develop a mapping between the curve images based on noisy raw data and the associated performance curves finally identified by domain experts. After extensive computational experiments, Dr. ZHANG's group was excited about positive results, "It is quite exciting to see that computer vision models demonstrate a great potential of learning mappings between the visualisation of noisy data and the associated clean performance curves. Our finding indicates the feasibility of replacing humans with computers in identifying wind turbine performance curves from data."

Such results indicate many exciting things. First, the success of such AI-assisted vision analytics models will free experts from cumbersome data pre-processing, which consumes the most amount of time in data analytics nowadays. Meanwhile, performance curve analytics is eventually the routine task. AI models can facilitate such a routine to accelerate the whole analytics process. Moreover, a consistent and accurate performance of AI models in the performance curve identification has been observed, which offers high confidence in terms of the generalisability and an assurance of the analytics quality.

Previous reported findings of Dr. ZHANG's group have appeared in the top journal of the power and energy field, IEEE Transactions on Power Systems.

AI ASSISTED VISION INSPECTION OF RAIL TRANSPORT INFRASTRUCTURE CONDITIONS

In recent years, metro companies in mainland China and Hong Kong SAR have explored equipping trains with visual sensors to better monitor surface conditions of rail tracks and other infrastructure components as well as identify foreign objects intruding on the track site in advance. Visual sensors have been designed, and mounted on the front or bottom of trains to collect demanded visual data of the railway infrastructure. The foreseeable next challenge is the analytics of collected visual data. It is almost infeasible to assign analysts to manually check such a large volume of collected images and generate analytics in terms of detecting defects and foreign objects.

To respond to such emerging challenges, Dr. ZHANG and his research group have pioneered studies of computer vision techniques for automating various analytical tasks based on collected railway infrastructure images, including the rail track surface defect inspection, detection of missing components, and foreign object detection.

Innovations have appeared on both image feature engineering and decision model development sides. Novel multi-branch deep convolutional network architectures integrated with domain knowledge based decision rules have been designed to derive meaningful latent features for supporting subsequent decision-making in the defect or component detection tasks.

To realise the detection of any possible foreign objects intruding the rail track site, a novel semi-supervised deep generative modelling framework was proposed by Dr. ZHANG. "We are excited about this idea, which first employs adversarial learning to realise a deep convolutional auto-encoder in reproducing a healthy version of any rail track images and next, identifying foreign objects via the image matching." Many existing works studied foreign object detection via a classification manner, which is limited by types of objects considered in the detection. Dr. ZHANG's simple idea created a new avenue paradigm of addressing such issues and enabled the identification of any foreign objects ideally.

The aforementioned research has been published in multiple flagship journals in transportation and industrial informatics fields, such as IEEE Transactions on Intelligent Transportation Systems, IEEE Transaction on Industrial Informatics, IEEE Internet of Things Journal and others.

AI HAS A POTENTIAL OF SIMPLIFYING THE MEDICAL DIAGNOSIS PROCESS

In recent years, Dr. ZHANG has been invited by doctors from Nanfang Hospital to explore the feasibility of developing a machine vision assisted AI model for diagnosing lung adenocarcinoma types via using only CT scans. The success of such a study will facilitate the diagnostic process, which traditionally relies on time-consuming and expensive pathological examinations.

Existing computer vision methods cannot be directly applied to address such a problem and one grand challenge is the extreme data imbalance in terms of the target class labels. To tackle such challenges and respond to such real demand, a bilateral-branch network with a knowledge distillation procedure (KDBBN) was developed for the auxiliary diagnosis of lung adenocarcinoma by Dr. ZHANG and his research team. KDBBN can automatically identify adenocarcinoma categories and detect the lesion area that most likely contributes to the identification of specific types of adenocarcinoma based on lung CT images. In addition, a knowledge distillation process was established for the proposed framework to ensure that the developed models can be applied to different datasets. Results of a comprehensive computational study confirmed that Dr. ZHANG's method provides a reliable supplementary basis for adenocarcinoma diagnosis to pathological examination.

Dr. ZHANG's research result can be potentially regarded as an AI system for adenocarcinoma identification using CT images, which will upgrade adenocarcinoma identification from the traditional expert-based evidence investigation to an automated AI-assisted paradigm.

Research findings have been published in the new data science journal launched by Cell Press, the Patterns: Cell Press, and a protocol of this study is also available in Star Protocols: Cell Press. ⬢

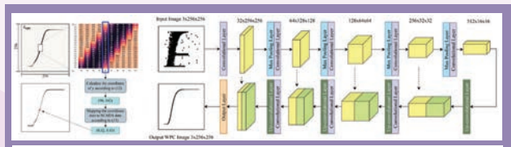


Figure 1. Machine vision for automating the system performance curve identification.

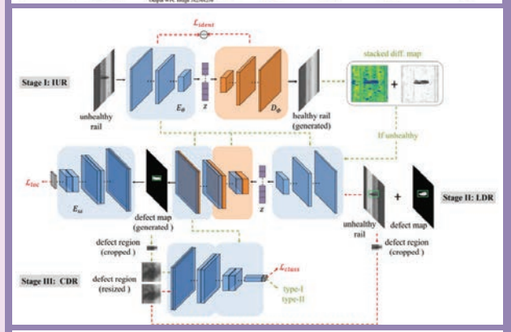


Figure 2. Vision assisted inspection of rail track defects.

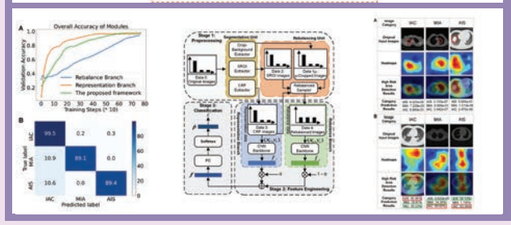


Figure 3. Machine vision informed diagnosis of the lung adenocarcinoma.

CITYU'S MULTI-DISCIPLINARY RESEARCH PLATFORM:
HONG KONG INSTITUTE FOR DATA SCIENCE

Established in 2018, the Hong Kong Institute for Data Science (HKIDS) operates alongside the School of Data Science to develop cutting-edge research and knowledge in the field. It serves as a research and educational hub to integrate data science strengths across the campus, and helps train the next generation of data scientists. It is an international focal point of excellence for research initiatives and translational activities in data science, and the region's leading data science platform. It also provides an experimental stage for research opportunities to PhD students and supports interdisciplinary research projects.

Under HKIDS, we have three research centres and joint laboratories to facilitate high quality and influential research in the area of data science:

- Centre for Systems Informatics Engineering
- City University of Hong Kong – JD (Jingdong) Digital Joint Laboratory in Finance Technology and Engineering
- City University of Hong Kong – DataStory Joint Laboratory in Artificial Intelligence

Collaboration on Commercialisation: CityU x ASTRI

HKIDS is currently working with the Hong Kong Applied Science and Technology Research Institute (ASTRI) on potential collaboration in strengthening co-operation in knowledge exchange, talent development and commercialisation. We are aiming to establish a technology knowledge exchange programme. Our common goal is to build a joint advisory practice to collaboratively design curriculum and materials, supervise taught courses and provide advisory on students' thesis and research topics. We also wish to launch an internship programme in applied data science for our students.

ASTRI was established by the Hong Kong Special Administrative Region Government in 2000 as an R&D centre for information and communications technologies. The Institute states its objective as "enhancing Hong Kong's competitiveness in technology-based industries through applied research".

STRENGTHENING DATA SCIENCE RESEARCH THROUGH SEMINARS AND PARTNERSHIPS

Centre for Systems Informatics Engineering Seminar: Partial Least Squares for Big and Small Data: As a Statistical and an Optimisation Program

Professor S. Joe QIN, Dean and Chair Professor of the School of Data Science, and Director of Hong Kong Institute for Data Science, hosted an online talk on the captioned topic on 18 May 2022, introducing the concept of Partial Least Squares (PLS).

PLS has been around for five decades with accelerated adoptions and application in many fields, including engineering, social science, finance, analytic chemistry, bioinformatics and brain-computer interfaces. Professor QIN, as an expert in the field, talked on the motivation for PLS, the popular NIPLS algorithm, its interpretations and properties, its connection with the conjugate gradient and its difference from other regularised methods (Lasso and ridge regression). He also included a few simulated and real application examples for the cases of collinear data and small data to appreciate the uniqueness of PLS.

Other Thematic Seminars

HKIDS also hosted the new distinguished seminar series on topics below:

- Climate, Carbon and Computer Science (Speaker: Srinivasan KESHAV) – 29 September 2021
- Advances in Nonlinear Mix-integer and Generalized Disjunctive Programming and Applications to the Optimization of Engineering Systems (Speaker: Prof Ignacio E. GROSSMANN) – 20 October 2021
- Divide-and-Conquer: A Distributed Hierarchical Factor Approach to Modelling Large-Scale Time Series Data (Speaker: Prof Ruey S. TSAY) – 17 November 2021
- Learning and Control in Power Distribution Grids (Speaker: Prof Steven LOW) – 27 April 2022

Collaboration: CityU x PCCW Solutions

HKIDS and PCCW Solutions signed two Memorandum of Understanding (MoUs) to jointly develop smart city solutions and nurture IT talents on 6 May 2022, marking one of the most significant partnerships for our School.

Leveraging the strong research capabilities of HKIDS and the proven digital expertise of PCCW Solutions, the collaboration brings the latest research works into real life industry applications. The two parties jointly develop innovative solutions using data analytics and artificial intelligence technologies, focusing on developing solutions for sustainable urban development, such as smart energy management for industrials, asset health monitoring, predictive maintenance and traffic flow optimisation for aviation and railway industries. They also work jointly to commercialise their research deliverables from pilot projects to tackle challenges facing the industries.

At the signing ceremony, Mr. Jerry LI, Managing Director of PCCW Solutions, said: "As the leading IT service company in Hong Kong, we aspire to accelerate development of the smart city and groom local IT talents. We are delighted to collaborate with CityU to co-develop cutting-edge IT solutions. We look forward to developing impactful innovations and translating the research works into commercial success."

In his address, Professor Richard YUEN, Chief-of-Staff of City University of Hong Kong, expressed delight to see CityU's alliance with PCCW Solutions. He said: "We have high hopes for collaborating with a leading IT services giant in Hong Kong, mainland China and Southeast Asia, which not only puts into practice our academic achievements for the betterment of society but also brings real experiences from industry to the campus, thus nurturing talented data scientists".

Professor S. Joe QIN, Director of HKIDS, added: "Data Science has always been a pioneer discipline when it comes to practical applications. I am glad that this MoU seeks to bring the latest and most advanced research work in the fields of data analytics and artificial intelligence to resolve real-world challenges. We look forward to co-developing useful smart city solutions for Hong Kong. I am confident that our students play a significant role through proactively participating in internships".

Further details of the collaboration are featured under 'Dialogue on Data Science' (P16-19).

SDSC and HKIDS collaborate with PCCW Solutions for Joint Solutions and Talent Development.

The 2nd CityU's Data Science Day in August 2021.

DATA SCIENCE DAY 2021

SPEARHEADING DATA SCIENCE AND AI DEVELOPMENTS ON ALL FRONTS

The School of Data Science (SDSC) and the Hong Kong Institute for Data Science (HKIDS) co-organised the annual CityU Data Science Day 2021 on 10 August 2021. The occasion also marked the third anniversary of SDSC and HKIDS.

The day commenced with the opening address by Professor Way KUO, CityU President and University Distinguished Professor, who is also a faculty member at the SDSC. It was followed by an overview on the SDSC and HKIDS' development progress, delivered by Professor S. Joe QIN, Dean and Chair Professor of SDSC, and Director of HKIDS.

Professor Wen GAO, a world-renowned scholar in the areas of AI, multimedia and computer vision, delivered a keynote speech virtually on "Peng Cheng Cloud Brain Open Source Ecosystem". Professor GAO is an academician of the Chinese Academy of Engineering, Director of Peng Cheng Laboratory (PCL), Shenzhen, China, Boya Chair Professor, and Dean at the School of Electronics Engineering and Computer Science at Peking University. PCL, being the first independent E-level artificial intelligence supercomputing platform in China, is open source with ultra-high computing density, super large-scale computing power and ultra-fast training speed. It focuses on strategic, forward-looking, original scientific research and core technology development in the related fields. It is expected to create an ecological environment to support future scientific research and empower industrial development.

Professor Michael YANG, Vice President (Research and Technology) of CityU, then gave a thorough introduction on "HK Tech 300 Venture" – the flagship innovation and entrepreneurship programme launched by CityU in March 2021. It was followed by one of the highlights of the day—panel discussions with members comprising scholars across CityU, including Professor Michael TSE, Associate Vice President of Strategic Research; Professor Tei Wei KUO, Dean of College of Engineering; Professor Richard ALLEN, Dean of School of Creative Media, as well as Professor Houmin YAN, Director of Laboratory for AI-Powered Financial Technologies Limited. They discussed 'Accelerating AI and Data Science Impact Catalyzed by the HK Tech 300 Initiative', where Professor QIN moderated.

HKIDS PRINCIPAL INVESTIGATOR'S RESEARCH REVIEW AND LIGHTNING TALKS BY PHD STUDENTS

Another highlight of the day in the afternoon included a total of six technical presentations to showcase HKIDS' cutting-edge research progress. This session was chaired by Professor Dingxuan ZHOU, Associate Dean and Chair Professor of SDSC, and co-chair Professor Minghua CHEN. Topics were as follows:

- Using Network Science to Evaluate and Enhance Hong Kong's Bridging Role in One Belt One Road (OBOR)—by Professor Jonathan ZHU, Chair Professor, Department of Media and Communication and School of Data Science
- Big-data-driven Performance Analysis, Prediction and Control of Smart Factories—by Professor Hong YAN, Chair Professor, Department of Electrical Engineering
- Unstructured Data, Structured Analysis Using Digital Trace Data to Advance the Understanding of Digital Activism—by Dr. Yuner ZHU, Postdoc, Department of Public Policy
- Genomic Data Search and Analytics with Applications to Colorectal Cancer Subtype Classification—by Dr. Ka Chun WONG, Assistant Professor, Department of Computer Science
- Towards More Accurate Virus Classification Using Graph Convolutional Network—by Dr. Yanni SUN, Associate Professor, Department of Electrical Engineering
- Towards Linguistically-motivated Text Readability Assessment for Chinese Learning in Hong Kong—by Dr. John LEE, Associate Professor, Department of Linguistics and Translation

Finally, the day concluded with "Sharing by PhD students", a new initiative to engage 12 PhD students from the School to do lightning talks, which was chaired by Professor Junhui WANG. It provided an interactive learning platform for our PhD students to showcase their research works and projects, exhibiting the young energy of SDSC.

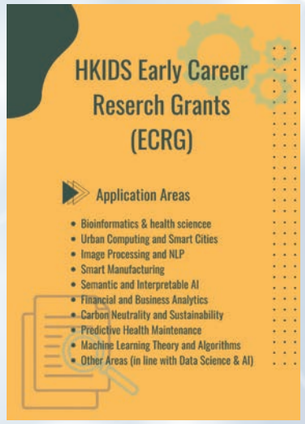
Professor Wen GAO delivered a Keynote speech virtually.

GRANTS AND FUNDED PROJECTS

HKIDS EARLY CAREER RESEARCH GRANTS (ECRG)

The HKIDS ECRGs aim to encourage young faculty members to conduct project-based collaborative research to solve data-science challenges that will highly likely lead to extramural grants. Below are the application areas of ECRG:

- Bioinformatics & health science
- Urban computing and Smart Cities
- Image processing and NLP
- Smart manufacturing
- Semantic and interpretable AI
- Financial and Business analytics
- Carbon neutrality and sustainability
- Predictive health maintenance
- Machine learning theory and algorithms
- Other important areas in line with data science and AI



EVERY MILESTONE COUNTS: OUR FOOTPRINTS IN THE WORLD OF DATA SCIENCE

Data Scientists are the most forefront analysts of the 21st new epoch. The School of Data Science (SDSC) constantly strives to find our place in modern science and society. While we navigate in the world of mega data, we never stop in realising our goals. SDSC goes above and beyond from achieving our educational mission to providing an ideal soil for research. It is our honour and pride to have accomplished these targets. They also serve as future benchmarks for our continuous achievements.

SCHOOL DEAN RECEIVING 2022 AICHE CAST DIVISION AWARD

Professor S. Joe QIN, Dean and Chair Professor of SDSC and Director of the Hong Kong Institute for Data Science, has become the first scholar educated in mainland China to receive the 2022 CAST Computing in Chemical Engineering Award.

The award, which is presented by the American Institute of Chemical Engineers (AIChE), recognises his outstanding contributions in the application of computing and systems technology to chemical engineering.

Professor QIN has been selected for his pioneering use of data analytics and AI for process engineering applications and fault diagnosis and for his efforts to unify industrial model predictive control practices used by industries worldwide. The award also reflects the high status of research at CityU.

PROFESSOR MINGHUA CHEN ON ELEVATION TO IEEE FELLOW

The IEEE Board of Directors has elevated Professor Minghua CHEN to IEEE Fellow, effective 1 January 2022, with the citation: 'For Contributions to Delay-Critical Networked Systems'.

Each year, following a rigorous evaluation procedure, the IEEE Fellow Committee recommends a select group of recipients for elevation to IEEE Fellow. IEEE has more than 400,000 members in more than 160 countries and less than 0.1% of voting members are selected annually for this member grade elevation.

SDSC CONTRIBUTES TO CITYU'S REPUTATION—BEING NAMED AS "TOP BLOCKCHAIN UNIVERSITY"

SDSC co-organised the 2020 Virtual Crypto Forum with College of Business and GOSS Institute of Research Ltd, Crypto Review and B2 Fintech School in June 2020. The forum was themed "The Role of Cryptocurrency—Blockchain in the Post-Pandemic World".

U.S. Professor Way KUO, CityU President and University Distinguished Professor, delivered a welcome address while Prof. S. Joe QIN, Dean of SDSC, served as Panel Chair for the morning session. The interdisciplinary discussion looked at currency and blockchain integration, as well as their social and economic significance in the post-pandemic world. CityU's recognition was reported on the international newsletter CoinDesk on 25 November 2021, naming CityU as "Top Blockchain University".

The forum brought together scholars in academia and senior experts from regional industry from Asia and the U.S.

PROFESSOR QIN INDUCTED TO NATIONAL ACADEMY OF INVENTORS (NAI)

Professor S. Joe QIN, Dean of SDSC, has been inducted into the National Academy of Inventors (NAI) as a Fellow of Class 2020. He is one of 175 newly elected fellows for this class. At the Induction Ceremony, he was officially presented with a Fellow medal and rosette. Professor QIN's research over two decades set standards in various manufacturing processes. Some of the inventions are being commercially used today. Professor QIN is also a Fellow of the IEEE, the International Federation of Automatic Control (IFAC), and AIChE.

SDSC/HKIDS CONTRIBUTE TO EMSD'S WINNING AWARD AT INVENTIONS GENEVA EVALUATION DAYS 2022

Empowered by a consultant team comprising CityU's scholars, an invention from the Electrical and Mechanical Services Department (EMSD), "Semantic AI for Predictive Maintenance of Railway Track Systems", won the Silver Medal at the International Exhibition of Inventions of Geneva 2022.

Spearheaded by Professor S. Joe QIN, Dean and Chair Professor of SDSC and Director HKIDS, the team comprised other inventors from CityU, including Dr. Paul LAM, Associate Professor of Department of Architecture and Civil Engineering, and faculties from SDSC Dr. Qingpeng ZHANG, Dr. Yu YANG, and Dr. Lishuai LI. Together with EMSD, MTR Corporation Limited and Risksis Technology Limited, they developed an AI semantic model which generates insights for predictive maintenance recommendations for a railway system.

Professor QIN stated, "Hong Kong already bears the features of a smart city with our well-designed infrastructures. We have high traffic in the public transport system, and it generates a high amount of data daily. We must make the best use of this data."

The International Exhibition of Inventions of Geneva is one of the world's most prestigious events exclusively devoted to inventions. All entries are evaluated by international specialists. Many inventions will be applied in practice or commercialised. This year, about 800 inventions from 25 countries and regions were exhibited.

AEROSPACE, HEALTH AND TELEMETRY—SDSC AND HKIDS'S PROJECT AWARDED INNOVATION AND TECHNOLOGY FUND 2021/22

A research team led by Prof S. Joe QIN, Dean and Chair Professor of SDSC and Director of HKIDS, has been awarded a grant of around HK$2.2 million from the Innovation and Technology Fund (ITF) 2021-22 for a research project entitled "Aerospace System Prognostics and Health Management Model and Telemetry Task Optimisation".

This research team pools two women data scientists as co-investigators, including Dr. Lishuai LI, Associate Professor and Dr. Yining DONG, Assistant Professor from the School of Data Science.

During 2021-22, CityU faculty has secured 24 projects with over HK$60 million funding from ITF, with HKIDS as one of the recipients. The number of approved projects and the funded amount are among the highest in recent years. ITF is administered by the Innovation and Technology Commission of the Hong Kong Government with the aim to strengthen collaborations among the government, industry, academia and research sectors.

DR. QINGPENG ZHANG WINNING OUTSTANDING RESEARCH AWARDS FOR JUNIOR FACULTY

Dr. Qingpeng ZHANG of SDSC at CityU has been granted the CityU Outstanding Research Awards for Junior Faculty 2021.
Dr. ZHANG has longstanding research interests in medical informatics. His research team built a series of mathematical models of the COVID-19 outbreak, and machine learning models to predict the severe infections of COVID-19 patients. His work facilitated the decision-making in combating the pandemic and has been widely reported by international and local media. His group is also developing AI models for drug discovery and patient risk stratification.

His work has been published in top journals such as Nature Communications, Gut, and Journal of the American Medical Informatics Association. In 2021, Dr. ZHANG was one of the eight faculty members from SDSC to receive the General Research Fund in the 2021-22 exercise.

CO-EFFORT IN WINNING BEST PAPER AWARD AT INTERNATIONAL CONFERENCE

Our School Dean Professor S. Joe QIN and Assistant Professor Dr. Dong YINING's paper "Dynamically Embedded Latent Feature Analysis for Plant-Wide Troubleshooting" won the "Best Paper Award" at the 3rd International Conference on Industrial Artificial Intelligence (IAI 2021) held on November 8-11, 2021 in Shenyang, China.

The conference brings together practitioners to discuss the development of artificial intelligence driven modelling, control, and optimisation of industrial processes. More than 400 researchers from 19 countries and regions, as well as domestic researchers and scholars, attended the conference. Out of 206 papers, two papers received the "Best Paper Award". The award-winning paper also included another student author from the University of South California.

SIX FACULTY FROM SDSC RECEIVING GENERAL RESEARCH FUNDS

SDSC has been awarded HK$4.26 million for six research projects as part of the 2022/23 General Research Fund (GRF) and Early Career Scheme (ECS) announced by the Research Grants Council (RGC). SDSC continues to succeed in developing a strong research culture which indicates that we have a high-quality research capability and environment.

We congratulate our principal investigators, including Professor Minghua CHEN, Professor Junhui WANG, Dr. Matthias TAN, Dr. Xiang ZHOU, Dr. Long FENG and Dr. Xiao QIAO on their remarkable achievements, and look forward to their outstanding research outputs.

Name of PI	Project Title	Grant Awarded	Scheme
Professor Minghua CHEN	Developing Deep Neural Network Schemes for Solving Optimal Power Flow Problems: Solution Feasibility and Multiple Load-Solution Mappings	HK$ 1.1 million	GRF
Professor Junhui WANG	A Statistical Framework for Structure-Preserving Embedding of Signed Networks	HK$ 1 million	GRF
Dr. Matthias TAN	Bayesian optimization for robust parameter design based on quantiles of the loss distribution	HK$400,000	GRF
Dr. Xiang ZHOU	Topics on Dynamics and Algorithms for Saddle Point Calculation	HK$600,000	GRF
Dr. Long FENG	A Statistical Approach to High-dimension High-order Spatial-Temporal Data Clustering	HK$700,000	ECS
Dr. Xiao QIAO	Understanding Commodity Markets via Return Predictability	HK$400,000	ECS

EQUIPPING STUDENTS FOR CAREER SUCCESS

Internships are job tastings—aiming to prepare students for career success in the rapidly evolving job market. The School of Data Science (SDSC) strives to provide rich internship opportunities to nurture the next generation of vigorous young data scientists. By 2022, we have offered up to 300 industry placement opportunities for our undergraduates.

We continue to build our list of corporate partners, ranging from major players in Hong Kong's finance, technology, healthcare, and entertainment sectors, to big regional corporations. To name a few, they include Active Care Group, APSTAR, ASTRI, Bank of Thailand (Thailand), Cathay Pacific, China Telecom, Coca-Cola, DFS, Fleet Management Limited, Hang Seng Bank, the HKSAR Government (Census and Statistics Department, Electrical and Mechanical Services Department, Logistics Department), Hong Kong Express Limited, Huawei, InnoHK, Innovation and Technology Commission of the HKSAR Government (STEM Internship Scheme), KG Data, NetEase Games, Nova Credit, Ocean Park, PCCW Solutions, Reinsurance Group of America, Ricoh Hong Kong Limited, SF Express, Skieer, Shangri-La International Hotel Management Limited, TianYanCha (Beijing), Vandalsoft (South Korea) and Wengegroup, among others.

These industry leaders, supplementing our classroom teachings, let students experience real-world challenges in fast-paced, competitive business environments. The placements do more than merely develop students' technical expertise, they also equip them with communication and teamwork skills that are difficult to acquire on campus.

Let's hear more about their fresh experiences!

Internship

Miss Joan YUN

Hong Kong Applied Science and Technology Research Institute (ASTRI)
Summer Internship Programme at the Chief Technology Office

In the summer of 2021, I joined ASTRI's two-month summer internship programme. I was delighted to experience work at one of the best R&D companies in Hong Kong. We were first given a guided tour of ASTRI, which included demonstrations of some of the products invented by its employees. ASTRI then provided many activities that enabled the interns to develop a better understanding of the company's goals and achievements. For example, we were given various talks on key state-of-the-art technologies, such as 5G and deep learning.

We were encouraged to make new acquaintances during our internships, both for knowledge exchange and to increase the value of our internship experience. During the programme, I worked on a project related to the applied research ecosystem. I learned about the importance of obtaining accurate data for conducting top-quality research of any kind. I also gained a deeper understanding of Hong Kong's R&D development system.

The internship has given me great assurance in my interest and ability in this discipline. I look forward to furthering my knowledge of data research during my studies at SDSC. In addition, I am eager to develop excellent research and critical thinking skills, as well as the ability to apply scientific principles to analyse and solve problems.

Mr. Roy LEUNG

PVH Far East Limited
Business Analyst
(Virtual Internship)

As a business analyst working in PVH Far East Limited, I was engaged in many tasks related to business insight and KPI. My duties included creating a dashboard using Power BI, changing Excel data into SQL format and performing ad hoc data-analysis tasks.

I have learnt many new skills during this time, especially soft skills that I could not learn in school. For instance, communicating with people of different backgrounds and nationalities is a challenge for a new employee, and I have also learnt how to express my ideas clearly and how to tell stories with data. I believe these skills are as valuable as technical skills.

I faced some challenges as I was in the sourcing department of the CK and TH teams, and I needed to know about HANA and SOP data, which required supply chain domain knowledge that I did not have. This trained me to be a fast learner and helped me understand how to ask appropriate questions.

Miss Ivana LAW

Alpha AI Technology Limited
Machine Learning Engineer Intern

I joined Alpha AI as a part-time intern in September 2021 and have been working for them since then. I even worked full-time during the winter semester break in between to gain more experience. I'm currently working on building convolutional neural network-based deep learning models for car damage recognition and on improving the existing machine learning infrastructure.

Even though I was a Year 1 student with no machine learning experience, Alpha AI gave me an opportunity to intern with them. I feel blessed to be a part of the Alpha AI community. The team at Alpha AI treats student interns as friends and truly cares about their learning. They gave me a lot of hands-on experience. I was encouraged to work on model training and have been given opportunities to learn about GitHub and AWS. Undoubtedly, everything I learnt here will be precious for my studies and future career.

During my internship, I was assigned to work on training a model to recognise the different parts of a car. However, due to my limited knowledge on Python and lack of work experience in machine learning, it took me approximately a month to finish the debugging process. This challenging experience has given me the confidence to succeed in whichever field I choose to work in.

I greatly appreciate this internship experience, and I'm grateful to the STEM Internship Scheme for giving me a salary raise for my winter semester internship. This gave me great motivation and respect for my work.

Mr. Matthew CHEUNG

ShineWing (HK) CPA Limited
Network Engineer

I interned at ShineWing (HK) CPA Limited from January 2022 to June 2022. I was assigned to work in their IT department, where I helped to organise the inventory database and provided some IT services. I collected data on remaining inventory and its status, salvaged any parts that could still be used from old inventory, updated the inventory database accordingly and created graphical reports for my supervisors. I also validated the dataset, checked for missing or wrongly entered data and reported to my supervisors for further tasks when required.

Despite my having no experience in IT services, the supportive and kind colleagues at ShineWing helped me learn quickly through a process of trial and error, answered my questions when I was uncertain, and assisted me with written instructions whenever necessary. Providing IT inquiry services helped me improve my communication skills and trained me to quickly come up with solutions to problems, as I often needed to handle multiple queries from different colleagues at the same time. This internship provided valuable experience that enabled me to apply my knowledge to real-world challenges, giving me useful insights and skills in expanding my computer knowledge.

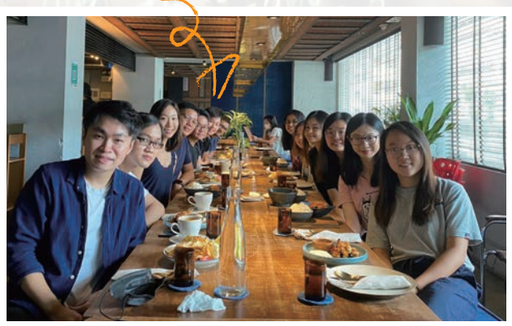
MENTOR EXPERIENCES TRAINING

Mr. Vic HUNG

DFS Group Limited
IT Genius Bar Engineer

During my internship at DFS, I provided ad hoc support to internal users and I have also been involved in some short- and long-term projects. My daily tasks included giving desktop support to users, such as solving bugs/config issues on laptops and educating users about software operation. I also updated and managed inventory data, as well as delivered monthly reports.

I have been involved in projects as follows: the launch of a lab that provides instant support to users; name tag design and data cleaning to update employees' position titles; giving suggestions about facilities and booking methods for new meeting rooms; and arranging laptop and monitor replacement for all users. Many more projects are coming up, and I look forward to the challenges they will bring. Working here gives me insights about the industry's working culture in my potential career. Working with a wide range of people has also given me a better understanding of how job distribution works and why it is so important. This internship has given me a preview of a real future job!



Mr. Febrian MANUEL

KaChick AI Limited
Growth Hacking Intern

In the summer of 2021, I obtained valuable work experience as a full-time growth hacking intern for KaChick AI Limited. During this ITC STEM internship, I was responsible for performing marketing tasks and building relevant tools, such as bots and custom social media analysers, to implement a customer acquisition strategy for penetrating the Indonesian market. The best part of my job was analysing user data to find the optimal strategy for improving the company's services and acquiring new users.

During my internship, I learnt many new technical skills that will be invaluable and useful for my future career. I also learnt about work ethics, in addition to communication and decision-making skills that are difficult to acquire on campus. My interpersonal skills have significantly improved since I participated in the internship programme.

I am grateful to be a member of the School of Data Science family, which is very supportive and cares a great deal about the career development of its students. Although I'm an international student, I had the same opportunity of joining the internship programme like local students. I hope more students will benefit from this programme and I trust SDSC will continue to support the career development of its students relentlessly.

Mr. Jeffrey NG

AREIX Analytics Limited
Digital Growth Strategist

There were two parts of my job as a digital growth strategist—70% marketing and 30% programming.

In the marketing portion of my work, the first goal was to gain more brand awareness for AREIX products. We promoted using social media channels such as Telegram and Instagram. Posting timely, relevant, and engaging content provides information about financial and investment planning to the public and attracts them to use AREIX's AI-orientated saving app.

In the programming portion of my work, I tried to make model predictions about on-chain data in the crypto world, focusing on Bitcoin. There are many indexes and indicators that provide information about Bitcoin, and my task was to investigate whether they were accurate and trustworthy.

In my internship, I learnt that digital marketing and data science are co-dependent, especially in terms of SEO and SMO. Digital marketers obtain useful data from data scientists to do sentiment analysis, which can yield key insights into users' opinions and beliefs, thus enabling marketers to monitor how users react to marketing campaigns. This experience was exceptionally useful to me.

Mr. Alisher BAZARBAY

uHey Limited (TRAILME mobile app)
Data Scientist

I worked at uHey Limited as a data science intern in Semester B. I was mainly responsible for data analytics and data visualisation for decision making. During the internship, I analysed staging and production data to detect optimisation patterns for IoT devices. This helped to increase the system's performance by 15%.

The main project that I worked on was a dashboard used by our team and clients. This was a highly challenging project as I needed to visualise the data from MongoDB without using third-party ETL tools. As the architecture was on AWS, I chose AWS QuickSight for the dashboard. The first part of the project primarily involved data engineering, where I needed to extract, process and load the data to AWS buckets. The second part primarily involved business analytics, as I needed to create a visualisation that would be useful for decision making. I encountered many challenges because I had not done these things before, but thanks to my team, I finished the project and deployed it.

Another aspect of my internship that I enjoyed was that in addition to assisting with data analytics tasks, I helped developers improve the app by changing the flow, UI/UX, and adding new features. I delivered approximately five specifications and all these features were added to the app.

INTERNSHIP SKILLS OPPORTUNITY PERSONAL DEVELOPMENT

Student Exchange: Crossing Boundaries of Culture and Learning

Data Science is a global language—and exchanges strengthen the skills to master it. The School of Data Science (SDSC) encourages students to outgrow their comfort zones and gain global exposure in learning and experience. In every possible aspect, including connecting with renowned institutions, we support our undergraduates to take a bigger step in order to connect with the world. In this session, four students who went on student exchange programmes for Semester B, 2021/22, at top QS ranked institutions across Asia, North America and Europe are eager to share their stories.

Qingyang YU
NATIONAL UNIVERSITY OF SINGAPORE

It has been an unforgettable experience to stay at the best university in Singapore, NUS!

I took four modules at NUS, including Stochastic Process, Simulation, Design and Analysis of Experiment, and Social Network Analysis. One big advantage of taking these four modules is that the courses could be transferred to CityU. This was a very encouraging point for me as an exchange student.

NUS has a very widespread campus where students need to commute by shuttle bus every day. There are several routes and quite a number of bus stops. It is easy to get lost if you are not familiar with them. However, you would get a sense of satisfaction once you can get to your destination effortlessly. It was like a mini version of a city!

I must highlight the wonderful food there! Each canteen of NUS is like a food court, consisting of food from all over the world. Outside the campus, I also enjoyed the various outdoor activities with my friends, like cycling around the Marina Bay, zipping at Sentosa, and hiking. I really appreciate Singapore's local people. They are very helpful, open-minded, and energetic. As a foreigner, I felt welcomed and was able to blend into the new environment easily because of their inclusive culture. I guess that is why most people believe that Singapore is one of the most livable countries!

Yuchen QIU,
UNIVERSITY OF TORONTO, CANADA

I am so glad to have the chance to spend the winter at the University of Toronto, Canada.

I took four high-level courses during my study there and the curriculums are quite demanding. Three courses were in the Statistical Learning module and one course was in the AI module, in accordance with the major requirements of CityU. The Deep Learning course in the AI module at University of Toronto (which is the powerhouse of AI research in the world) is among the best introductory courses on this subject. The course features the lecturer Jimmy BA, one of the leading researchers in AI who is the student of Geoffrey HINTON (Godfather of Deep Learning) and co-author of the most popular optimisation algorithm Adam. The course is very well structured with both theoretical and coding assignments. It covers both the foundational ideas and the recent advances in deep learning. All in all, the course gives an overview of many practical applications like image recognition, language processing and game playing agent.

I benefited a lot from the course and was able to gain a thorough understanding of this actively researched area. Since my personal preference is theory rather than application, the other three courses I selected are math oriented. I spent a lot of effort and time working out the mathematical proof. Very challenging as it has been, it was an intellectually rewarding process that encouraged me to study extensively, even well after the exchange period.

Thanks to the collaborative culture, peer students formed many study groups, which not only made my learning experience smooth and productive, but also helped me establish friendships and get accustomed to life in a new country. One of my group mates who is also from China shared a lot of useful tips; another exchange student in my group invited me to go skiing with him... it was my first time! It was really satisfying that I finally mastered my speed and turns after countless attempts. I am grateful to have met them during my exchange.

Studying in a historic campus is also full of wonder. The campus sprawls across a very large area, making it a challenge to rush from one building to another for the next course, but along the way, one can discover beautiful and Gothic-style architecture, and sometimes squirrels too! The natural scenery in Toronto is gorgeous. I miss my time there!

Summer LAM
UNIVERSITY OF OSLO, NORWAY

If I were to recall the most unforgettable experiences of my university life, my Norway exchange study would definitely be one of them!

Growing up in Guangdong and Hong Kong, I had never seen snow until the day I arrived in Norway. It was stunning to see everything in white. During my quarantine, we could even go for a walk, for at most two hours.

After my quarantine, my exchange started off with a "buddy week" which was full of activities for newcomers to hang out with students at the University of Oslo. I met friends from Norway, Germany, Korea and Singapore who were in the same buddy group as me. Later I found out I took exactly the same courses as a Korean girl named Michelle. It was quite a coincidence. And because of that, we always hung out and studied together. We became best friends in Norway. Sometimes I hung out with my buddies—we talked about our own culture and learned from each other. I learned a lot from them, breaking some of the stereotypes that I had previously towards different cultures.

I went ice bathing, skiing, snowboarding, sledding, and all kinds of winter sports with friends from the buddy group and classmates from Hong Kong. I was especially attracted to snowboarding. It became my favorite sport after my first try. Aside from sports, I even chased northern lights at the park near the student village where I lived! The winter in Oslo was amazing.

Studying at the University of Oslo was not much different from studying in Hong Kong. However, face to face classes were never terminated since the semester started. This might be the biggest contrast. In terms of course structure, the university allowed students to take overlapping classes as long as they could manage it. I was quite surprised by this since it gave us adequate flexibility to study what we wanted. Some of the professors would even record the class for students who had overlapping classes.

As a student who loves nature, studying in Norway was the perfect choice for me. It is going to be one of the most precious memories in my life.

Yutian CHEN
NATIONAL UNIVERSITY OF SINGAPORE

As an exchange student, my recent experience at NUS was very meaningful.

The campus is quite big, and it was like a whole new world for me to explore. My professors at NUS were so energetic and active that I was highly encouraged to be responsive.

There are various canteens providing different types of food like Chinese, Western, Korean, and local. Although all my lectures were online, I didn't give up any opportunity to make friends with other students. I met Wan Ting, a local student who had the same major as me, and we quickly became good friends. Also, she acted as a personal local guide for me to explore Singapore. We took interesting photos with the Merlion, walked along Marina Bay, and tried Hokkien shrimp noodles and satay at Lau Pa Sat. How I wish I could spend more time with her!

My residence life was also excellent. The dormitory was quite different from the one when I lived in CityU. It looked like a flat in the countryside and there were many animals around! Additionally, my neighbours were also very friendly and we enjoyed lots of hall activities together.

All in all, I was so glad that I took part in the exchange programme because I have gained so much from it. An exchange programme, even for a very short period, can always cheer one up and inspire one to go further —the world is enormous but we should never stop exploring it!

OUR UNDERGRADUATES—NAVIGATING THE REAL WORLD

SDSC STUDENTS EXCEL IN REGIONAL BIG DATA ANALYSIS CONTEST

A team comprising seven CityU students—five from the School of Data Science (SDSC) and two from the Department of Public Policy and School of Law—won the third prize (fifth place) in the Guangdong-Hong Kong-Macau College Student Public Administration Data Analysis Contest.

The award-winning project, Priority Probing Algorithm on Spread of COVID-19, was the final product after the team participated in six rounds of the Big Data Analysis Training Camp held from 3 November 2021 to 3 January 2022. In this regional competition, our undergraduates outperformed 100 projects from higher education institutions across the Greater Bay Area. All other winning teams consisted of postgraduate students and CityU sent more than 10 teams.

These student researchers were inspired by society's need for a system used for computing the stationary distribution of critical nodes in the spread of COVID-19 through priority probing. The idea was to obtain the degree of contagion impact on confirmed cases, which aimed to provide a more efficient strategy to handle the COVID-19 pandemic. This award recognises their innovative ideas and is an acknowledgment of their values to help society.

"The prize speaks loudly about CityU's pioneering role in providing data science education to students with multi-disciplinary backgrounds," said Professor S. Joe QIN, Dean of SDSC. "I am also pleased to see that six of the seven team members are female students."

The winners were thrilled with their win and expressed gratitude to SDSC's faculty members including Associate Professors Dr. Qingpeng ZHANG, Dr. Zijun ZHANG, and Assistant Professor Dr. Yu YANG who encouraged them to enter the competition and provided full guidance with untiring support throughout the entire stage of the competition. Our students received the honour from Professor Alfred HO from the Department of Public Policy of CityU, who represented one of the co-organisers of this competition, at an online presentation ceremony that took place on 14 January 2022.

The students spent months working really hard on the project. This award is the recognition of their collective intelligence and acknowledgment of the values of their innovation and inspiration.

Student representatives from SDSC, including Team Leader Zihang ZHAO (middle) and Jing ZHANG (2nd from left), represent the winning team to receive the prize from Professor HO Tat Kei Alfred (1st from right) and Assistant Professor Dr. Ning LIU (1st from left) of the Department of Public Policy, CityU at the award presentation ceremony.

RECRUITMENT TALK ON CAREER AND INTERNSHIP OPPORTUNITIES

The School provides rich internship opportunities, both local and overseas. We are constantly looking for partnerships to secure internship and graduate opportunities, with the aim to connect them to the real world of work and placements.

Hong Kong Applied Science and Technology Research Institute (ASTRI), the R&D research conglomerate founded by the Hong Kong Government, which operates under the Innovation and Technology Commission, partners with us in providing interns placements and graduate prospects. On 25 November 2021, ASTRI hosted an on-campus recruitment talk exclusively for SDSC students. Despite the pandemic, the talk attracted almost 30 students who attended in person on campus. Internship Coordinator Dr. Qingpeng ZHANG made an opening remark.

At this briefing, speakers from ASTRI, including Dr. Tao YU (Director of Big Data Analytics), Dr. Arvin TANG (Director) and Mr. Patrick WONG (Manager, Talent Acquisition), introduced its Graduate Career Opportunity and 2022 Summer Internship Programme.

A vigorous Q&A session followed. Students were very interested in such opportunities with a leading institute in the field of STEM. ASTRI collected a pile of CVs onsite. The School will continue to strengthen networks with prospective corporate partners and line up recruitment talks for our students.

SDSC'S EXCLUSIVE CAREER TRAINING WORKSHOP SERIES

Educating students is preparing for their future in all aspects. To facilitate smooth transitions from education to employment, SDSC organises career workshops for students to better prepare themselves for their careers. This year, we arranged four modules in a total of eight sessions with the support of the Student Development Services Career and Leadership Fund.

Employability is not only about gathering degrees and qualifications but also equipping oneself with a full set of skills, including presentation, communication, networking, leadership, as well as knowledge of the job market. It is important for educators to prepare students in these aspects.

This newest career series, spreading out from January to August 2022, focused on leadership, employability skills, social mobility, entrepreneurships, etc. These online workshops, hosted by external trainers, are instilled with lively elements—through inspirational lectures, classroom exercises, brainstorming, and interactive sharing.

After attending all four workshops, Mr. Jacky WONG of Year 1 remarked on the positive impact: "The talks helped me strengthen my critical thinking and problem-solving capabilities. These abilities are crucial for me to build leadership competencies in my future workplace."

"The training series prepared me well with good communication skills and knowledge of the real market. This is practical information that one needs for the workplace and teamwork. I am now more confident of joining the workforce!" said Year 3 student, Mr. Matthew CHEUNG.

Class OF 2022

OUR POSTGRADUATES- EMERGING AS NEW DATA SCIENTISTS

COMMENCEMENT CELEBRATES THE CLASS OF 2022

The School of Data Science (SDSC) held its third annual Commencement on 27 May to honor 94 students graduating this year from the Doctor of Philosophy, Master of Philosophy, and Master of Science in Data Science programmes. Held online, the ceremony brought together graduates from different regions to celebrate their accomplishments with family and friends. Kicking off this historic event, Professor S. Joe QIN, Dean of SDSC, expressed his heartfelt congratulations to the graduating class of 2022. “I am proud that you have achieved your goal at CityU to fulfill your dreams!”

Looking ahead to another milestone, the fourth anniversary of the SDSC’s establishment, Professor QIN reminded the graduates of their key role in the School’s early success. “With the effort of every one of you,” he said, “we are becoming an exemplar of data science schools regionally and worldwide”. As professional data scientists, graduates of the SDSC have an important mission to fulfil. Stressing the damage done by the spread of misinformation, Professor QIN urged his audience to think critically and “triple-validate” all information before sharing it. “Better yet, as data scientists, we may develop a solution to misinformation,” he added. After sharing some of his own ideas for combatting the spread of false information, Professor QIN ended his speech on an upbeat note: “Please return to visit us when the pandemic restrictions are removed!”

Dean Professor S. Joe QIN presided at the 2022 Commencement.

Dr. Qingpeng ZHANG received the “CityU Outstanding Research Award for Junior Faculty” from the School Dean.

College/School Commencement
學院畢業典禮

Next to address the graduates was Mr. Joseph TSE, a CityU Council Member and a keen supporter of SDSC. Mr. TSE told his own inspiring story of funding a fintech company that leverages data technology to make small business loans more accessible to Chinese SMEs. Reminding the graduates that data science can be a double-edged sword, he urged them to use the power of data for the benefit of humanity rather than doing damage. Mr. TSE concluded his speech by assuring the graduates that they would emerge from this challenging time wiser and more resilient. “Tough times never last, but tough people do!”

Speech by Guest of Honour Mr. Joseph TSE, a CityU Council Member and keen supporter of the SDSC.

Last to speak was Mr. Aaron CHEUNG, a 2022 graduate of the Master of Science in Data Science programme. After thanking the University, the School, and his teachers for their support, he congratulated his fellow graduates on overcoming the many challenges arising from the pandemic. “We accepted the obstacles thrown at us and found ways to adapt. I believe that this adaptive mentality will be crucial in our careers as data scientists”. Like Professor QIN, Aaron ended his speech by looking to the future. “It is now time for us to move on to a new stage of life,” he said. “Our experience at CityU has prepared us for whatever goal we want to achieve.”

Mr. Aaron CHEUNG of 2022 Master Class delivered a graduate speech during the Commencement.

PHD STUDENT OF SDSC WINS TOP AWARDS AT THE GLOBAL AI CHALLENGE FOR BUILDING E&M FACILITIES – AI COMPETITION

The School of Data Science (SDSC)'s PhD student Yiren LIU, who is supervised by School Dean Prof. S. Joe QIN, has won a Grand Prize (Academic Group) on top of a Gold Award at an AI competition—"The Global AI Challenge for Building E&M Facilities". LIU leads the four-member team advised by Professor QIN and Dr. Xiangyu ZHAO, with three other undergraduates Guo HAN and Shenglong YAO (Department of Computer Science) and Yixiao HUANG (Department of Electrical Engineering of CityU). They are delighted to receive the "Outstanding AI Influencer Award" sponsored by Microsoft, and the wide recognition that the award brings and acknowledges.

Contestants participate either in "Academic Groups" or "Open Groups", each exceeding 100 teams, thus the competition is exceptionally keen. The best five teams from each category will be awarded the grand prizes sponsored by Huawei, Siemens, AWS, Microsoft and Towngas, respectively.

The winners express gratitude to Professor QIN, Dean of SDSC, and Dr. ZHAO, Assistant Professor, for their valuable guidance and inspiration. LIU, the team leader, said he has learned a lot from the competition as all the entries were of world-class quality.

Professor QIN, being their mentor, expressed his satisfaction, "We are very honored to have received these awards. More importantly, we raised the interest among students on campus to deploy AI and data science for practical use".

The organiser, Electrical and Mechanical Services Department (EMSD), also applauded the team's achievement. "Big congratulations to City University of Hong Kong on the remarkable achievements in the Global AI Challenge for Building E&M Facilities and we also thank the teams for their enthusiastic participation," said Mr. Edmond CHEONG, Chief Engineer of EMSD. The competition is organised by the Guangdong Provincial Association for Science and Technology, and the EMSD of Hong Kong. A first of its kind, Global AI Challenge is the world's largest AI event aimed at promoting AI technologies in building energy conservation and to encourage further research in smart buildings.

The AI competition is open to all participants around the globe, from tertiary students to start-ups, researchers and innovators. Apart from the competition, the event consists of a conference and a workshop to promote international innovative ideas and to inspire young innovators' enthusiasm for AI.

ClassNote

ALUMNI RECONNECTING WITH THE SDSC COMMUNITY !

You are invited to share your special moments with us at sdscgo@cityu.edu.hk

Catherine MOONEY

2021 Master of Science in Data Science

After completing her MSDS, Catherine became a Managing Director, Product Strategy at Valt, an enterprise software company in Hong Kong that is transforming the private market industry. Utilizing her data science background, Catherine focuses on product strategy including the use of data and analytics across the fintech platform.

Yuchen ZHUANG

2021 Master of Science in Data Science

Through working as a summer intern in the China Foreign Exchange Trade System National Interbank Funding Center in Shanghai, Yuchen is happy to share that he had the opportunity to learn the theory of data quality analysis of foreign exchange trading. Through the effective combination of technology and business practice, he used Python to gradually complete the automatic data processing and graphical presentation of bond transaction, quotation, valuation curve, economic transaction and economic quotation in bond quality analysis. Yuchen further his studies and completed the automatic processing of bond rating data. He is grateful to SDSC for helping him improve his practical skills and theoretical knowledge in data science. His study at SDSC has laid a solid foundation for his future career.

Aaron CHEUNG

2022 Master of Science in Data Science

Since graduating from his Data Science Master programme in 2022, Aaron has been working in the AI team at CASTCO, one of the leading independent commercial laboratories in Hong Kong. Combining his engineering experience and data science knowledge, he adds value to the business by developing AI models to automate operations.

Phoebe NG

2021 Master of Science in Data Science

After graduating from MSDS in 2021, Phoebe worked in the technical field as a full-time Technical Consultant Trainee for Cogent Consulting Services Limited in Hong Kong. At the same time, she also wanted to give back to her alma mater, as she studied both her undergraduate and postgraduate degrees in City University Hong Kong. Therefore, in 2021/22, she signed up as a Student Helper for teaching CityU students with academic work and revision, mainly on programming languages.

SCHOOL OF DATA SCIENCE

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