



# GROWING KNOWLEDGE



Delving into the forefront of innovation, SMU continues to unveil impactful research that redefines possibilities. From digital sustainability and entrepreneurship as well as tackling climate change head-on, to pioneering insights in commercial mediation and encompassing the findings of its scholars, SMU continues to challenge conventional norms and inspire global progress. With unrivalled expertise and visionary thought leaders at its helm, SMU leads the charge in shaping a future that thrives on knowledge and innovation.



## *Nurturing progress in* **Cutting Edge Research**





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**Cutting edge approaches take centre stage at SMU's College of Graduate Research Studies**

SMU announced the establishment of its eighth school, the College of Graduate Research Studies (CGRS). CGRS plays a facilitating role in the development of interdisciplinary PhD programmes, which are offered and delivered by Schools. In particular, CGRS provides inputs on programme proposals to enhance their inter-disciplinary content, facilitates

discussions on required and elective courses, and coordinates across schools to ensure a comprehensive range of course offerings for students. In the last year, CGRS assisted in these ways in the development and launch of two inter-disciplinary PhD programmes: at the Yong Pung How School of Law (PhD in Law, Commerce & Technology), and the College of Integrative Studies (PhD in Asian Urbanisms).

The CGRS also offers credit-bearing inter-disciplinary courses, including in Graduate Research Interdisciplinary

Topics and Graduate Research Professional Development (GRPD), to enhance integration and interdisciplinarity.

It also fosters co-learning experiences and academic exchanges across SMU Schools, facilitating intellectual content sharing and inter-disciplinary events. Moreover, the College is boosting networking, cohort building, and collaboration through the Graduate Research Student Society and Graduate Research Alumni Chapter.

1 (L-R) SMU Provost Professor Timothy Clark; SMU Board of Trustees Member Professor Maxwell King; then-Chairman of SMU Mr Ho Kwon Ping; Chairman of the Academic Affairs Committee, SMU Board of Trustees Sir Nigel Thrift; SMU President Professor Lily Kong; and SMU Dean of the College of Graduate Research Studies Professor Wang Heli, at the launch of the eighth school of SMU on 11 August 2022.

# GLOBAL ACCOLADES

**SMU Provost to lead Societal Impact and Global Management Alliance**

SMU Provost Professor Timothy Clark took on the presidency of the Societal Impact and Global Management Alliance (SIGMA) for a two-year term starting in May 2023. SIGMA, established in 2015, is a network of leading specialist universities from Asia, Europe, and Latin America, aiming to address societal challenges through research, teaching innovation, and knowledge dissemination in management and social sciences. SMU's involvement in SIGMA has



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resulted in collaborations, such as virtual courses on managing sustainable development goals and responsible digital

transformation, research into ageing and, most recently, a joint research symposium on successful ageing.



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**Associate Professor Winston Chow elected Co-Chair of Working Group by Intergovernmental Panel on Climate Change**

Associate Professor of Urban Climate Winston Chow from the SMU College of Integrative Studies was successfully elected as Co-Chair for Working Group II on Impacts, Adaptation and Vulnerability of the Intergovernmental Panel on Climate Change (IPCC)'s Seventh Assessment Report (AR7) Cycle Bureau.

Assoc Prof Chow is Singapore's first elected member of the IPCC Bureau, the United Nations body for assessing the science related to climate change. IPCC assessments provide a scientific basis for governments to develop climate-related policies and contribute to global climate action under the United Nations Framework Convention on Climate Change (UNFCCC).

2 Group photo of SIGMA members taken in Tokyo, Japan, in May 2023. Prof Clark is third from the right.

3 SMU Associate Prof Winston Chow (right) with IPCC Working Group II Co-Chair Prof Bart van den Hurk of the Netherlands in Kenya.



## GLOBAL ACCOLADES



### Professor Nirmalya Kumar receives American Marketing Association Lifetime Award

For his contribution to inter-organisational research, Lee Kong Chian Professor of Marketing Nirmalya Kumar received the 2023 Lifetime Award from the Interorganizational Special Interest Group (IOSIG) of the American Marketing Association (AMA). IOSIG was impressed with the multiple dimensions of Prof Kumar's contribution to inter-organisational research, which has garnered over 27,000 citations on Google Scholar. Additionally, he received the AMA Vijay Mahajan Award for lifetime contribution to marketing strategy research in 2021.

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### Assistant Professor Kimin Eom is APS Rising Star

Assistant Professor of Psychology Kimin Eom from the School of Social Sciences was named "Rising Star" by the Association for Psychological Science. This prestigious accolade honours early-career researchers whose innovative work has significantly contributed to the field. Asst Prof Eom's research focuses on prosocial behaviour and its impact on society and the environment, addressing pressing global challenges such as climate change and pandemics.



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### Professor Nadja Alexander recognised as Top Thought Leader and Educator for Mediation

SMU Professor of Law and Singapore International Dispute Resolution Academy Director Nadja Alexander achieved Global Elite Thought Leader status in commercial mediation in *Who's Who Legal 2023*. She also received the Outstanding International ADR Educator Award at the Asia Pacific Centre for Arbitration and Mediation Summit in May 2023. The accolades acknowledge her significant contributions to mediation academia, inspiring participants to explore and excel in mediation.



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## SIGNIFICANT PROJECTS

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### Understanding and Closing Gender Gaps in Workplace Outcomes

To shed light on gender gaps in the workplace, Associate Professor of Organisational Behaviour and Human Resources Michael Schaerer leads a study delving into the prevalence and causes of, and potential remedies for gender discrimination across various organisational contexts. The research comprises three parts: investigating discrimination in candidate selection and promotions, exploring decision-makers' reactions to errors by male and female employees during performance evaluations, and examining the factors contributing to gender gaps in negotiation outcomes. By understanding these dynamics, the team aims to pave the way for fairer and more equitable workplaces.

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### Mechanism Design for Weakly Structured Environments

Associate Professor of Economics Li Jiangtao delves into existing literature on mechanism design by challenging the conventional assumptions of strategic sophistication and detailed knowledge of the environment. Recognising that real-life economic agents are not always as rational as traditionally modelled, and that designers often lack comprehensive environmental information, Assoc Prof Li's project aims to enhance our understanding of mechanism design in weakly structured environments. By relaxing these strong assumptions, he seeks to uncover new insights and strategies that can improve the performance of mechanisms in more realistic settings.

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### AI Audits for Who? Some Asian Perspectives

To build public trust in artificial intelligence (AI) technologies, it is key to prioritise responsible data use and ethics-by-design principles. Former SMU Research Faculty and Adjunct Faculty member Ms Willow Wong emphasises the need for AI regulators to incorporate community-centric approaches that integrate the voices of data subjects in AI ethical decision-making, as opposed to traditional financial audits that offer insights into legal compliance. This research project aims to explore Singaporean and Asian viewpoints on AI regulation, analyse AI audit scopes and methodologies, and provide recommendations for the necessary skillsets of future AI auditors.

## SIGNIFICANT PROJECTS

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### Trusted Intelligent Work Bots for Faster Software Development

OUB Chair Professor of Computer Science David Lo is leading a pioneering project to develop trusted automation bots that will act as concierges and interactive advisors for software engineers. The project, TrustedSEERs, aims to improve productivity and software quality by effectively learning from diverse software artefacts, such as source codes, bug reports, blogs, and documentation. TrustedSEERs will advance the field of software analytics (SA) by establishing two key initiatives: data-centric SA, focusing on engineering data for more effective bots, and trustworthy SA, ensuring the bots are explainable, compliant with privacy and copyright laws, and are robust against external attacks.

10 Prof David Lo.

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### Cooling Singapore 2.0 Plays into Future Climate Policy

Associate Professor Winston Chow is leading an inter-disciplinary and multi-institute project that utilises the Digital Urban Climate Twin (DUCT) data from the Cooling Singapore 2.0 initiative. The project aims to assess urban climate risks and impacts in Singapore, identify areas and populations at risk of excessive heat, as well as evaluate the effectiveness of existing measures like vegetation cover in reducing heat exposure. The project's findings will inform policy development and urban warmth solutions in Singapore.

11 Associate Prof Winston Chow.

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### Singapore Future Resilience Index 2022 for Singapore Residents Aged 25 to 76

The Centre for Research on Successful Ageing (ROSA) at SMU and Income Insurance Limited are piloting this research project to study the state of resilience amongst Singaporeans and comparing the levels of resilience among those aged 25-50 and those above 50. This study, led by ROSA Director and Professor of Sociology Paulin Straughan, aims to form a baseline resilience index, inform policies for potential interventions, and raise awareness in key strategies that can boost Singapore's collective resilience.

12 Prof Paulin Straughan.

## RESEARCH DEVELOPMENTS

### Launch of Centre for Intelligent Software Engineering Research

SMU has elevated the Lab for Research on Intelligent Engineering to a dedicated centre led by the School of Computing and Information Science's OUB Chair Professor of Computer Science David Lo, Associate Professor Jiang Lingxiao, and Professor Sun Jun. The new centre focuses on applied and fundamental research at the intersection of software engineering, artificial intelligence, and cybersecurity.

Its primary objectives are to enhance software quality while reducing costs through innovative advancements, drive progress in intelligent software engineering, foster collaboration, and strengthen expertise in these critical areas.

### SMU Institutional Repository, InK, surpasses 7 million downloads

In March 2023, SMU institutional repository InK achieved a remarkable milestone, with a cumulative

total of 7 million downloads. Launched in 2010, InK has experienced substantial growth, offering access to over 17,000 full-text items. The most popular papers focus on strategic priorities, such as digital transformation, sustainable living, and Asia's growth. InK is instrumental in enhancing SMU's research visibility and impact globally, as increased downloads correlate with higher citations and greater recognition for the university and its research endeavours.

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13 SMU Li Ka Shing Library.

# RESEARCH GRANT WINS

Date Awarded	School/ICL	Funding Agency/ Grant Call	Project Title	Principal Investigator	Project Synopsis
Apr 2022	RISE Lab	Cyber Security Agency of Singapore's National Cybersecurity Research and Development Programme	Less is More: Addressing Mobile Application Security and Privacy through Debloating	David LO	This project will develop a new approach, named MINIMA, for protecting end users against privacy and security risks in mobile operating systems. The success of this project can lead to an effective strategy to allow citizens to better protect themselves against cyber threats by minimising their individual attack surface.
Apr 2022	SCIS	National University of Singapore	Digital Wellbeing: Identifying, Testing and Measuring Framework Indicators Towards Digital Readiness, Inclusion and Safety	LIM Ee Peng (Co-PI)	Digital wellbeing has arisen in public, governmental and policy discourse as a key measure of a person's wellbeing through a healthy use of technology. This project aims to identify and measure digital wellbeing for digital readiness, inclusion and safety. Building on the Digital Wellbeing Indicator Framework (DWIF) developed by researchers at the NUS Centre for Trusted Internet and Community, this project will test, evaluate, and revise the DWIF by conducting both qualitative and quantitative analysis of data collected from local context (i.e., Singapore) and global contexts (i.e., UK, US, China), with specific focus on mainstream job trends (digital readiness), minority disability access (digital inclusion) and women (digital safety).
Jun 2022	CCLA	Baker McKenzie Wong & Leow	Sustainability and Commercial Law in Asia	YIP Man	This collaboration develops "Sustainability and Commercial Law in Asia" as a focus area of research for the SMU Centre for Commercial Law in Asia, seeking to investigate the relationship between sustainability and commercial law developments in Asia and to propose suggestions for review and reform where appropriate.
Jun 2022	CIS	National Heritage Board's Heritage Research Grant	The 'Other' Garden City: Documenting Singapore's Edible Gardening Heritage	Fiona Clare WILLIAMSON	<p>Modern Singapore is internationally renowned as a 'Garden City'. Firmly entrenched in the official narrative as a linchpin of its national and global identities, the imagery of a verdant city-state serves as a reflection of Singapore's economic prosperity along with the success of its governance model. Though largely attributable to the state-led greening campaign initiated in 1967 by Lee Kuan Yew, public parks, formal gardens, and roadside trees do not constitute the entirety of Singapore's rich gardening heritage as a 'Garden City'. Indeed, according to a survey conducted by the National Parks Board, approximately one in two respondents cultivate plants at home. Found in a wide range of residential and public settings, edible vernacular gardens are tightly interwoven into the fabric of everyday life as stylistically informal small-scale green spaces, cultivated by individuals and communities.</p> <p>Spanning approximately two hundred years of Singapore's modern history, this study will draw upon a wide array of textual and non-textual historical and contemporary sources to document gardening in Singapore from the 19th century to the present day. It will identify the ways in which historical gardening practices in Singapore have been continued, reinforced, and transformed into the contemporary period through building a body of new research and knowledge. In doing so, our proposed study will reflect an increased focus on ICH as part of the Our SG Heritage Plan and catalyse the writing of a new environmental history of Singapore, one which places ordinary people and practices in the foreground.</p>



## RESEARCH GRANT WINS (CONT'D)

Date Awarded	School/ICL	Funding Agency/ Grant Call	Project Title	Principal Investigator	Project Synopsis
Aug 2022	YPHSL	Chiang Ching-kuo Foundation for International Scholarly Exchange's Call for Research Grants	The Rise of China and the Future of High Seas Governance	LIU Nengye	The project aims to identify the nature of China's influence on the international law governing the high seas. This research will comprehensively examine China's strategies to expand its impact on global ocean governance in an era of geopolitical and environmental change. The project is expected to generate new knowledge for better understanding of China's approaches to international law of the sea.
Aug 2022	SOE	Ministry of Education's Academic Research Fund Tier 2	Mechanism Design for Weakly Structured Environments	LI Jiangtao	The mechanism design literature hinges upon several assumptions, including (1) strategic sophistication - the ability of the individuals to think in complex ways, and (2) detailed knowledge of the environment. While these assumptions are standard in mechanism design, they are nevertheless very strong. "Real-life" economic agents are not as rational as typically modelled. When agents have limited strategic sophistication, economists lose confidence in the performance of mechanisms that force participants to engage in complicated mental tasks. Furthermore, in realistic settings, the designer typically does not have detailed knowledge of the environment. Thus, a mechanism that performs well under strong assumptions of the environment might perform poorly when these assumptions turn out not to be true. The projects we propose here aim to further the understanding of mechanism design when the above-mentioned assumptions are relaxed.
Aug 2022	LKCSB	Ministry of Education's Academic Research Fund Tier 2	Understanding and Closing Gender Gaps in Workplace Outcomes	Michael SCHAERER	To better understand gender gaps in opportunities and outcomes in the workplace, the team plans to examine the prevalence, causes, and potential remedies of gender discrimination across three organisational contexts. Part 1 of the project will focus on causes of discrimination in the selection of candidates for jobs and promotions. Part 2 will focus on performance evaluations, specifically how decision-makers may react differently to female and male employees who make errors on the job. Part 3 will examine the underlying reasons for gender gaps in negotiation outcomes as well as strategies to help promote fairer outcomes in compensation discussions.

## RESEARCH GRANT WINS (CONT'D)

Date Awarded	School/ICL	Funding Agency/ Grant Call	Project Title	Principal Investigator	Project Synopsis
Aug 2022	SCIS	Ministry of Education's Academic Research Fund Tier 2	Universal Pre-training of Graph Neural Networks	FANG Yuan	<p>This project studies a way to efficiently bootstrap graph neural networks (GNN), a deep learning technique on graphs. A graph (also called network) contains different entities, which are further linked based on their interactions, to form complex networks. For instance, consumer and corporate entities are linked based on their transactions to form a financial network; suppliers and customers are linked based on their business relationships to form a supply chain network. A plethora of graph analytics tasks exist on these graphs, such as fraud detection and anti-money laundering on financial networks, as well as container demand and shipping prediction on supply chain networks.</p> <p>GNNs represent the state-of-the-art technology behind graph analytics. However, to achieve optimal performance, for each graph and analytics task, GNNs require a large amount of task-specific labels, which are example cases happened in the past. Such labels are often unavailable or expensive to collect in large scale. In contrast, label-free graphs (i.e., graphs without task-specific labels) are more readily available in various domains. To overcome this critical limitation, the project team turn to GNN pre-training, which can efficiently bootstrap GNNs using label-free graphs and only a small amount of task-specific labels, to capture intrinsic graph properties that can be generalized across tasks and graphs in a domain. The pre-trained general knowledge would reduce the reliance on task-specific labels.</p> <p>Practical applications of this research include fraud detection and anti-money laundry on financial networks, and container demand and shipping prediction on supply chain networks. The burgeoning e-commerce industry in Singapore, and the nation's vision of skill upgrading and job transformation, can also benefit from graph analytics, such as product recommendation and suspicious user flagging on e-commerce graphs, and talent match on job/skill graphs.</p>
Sep 2022	CIS	National Research Foundation	Cooling Singapore 2.0: Work Package B - Urban Climate Risks and Benefits	Winston CHOW Tseon Loong	<p>This project is an inter-disciplinary and multi-institute work package, led by SMU, making use of the Digital Urban Climate Twin (DUCT) results from the first Cooling Singapore 2.0 work package to examine the urban climate risks and impacts from environmental and physiological perspectives. The objectives include (a) investigating where and who in Singapore will be affected by excessive heat from urbanisation and climate change, and (b) examining if existing measures, such as vegetation cover, will have reduced effectiveness in minimising heat exposure under a warming climate. Results from this project will aid in assessment and future policy development towards urban warmth solutions in Singapore.</p>

## RESEARCH GRANT WINS (CONT'D)

Date Awarded	School/ICL	Funding Agency/ Grant Call	Project Title	Principal Investigator	Project Synopsis
Oct 2022	SCIS	AI Singapore	Next generation roster management via reinforcement learning	LAU Hoong Chuin	<p>This is a project under the AI Singapore 100 Experiments (Research) Programme. BIPO has a unique advantage in payroll processing and saw an opportunity to build a tool anchoring on downstream pay outcomes as an enabler in strategic design of a rostering tool, that should not only feedback about staff costs, productivity, and preferences, but also feedback on skills-based job evaluation and design. BIPO's client pool in labour-intensive industries such as logistics, retail (restaurants, shops), call centres, healthcare and hospitality have an acute need for a rostering tool that is based on roles, skills and pay. In this project, we combine constraint programming with adaptive large neighbourhood search to generate rosters according to rostering requirement and maximising the preferences of employees. We also cover the dynamic setting where reinforcement learning is applied to prescribe changes to the roster due to changes in the environment.</p> <p>This research/project is supported by the National Research Foundation, Singapore under its AI Singapore Programme (AISG Award No: AISG2-100E-2022-098).</p>
Oct 2022	SCIS	National Research Foundation	Optimizing Supply Chain Resilience with Quantum Sampling	LAU Hoong Chuin (SMU PI)	<p>This proposal contributes to Thrust 3 of the National Quantum Computing Hub (NQCH) that is focused on translational R&amp;D, such as the development of libraries, prebuild models, and templates to enable easier and faster programming and developments of software applications by early adopters in the industry, government agencies and Institutes of Higher Learning (IHLs). This project aims to develop hybrid quantum-classical algorithms and tools that will contribute to the libraries and pre-build models for supply chain use cases. Compared with classical techniques, we aim to enhance the performance of the Sample Average Approximation (SAA) and Simulation Optimisation, that is verifiable in today's NISQ quantum hardware, and apply these algorithms to supply chain risk management contexts. It is anticipated that these algorithms will achieve higher-quality and computationally attractive solutions over pure classical algorithms. The project start date was 1 January 2023.</p>



## RESEARCH GRANT WINS (CONT'D)

Date Awarded	School/ICL	Funding Agency/ Grant Call	Project Title	Principal Investigator	Project Synopsis
Oct 2022	SCIS	Info-communications Media Development Authority of Singapore	TradeMaster: Reinforcement Learning-based Quantitative Trading Toolkit	ZHU Feida (Co-PI)	This project aims to design a hierarchical cross-network multi-agent Reinforcement-Learning-based trading strategy generator and examines governance framework for crypto asset markets.
Nov 2022	LKCSB	Temasek Laboratories at Nanyang Technological University's Call for Proposal – Behavioural and Communication Science Programme Research Project	Building group cohesion through leader oratory and perceptions of the impact of speaker practices across different audience groups	Timothy CLARK	For the Singapore leader, the final audience is always larger than the physical audience at a particular venue. The importance of leadership oratory is not confined to live co-present audiences, as wider audiences have long viewed political and organisational leaders' speeches via television (and radio) and the use of various recording technologies (VHS, DVD). Recently, it has become common for speeches to be broadcast live on the internet and/or disseminated via online video. As a result, they can be viewed by potentially vast and diverse national and global audiences at different times, in a wide variety of contexts, using a range of devices (Wenzel and Koch, 2018; Rossette-Crake, 2020). According to Rossette-Crake (2020), since the turn of the century, it has become standard practice for speeches to be written and delivered with this in mind, and this is leading to changes that are akin to the way in which political oratory was transformed by radio and television during the 20th century (Greatbatch and Clark, 2005). Building on these points, this research project seeks to establish which oratorical practices are associated with positive persuasive outcomes and inspire trust and a sense of group cohesiveness amongst members of diverse audiences. It will answer two questions: (1) What are the verbal and non-verbal practices associated with establishing trust and a sense of group cohesiveness among members of diverse audiences during live speeches, and (2) How do the diverse audience members perceive the impact of these practices and whether the themes of the speeches also influence their perceptions?
Nov 2022	SCIS	DSO National Laboratories	Weakly-supervised Semantic Segmentation and Its Applications in SAR Images	SUN Qianru	This project aims for learning efficient semantic segmentation models without using expensive annotations. Specifically, we leverage the most economical image-level labels to generate pseudo masks to facilitate the training of segmentation models. In the end, we will apply the resultant algorithms on tackling the remote sensing image segmentation in the challenging Continual, Few-shot, and Open-set Datasets.

## RESEARCH GRANT WINS (CONT'D)

Date Awarded	School/ICL	Funding Agency/ Grant Call	Project Title	Principal Investigator	Project Synopsis
Nov 2022	YPHSL	Notre Dame-IBM Technology Ethics Lab's 2022-2023 Call for Proposals	AI Audits for Who? Asian Perspectives on Rebuilding Public Trust via Community Ethics and Conflict Resolution Mechanisms	Willow WONG	The governance of artificial intelligence (AI) to mitigate societal and individual harm through ethics-by-design calls for equal attention to responsible data use before public trust can be conferred to AI technologies. Since trust is fundamentally rooted in community relationships, AI regulators seeking public acceptance toward AI innovation must attend to community-centric pathways to integrate data subjects' voices in AI ethical decision-making. While traditional actuarial methods in financial audits can indicate a diverse range of evidence used to determine legal compliance, the researchers suggest that community interests and data subjects' voices should not be absent in AI audit models. This research proposal will explore Singaporean (and Asian) perspectives on AI regulation to inform the motivations for using AI audits to rebuild public trust. Research analysis on the proposed scope and methodologies of AI audits will be followed by recommendations on the relevant skillsets for future AI auditors.
Dec 2022	LKCSB	Singapore Maritime Institute's Maritime Policy Research Grant Call on Global Maritime Research, Knowledge and Innovation Hub Ecosystem Benchmarking Study	Identifying Gaps and Opportunities for Singapore as a Leading Maritime Research, Knowledge, and Innovation Hub: A Global Benchmarking Study	TAN Siong Kuan (Patrick)	Singapore maritime cluster has achieved tremendous success through connectivity, collaborative research and development and effective knowledge and talent management. Excellent public policy measures and governance have also allowed Singapore to be an attractive location as a maritime city. In this study, we aim to review Singapore's current performance as a maritime research, knowledge and innovation hub and perform an international benchmarking against the potential global frontrunners. This would include defining what a maritime research, knowledge and innovation hub means and how that can be developed. This study is not limited to a global ranking exercise but a study of how Singapore can become the "Silicon Valley for Maritime Research, Knowledge and Innovation".
Dec 2022	ROSA	Income Insurance Limited	Singapore Future Resilience Index 2022 For Singapore Residents Aged 25 to 76	Paulin STRAUGHAN	The Centre for Research on Successful Ageing (ROSA) at SMU and Income Insurance Limited are piloting this research project to study the state of resilience amongst Singaporeans and comparing the levels of resilience among those aged 25-50 and those above 50. This study aims to form a baseline resilience index, inform policies for potential interventions, and raise awareness in key strategies that can boost Singapore's collective resilience.

## RESEARCH GRANT WINS (CONT'D)

Date Awarded	School/ICL	Funding Agency/ Grant Call	Project Title	Principal Investigator	Project Synopsis
Dec 2022	SCIS	DSO National Laboratories	Text Style Transfer with Pre-Trained Language Models	JIANG Jing	Text style transfer (TST) is the task of converting a piece of text written in one style (e.g., informal text) into text written in a different style (e.g., formal text). It has applications in many scenarios such as AI-based writing assistance and removal of offensive language in social media posts. Recent years, with the advances of pre-trained large-scale language models such as the Generative Pre-trained Transformer 3 (GPT-3) which is an autoregressive language model that uses deep learning to produce human-like text, solutions to TST are now shifting to fine-tuning-based and prompt-based approaches. In this project, we will study how to effectively utilise pre-trained language models for TST under low-resource settings. We will also design ways to measure whether solutions based on pre-trained language models can disentangle content and style.
Feb 2023	SCIS	Ministry of Education's Academic Research Fund Tier 2	Executable AI Semantics for AI Framework Analysis	SUN Jun	This project aims to provide a solid foundation for analysing AI systems as well as techniques used to facilitate the development of reliable secure AI systems. Central to the research is to develop an executable specification in the form of an abstract logical representation of all components that are used to build artificial intelligence, which subsequently enables powerful techniques to address three problems commonly encountered in AI systems, namely, how to ensure the quality or correctness of AI libraries, how to systematically locate bugs in neural network programs, and how to fix the bug. In other words, this project aims to define a semantics of AI models, thereby forming a solid fundamental to build AI systems upon.
Feb 2023	SCIS	Ministry of Education's Academic Research Fund Tier 2	Food Recognition: Causality-driven Cross-modal Cross-lingual Domain Adaptation	NGO Chong Wah	This project aims to improve the scalability of food recognition – to train classifier(s) that recognise a wide range of dishes regardless of cuisines, the amount and type of training examples. Here, “classifier” can be viewed as a “search engine” that retrieves the recipe of a food image. Training such classifiers requires an excessive number of training examples composed of recipes and images, where each recipe is paired with at least an image as visual reference. Training classifiers using paired or parallel data faces several practical limitations – tens of thousands of recipe-image pairs are required for training; other forms of data that are largely available in the public cannot be leveraged for model training; and additional training data is required when the recipes are written in different natural languages. Through the project, these practical limitations will be addressed from the perspective of transfer learning. The aim is to train a generalised classifier that is more adaptable for recognition, by removing the statistical bias, considering the evolving process, and aligning the semantics of different languages in machine learning.

## RESEARCH GRANT WINS (CONT'D)

Date Awarded	School/ICL	Funding Agency/ Grant Call	Project Title	Principal Investigator	Project Synopsis
Feb 2023	SCIS	Ministry of Education's Academic Research Fund Tier 2	Mobile-friendly Data Visualization	WANG Yong	Data visualisations have been widely used on mobile devices (e.g., smartphones), but they suffer from mobile-friendly issues in terms of their creation and usage. This project aims to develop novel techniques to achieve mobile-friendly data visualisations, including desirable mobile data visualisation creation and effective multimodal interaction design. The research outputs of this project will significantly improve the effectiveness and usability of mobile data visualisations and further promote their applications.
Feb 2023	SCIS	Ministry of Education's Academic Research Fund Tier 2	Unleashing the Power of Pre-trained Models for VisualQA: A Skill-based Framework	JIANG Jing	Consumers have widely used conversational AI systems such as Siri, Google Assistant and now ChatGPT. The next generation of conversational AI systems will have visual understanding capabilities to communicate with users through language and visual data. A core technology that enables such multimodal, human-like AI systems is visual question answering and the ability to answer questions based on information found in images and videos. This project focuses on visual question answering and aims to develop new visual question-answering technologies based on large-scale pre-trained vision-language models. Pre-training models developed by tech giants, particularly OpenAI, have made headlines in recent years, e.g., ChatGPT, which can converse with users in human language, and DALL-E 2, which can generate realistic images. This project aims to study how to best utilise large-scale pre-trained vision-language models for visual question answering. The project will systematically analyse these pre-trained models in terms of their capabilities and limitations in visual question answering and design technical solutions to bridge the gap between what pre-trained models can accomplish and what visual question answering systems require. The end of the project will be a new framework for building visual question-answering systems based on existing pre-trained models with minimal additional training.



## RESEARCH GRANT WINS (CONT'D)

Date Awarded	School/ICL	Funding Agency/ Grant Call	Project Title	Principal Investigator	Project Synopsis
Feb 2023	SOSS	Ministry of Sustainability and the Environment	Public Cleanliness Satisfaction Survey	Paulin STRAUGHAN	This is additional funding to SMU for the existing research project. MSE and SMU are collaborating to conduct the Public Cleanliness Satisfaction Survey (PCSS), an annual national household survey that aims to measure and track Singaporeans' satisfaction and perceptions towards public cleanliness and public hygiene. Findings from the survey will aid in identifying key areas of concern and recommendations which are policy or operational in nature, to improve the public's levels of satisfaction of public cleanliness, public hygiene and/or public cleaning services.
Mar 2023	SCIS	National Research Foundation's 8 <sup>th</sup> NRF Investigatorship	TrustedSEERs: Trusted Intelligent Work Bots for Engineering Better Software Faster	David LO	This project will pioneer approaches that realise trusted automation bots that act as concierges and interactive advisors to software engineers to improve their productivity as well as software quality. TrustedSEERs will realise such automation by effectively learning from domain-specific, loosely linked, multi-modal, multi-source and evolving software artefacts (e.g., source code, version history, bug reports, blogs, documentation, Q&A posts, videos, etc.). These artefacts can come from the organisation deploying the automation bots, a group of collaborating yet privacy-aware organisations, and from freely available yet possibly licensed (e.g., GPL v2, GPL v3, MIT, etc.) data contributed by many, including untrusted entities, on the internet. TrustedSEERs will bring about the next generation of Software Analytics (SA) – a rapidly growing research area in the Software Engineering research field that turns data into automation – by establishing two initiatives: First, data-centric SA, through the design and development of methods that can systematically engineer (link, select, transform, synthesise, and label) data needed to learn more effective SA bots from diverse software artefacts, many of which are domain-specific and unique. Second, trustworthy SA, through the design and development of mechanisms that can engender software engineers' trust in SA bots considering both intrinsic factors (explainability) and extrinsic ones (compliance to privacy and copyright laws and robustness to external attacks). In addition, TrustedSEERs will apply its core technologies to synergistic applications to improve engineer productivity and software security.