

ASPIRE

An SUTD Publication : Impactful Research Endeavors



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Turning the Sea into a Mega Battery

Assoc Prof Yang Hui Ying was taught early on by her grandmother that education was the key that could truly earn a person their freedom while her parents constantly reminded her that she could do anything she puts her mind to.

Assoc Prof Yang held on to their words and went on to be the top physics student at Nankai University in her hometown Tianjin, China and pursued her PhD studies in Nanyang Technological University in Singapore. She was subsequently honoured with other prestigious international awards along the way throughout her career. Some of which included the Outstanding Young Manufacturing Engineer Award, IUMRS Young Researcher Award, IPS Nanotechnology Medal, IES Prestigious Engineering Achievement Award, Tan Kah Kee Young Inventor Award and L'Oreal Singapore for Women in Science National Fellowship.

Now, as a materials scientist and faculty member at the Singapore University of Technology and Design's (SUTD) Engineering Product Development (EPD) pillar she leads a research team that develops advanced membrane technologies.

"My family's encouragement and foresight gave me the confidence to dream big and subscribe to a larger goal of making a difference. So being in research, where you constantly have to tread your way through big unknowns, it came to be a natural fit for my curious and determined nature to invent something that will be easily accessible for everyone to benefit from," shared Assoc Prof Yang.

Most recently, she and her team were awarded a \$2.8 million research grant by the National Research Foundation to purify water in a more cost and energy efficient manner. "Singapore is constantly faced with the issue of water scarcity and we are trying to find ways to ensure that we will have reliable and sustainable ways to access water with minimal energy and resources," explained Assoc Prof Yang.

When asked how she continues to stay inspired amidst the great pressures she encounters when trying to solve a pressing national issue, she adds, "My biggest motivation and inspiration is my students. Learning and working with the younger generation is always fulfilling and fun. They continually push me to explore new endeavors with their inquisitive, creative minds."

Harnessing Energy from Water

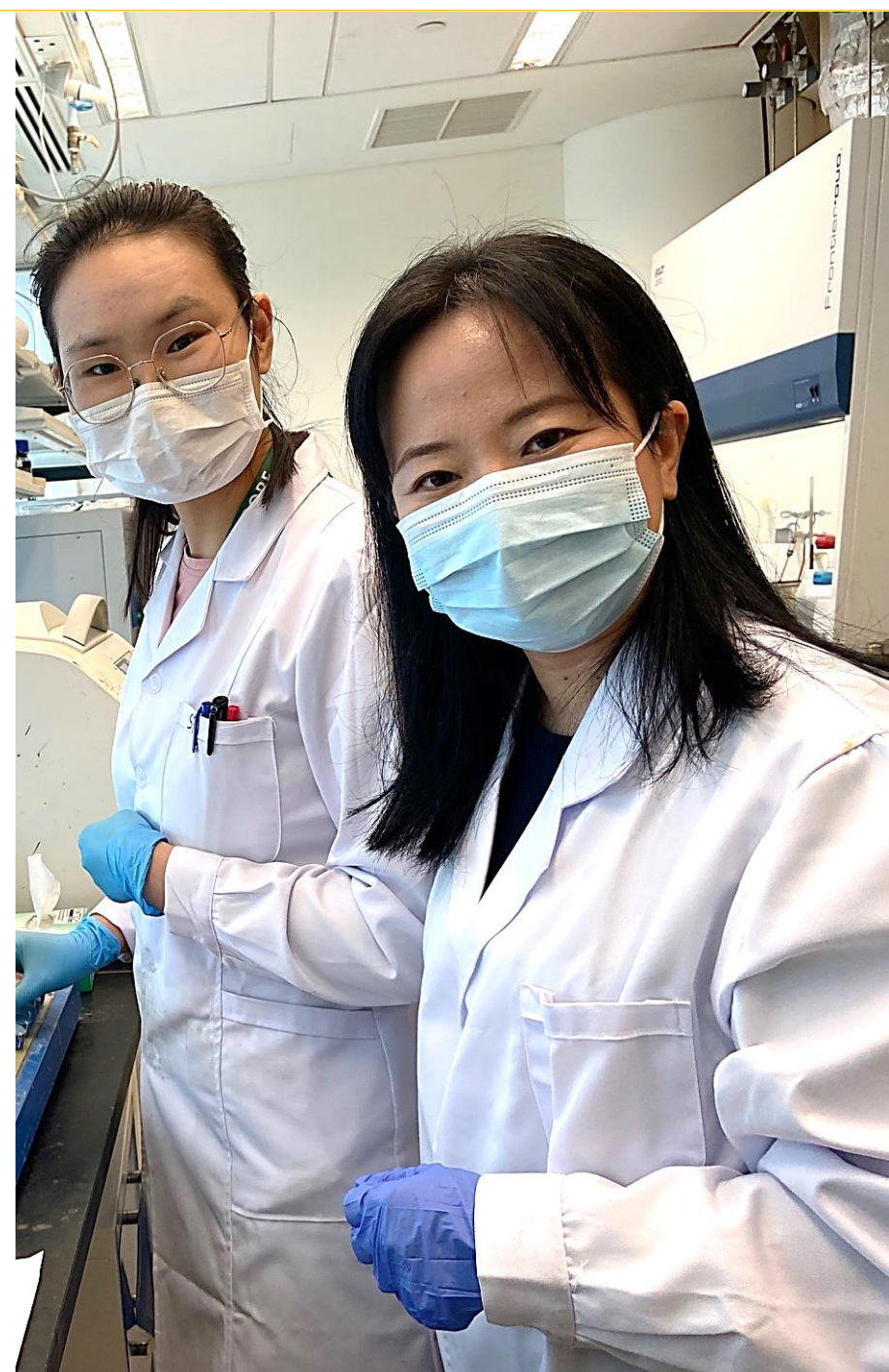
Assoc Prof Yang and her research team comprising PhD students, research fellows and peers from SUTD, developed a low dimensional nanomaterial to desalinate ocean water. This material allows for an electrochemical reaction to occur by attracting all the positively charged chloride ions on one side while attracting the negative charges sodium ions to the opposite side.

At the same time, the team utilises the extracting and releasing of the sodium and chloride ions from positive and negative electrodes to remove ions from seawater and store electric energy. This process, known as hybrid capacitive deionization, allows them to not just process desalinated water more efficiently, but to also provide low-cost energy storage. "Some research teams focus on water treatment while others focus on energy and the two research areas tend to be defined and separated as such.

"But my research team and I hold on to a very unique position in which we study both these areas of water desalination as well as energy storage simultaneously. This unconventional set-up provides us with opportunities to explore undiscovered intersections in these two broad areas of research," explained Assoc Prof Yang.

"My big vision for this project is to turn the entire ocean into a huge desalination battery so that everyone in Singapore can enjoy desalinated water and free power from this," she added.

Contact Assoc Prof Yang Hui Ying at yanghuiying@sutd.edu.sg & Jessica Sasayiah at jessica_sasayiah@sutd.edu.sg



Assoc Prof Yang Hui Ying (right) with one of her students in the lab at SUTD.



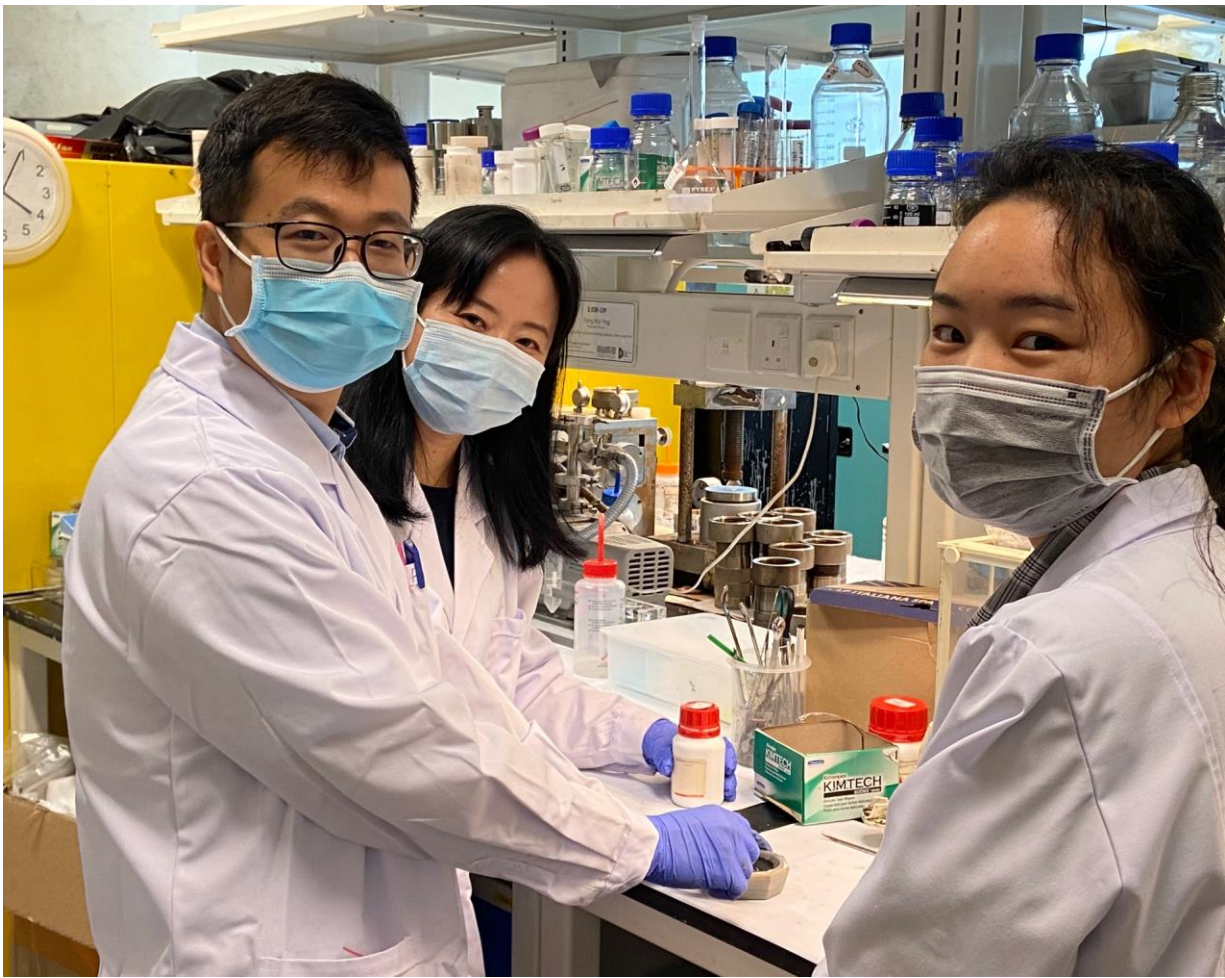
Assoc Prof Yang (second from left) with her research team.

Selective Separation

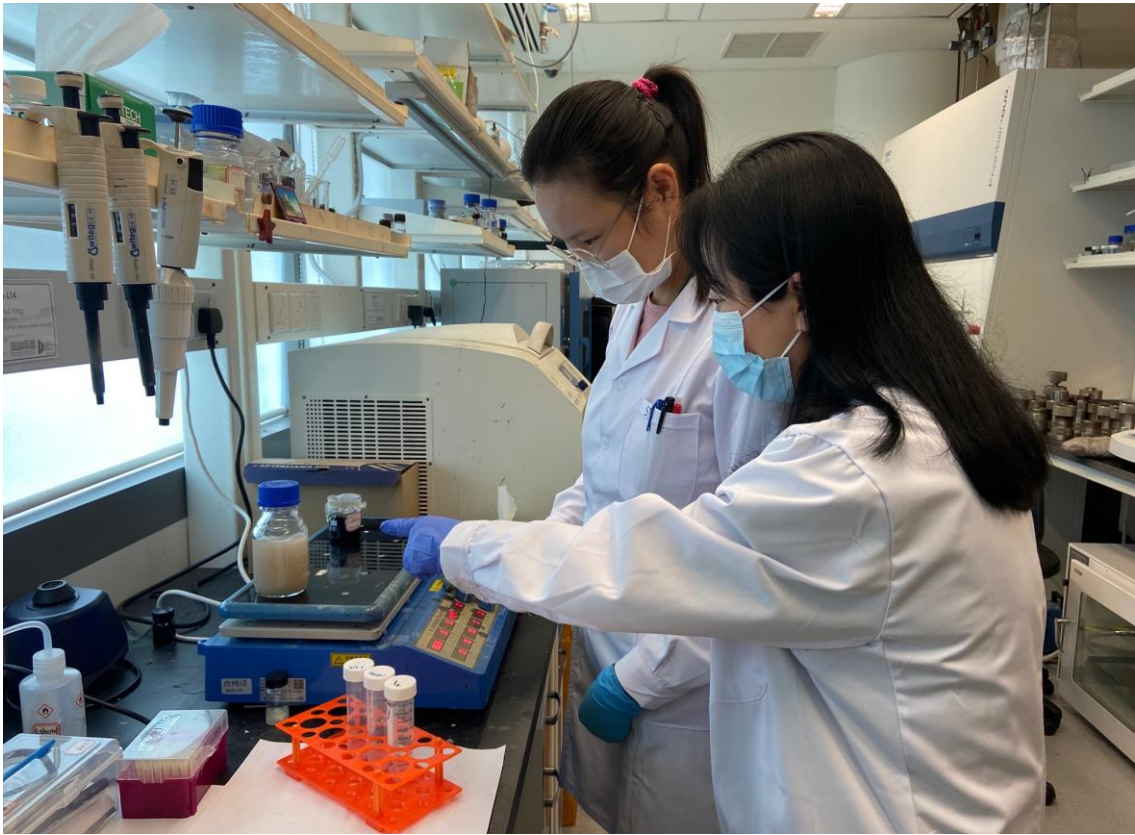
Using the same capacitive deionozation process, Assoc Prof Yang is also concurrently looking at recycling lithium metals - a valuable natural resource found in oceans that is used in batteries for mobile phones, laptops, electric vehicles and even heart pacemakers. The ocean is known to contain around 180 billion tons of lithium, but efforts to selectively extract lithium from seawater have proved to be challenging.

Apart from ocean mining, she is also exploring applications in the medical field to selectively extract harmful toxins from blood while maintaining essential nutrients and minerals.

"Mother Nature offers us many answers to the challenges we face in the oceans. We are using our research to observe, monitor and manipulate the ions in the ocean to try to find these answers and maximise the potential of our oceans," she added.



“ Mother Nature offers us many answers to the challenges we face in the oceans. We are using our research to observe, monitor and manipulate the ions in the ocean to try to find these answers and maximise the potential of our oceans. ”



About Yang Hui Ying
Assoc Prof Yang Hui Ying received her B.S. degree from Nankai University, China, in 2002. She obtained her PhD degree in Nanyang Technological University, Singapore in 2006. After her graduate study, she was appointed as Singapore Millennium Fellow and Lee Kuan Yew Fellow in 2006 and 2008, respectively. She worked as a research scholar in Massachusetts Institute of Technology (MIT), Cambridge, USA in 2011. Currently, Assoc Prof Yang is a faculty member of the Engineering Product Development Pillar at the Singapore University of Technology and Design.

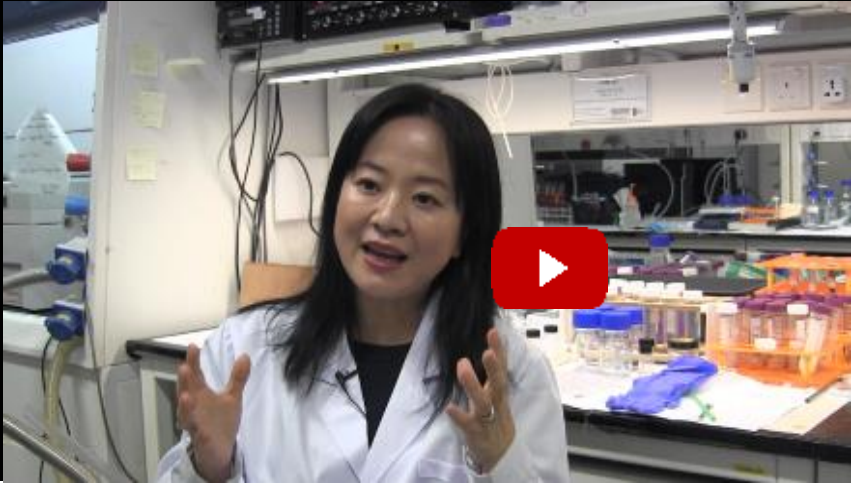
Assoc Prof Yang studies low dimensional nanomaterials for electrochemical energy storage and water treatment devices, which are centered on exploring the influence of function engineering and chemical doping on the materials synthesis and device performance. She is leading a research team to apply fundamental knowledge and new manufacturing methods in developing exceptional nanoscale materials and structures for efficient lithium storage and scalable water purification. She is a Fellow of Royal Chemistry Society (RCS).

She has published more than 252 manuscripts in top international journals with more than 10245 citations and a H-index at 52. According to Web of Science (OCED schema 1980 –2020), Assoc Prof Yang is lauded as Singapore’s 32nd most prolific researcher for materials science publications in top international journals. She is also one of the youngest in the top 40 list of researchers and her category normalised citation impact (CNCI) ranks 19th on the list.



SUTD Explains Video Series

Watch our faculty members and researchers lead discussions on everyday topics and explain how their inter-disciplinary research impacts us. [Click here.](#)



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Research News

Education Minister Lawrence Wong Visits SUTD



SUTD was honoured to host Minister of Education Mr Lawrence Wong on campus on 18 November 2020. SUTD President Prof Chong Tow Chong along with other senior management showed Minister Wong around the research facilities. He was also introduced to several students and alumni whose interdisciplinary research work have served societal needs and improved the lives of others.

More information can be found [here](#)

Ambassador-at-Large Prof Chan Heng Chee Steps Down as SUTD LKYCIC's Chair



Dr Cheong Koon Hean, former Housing Development Board's CEO, will be taking over as Chairman of SUTD's Lee Kuan Yew Centre for Innovative Cities (LKYCIC) on 15 June 2021.

Ambassador-at-Large and SUTD Prof Chan Heng Chee will step down from her appointment on 14 June 2021. Prof Chan has been the founding chair of LKYCIC since its establishment in late 2012.

More information can be found [here](#)

Launch of Guide to Job Redesign in the Age of AI



Under the guidance of the Advisory Council of the Ethical Use of AI and Data, the IMDA/PDPC collaborated with the Lee Kuan Yew Centre for Innovative Cities (LKYCIC) at SUTD to launch Singapore's first guide that helps organisations and employees understand how existing job roles can be redesigned to harness the potential of AI, so that the value of their work is increased.

Launched on 4 December 2020, 'A Guide to Job Redesign in the Age of AI' provides an industry-agnostic and practical approach to help companies manage the impact of AI on employees and prepare themselves for the digital future.

More information can be found [here](#)

Robots that Clean Floors, Chase Pigeons Away



Asst Prof Mohan Elara from the EPD Pillar developed a maintenance robot which is being tested at the Tampines food centre. The robot, that handles the inspection of false ceilings, will also be used to chase away pigeons and mynahs by emitting sound frequencies which target these birds.

Around 20 full-time engineers from SUTD, alongside a mix of undergraduate and post-graduate students, are working on the project and it is being funded by the National Robotics Programme.

More information can be found [here](#)

Research News

Launch of Smart City Index 2020 & IMD-SUTD Smart City Index Virtual Roundtable

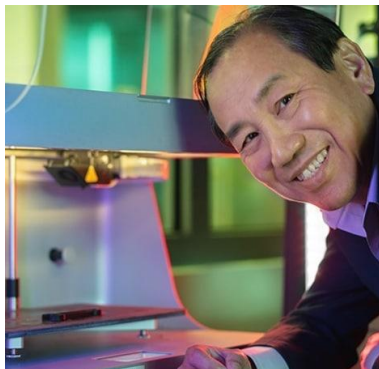


IMD in collaboration with SUTD has released the 2020 Smart City Index on 17 September 2020, with key findings on how technology is playing a role in the COVID-19 era in a way that is likely to remain. The Smart City Index ranks cities based on economic and technological data, as well as by their citizens' perceptions of how 'smart' their cities are.

In conjunction with the launch, an [online webinar](#) was organised to discuss the findings from the Index and how Singapore managed issues brought about by the COVID-19 pandemic. The webinar featured guest speakers such as Dr Vivian Balakrishnan (Singapore's Minister for Foreign Affairs and Minister-in-charge of the Smart Nation Initiative), Jan Vapaavuori (Mayor of Helsinki), Prof Arturo Bris (Director of the IMD World Competitiveness Center) and Bruno Lanvin (President of the Smart City Observatory). The session was moderated by Prof Chan Heng Chee, Chair of LKYCIC at SUTD.

More information can be found [here](#)

3D Printing Steps up to the Frontlines in the Battle Against Covid-19



In an article published in Nature Reviews Materials, SUTD together with researchers from Nanyang Technological University, Cedars-Sinai Medical Center and HP Inc. examined how the digital versatility and quick prototyping of 3D printing has enabled the swift mobilisation of the technology and a rapid response to emergencies in a closed loop economy.

More information can be found [here](#)

SUTD Faculty Named Top 10 books of Lianhe Zaobao's Booklist 2020



Assoc Prof Yeo Kang Shua from the Architecture and Sustainable Design Pillar (ASD) published a book 'Wak Hai Cheng Bio: A Dialogue between Architecture and History' and made the Lianhe Zaobao's 2020 Book Selection and is one of City Book Room's Bestsellers of 2020.

More information can be found [here](#)

Reviving of the ASEAN Airlines Amidst Pandemic



The Aviation Studies Institute at SUTD published a white paper which highlighted the pressing need for ASEAN airlines to rebuild revenue streams and urged them to set up air bubbles. This will help eliminate the need for quarantine, which is deemed as the most significant deterrence to air travel and revive the aviation industry that has been badly affected by the Covid-19 pandemic.

More information can be found [here](#)

Research Publications

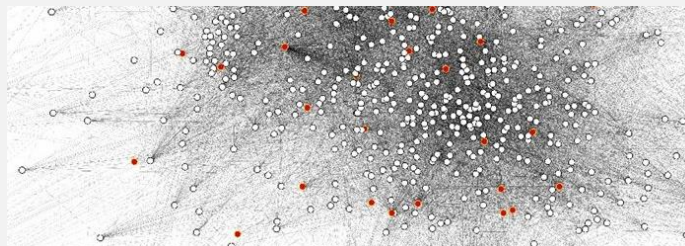
Threat Modeling Tool to Improve Security for Smart Nation Applications



Assoc Prof Chen Bin Bin from the Information Systems Technology and Design (ISTD) pillar designed a tool that can support comprehensive threat modeling. His research team plans to use the model's analysis results to enable effective security control management of critical smart nation applications.

More information can be found [here](#)

SUTD Develops New Model of Influence Maximization



Prof Karthik Natarajan and team from the Engineering Systems and Design (ESD) pillar developed a new model to enhance the robustness of influencing in networks such as in social media platforms. In the paper, the team outlined how their model had computational benefits over an independent cascade model.

More information can be found [here](#)

Largest Study of Asia's Rivers Unearths 800 Years of Paleoclimate Patterns



Assoc Prof Stefano Galelli from the ESD Pillar led a study on Asia's rivers that will be crucial for assessing future climatic changes and making more informed water management decisions.

More information can be found [here](#)

SUTD's Postgraduate's Research Selected as the Issue Cover for MDPI Electronics



A research paper published by postgraduate student Yan Jinna under the supervision of Prof Yeo Kiat Seng from the EPD Pillar, presented a new Marchand balun featuring the hybrid edge- and broadside-coupled structure. The current standalone edge- or broadside-coupled structure has reached the foundry process limitation.

More information can be found [here](#)

Low Cost, Customised Prosthesis using 3D Printing



Asst Prof Subburaj Karupppasamy and team from the EPD Pillar worked with Tan Tock Seng Hospital and developed a novel 3D printed non-metallic self-locking prosthetic arm for a patient with a forequarter amputation.

More information can be found [here](#)

Using Chitin, a Bioinspired Material, to Manufacture on Mars

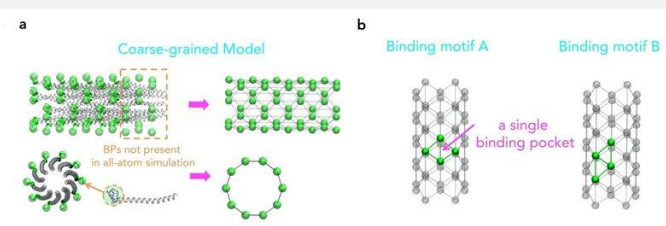


Researchers developed a manufacturing technology to build tools and shelters on Mars with minimal energy requirements and without specialised equipment. The study was led by Asst Prof Javier Fernandez from the EPD Pillar, and Assoc Prof Stylianos Dritsas from the ASD Pillar, while first author was PhD student Ng Shiwei from the EPD Pillar.

More information can be found [here](#)

Research Publications

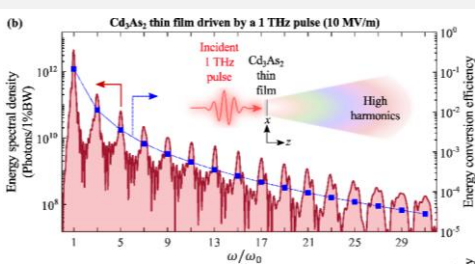
SUTD and Collaborators First to Simulate a Large-scale Virus, M13



SUTD and the Massachusetts Institute of Technology (MIT) research group led by Asst Prof Desmond Loke from the Science Mathematics and Technology cluster (SMT) cluster developed a procedure that links large-scale assembly processes to molecular simulations. The team was able to simulate a large-scale virus with nanoparticles and inside a solution for fifty nanoseconds.

More information can be found [here](#)

Ideal Unconventional Weyl Point in a Chiral Photonic Metamaterial



Head of SMT cluster, Prof Ricky Ang and his team developed theory and simulations which showed that in the terahertz regime, the output HHG intensities and number of harmonics from 3D Dirac semimetals can far exceed conventional materials despite using less intense lasers which are 100,000 times smaller than typical values.

More information can be found [here](#)

Virulent Zones: Animal Disease and Global Health at China's Pandemic Epicenter



In his latest book 'Virulent Zones', Asst Prof Lyle Fearnley from the Humanities, Arts and Social Sciences cluster (HASS) documented global plans to stop the next influenza pandemic at its source, accompanying virologists and veterinarians as they track lethal viruses to China's largest freshwater lake, Poyang Lake.

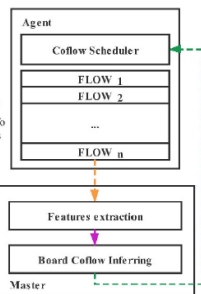
More information can be found [here](#)

Inferring Coflow Size Based on Broad Learning System in Data Center Network

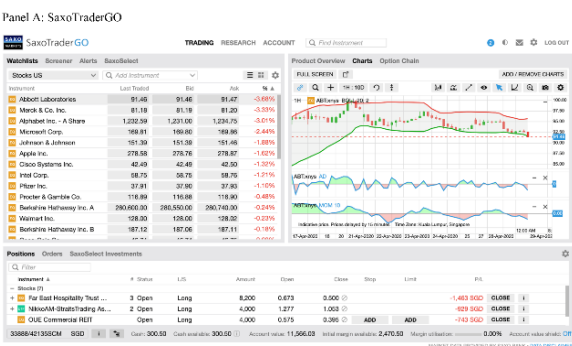
To predict the coflow size accurately and rapidly with limited information, Asst Prof Jiang Wenchao and his team from the

ISTD Pillar proposed a Broad Learning System based coflow size inferring model, which employs Multi-RELIEF method to extract features and trains BLS model on Facebook logs with incomplete information.

More information can be found [here](#)



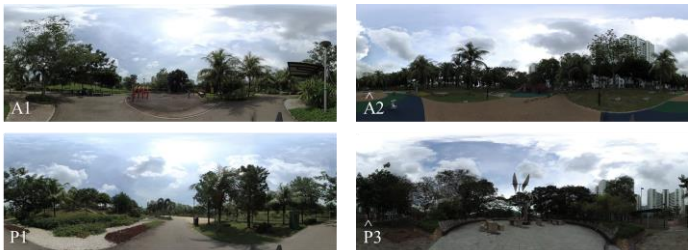
Robo-advisors and the Financialization of Lay Investors



Dr Gordon Kuo, a faculty fellow from the HASS cluster, explored how both financial inclusion and exclusion operate simultaneously in robo-advisors and argued that robo-advisors may weaken efforts to promote financial literacy and education.

More information can be found [here](#)

Pleasantness and Appropriateness of Natural Sounds



Asst Prof Joo Young Hong and his team from the ASD Pillar, studied how key contextual factors such as expected activities and audio-visual congruency affect the soundscape in a given location.

More information can be found [here](#)

Research Achievements

Prof Chan Heng Chee Honoured with IWF Woman Who Makes a Difference Award



Prof Chan Heng Chee, Chair of LKYCIC at SUTD, has been awarded International Women's Forum (IWF) Women Who Makes a Difference Award in October 2020.

IWF, founded in 1974 as the Women's Forum of New York, is an invitation-only women's organisation with some 7,000 members. Its mission is to support the women leaders of today and tomorrow. The IWF hosts two conferences each year to address women's issues and it provides intensive leadership training programmes for women.

More information can be found [here](#)

Prof Lim Sun Sun Recognised in Inaugural Singapore 100 Women in Tech List

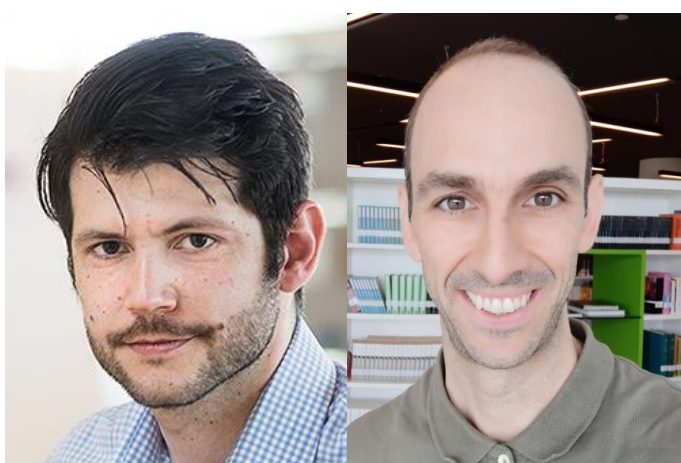


Prof Lim Sun Sun, Head of HASS cluster was named to the inaugural Singapore 100 Women in Tech list (SG100WIT) for her pioneering research on the social impact of technology and her public service on issues relating to digitalisation. Prof Lim is also a founding member of the Singapore Computer Society Special Interest Group on Women in Tech.

The SG100WIT list celebrates women role models who have made significant contributions to the technology sector. A total of 850 nominations were received from the public and the list was shortlisted by a selection committee of 14 members, chaired by Mr Lim Swee Cheang, Senior Advisor and former CEO of Institute of Systems Science, National University of Singapore.

More information can be found [here](#)

SUTD Faculty Received Best Paper Award at AAAI 2020



Asst Prof Georgios Piliouras from the ISTD Pillar, and research fellow Stefanos Leonardos from iTrust, received Best Paper Award for their joint paper titled 'Exploration-Exploitation in Multi-Agent Learning: Catastrophe Theory Meets Game Theory'.

AAAI is one of the most recognised and impactful conferences in the area of Artificial Intelligence. This year AAAI received a record number of 9034 submissions.

More information can be found [here](#)

Research Achievements

Prof Tony Quek Named Highly Cited Researcher and Nokia Visiting Professor Grant



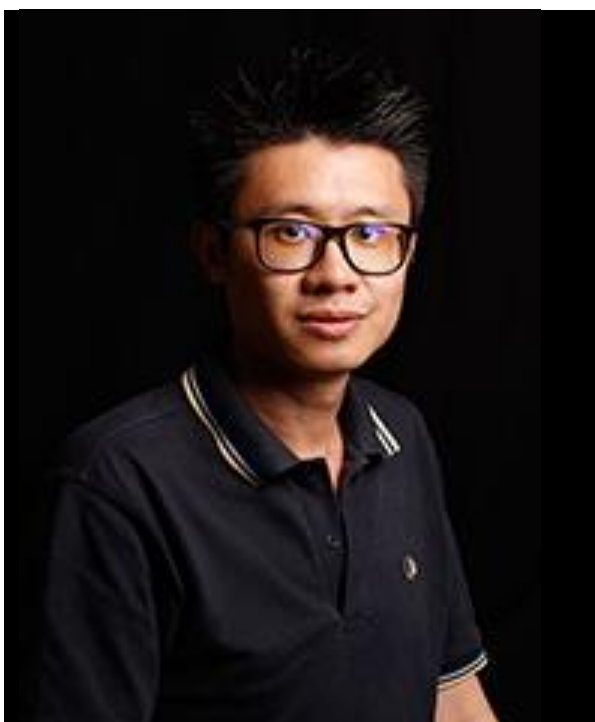
For the fifth year running, Prof Tony Quek, Head of Pillar (ISTD), has been named Clarivate Analytics' Highly Cited Researcher in the field of Computer Science. The highly anticipated annual list identifies researchers who demonstrated significant influence in their chosen field or fields through the publication of multiple highly cited papers during the last decade. Their names are drawn from the publications that rank in the top 1% by citations for field and publication year in the Web of Science™ citation index.

More information can be found [here](#)

He has also been awarded the 2020 Nokia Visiting Professor grant. Awarded by Nokia Foundation, the grants are given to distinguished foreign professors to visit Finland to work with local universities such as Aalto University, by participating in research work and giving lectures; and to collaborate with Finnish companies. Prof Quek is the only awardee this year, and his research focus include small cell networks and beyond 5G future communications.

More information can be found [here](#)

SUTD Faculty Elected IEEE Fellow



For his contributions to energy efficient wireless communications, Assoc Prof Yuen Chau has been elevated to Institute of Electrical and Electronics Engineers (IEEE) Fellow, Class of 2021. Assoc Prof Yuen, a faculty with the EPD Pillar, was also awarded the IEEE Vehicular Technology Society Distinguished Lecturer and IEEE VTS Singapore Chapter Outstanding Service Award in 2020 and 2019 respectively.

IEEE is the world's largest technical professional organisation dedicated to advancing technology for the benefit of humanity. Less than one-tenth of one percent of the total IEEE voting membership is bestowed the prestigious honour of the IEEE Fellow each year.

More information can be found [here](#)

SUTD Faculty Received 2020 ESORICS Outstanding Contribution Award



Prof Zhou Jianying, a faculty with the ISTD Pillar received the 2020 ESORICS Outstanding Contribution Award at the ESORICS 2020 Conference. This award is for recognition of research results and contributions to the community in cybersecurity. Prof Zhou received Best Paper Award in 2015 and was also the Programme Chair of ESORICS' 2018.

More information can be found [here](#)

Research Achievements

Design Odyssey Won Prestigious Singapore Design Mark Award



Design Odyssey (DO), a programme initiated by the International Design Centre at SUTD and sponsored by JP Morgan, won the Singapore Good Design (SG Mark) 2000 award for Experience Design. Established in 2015, it features a human-centric focus, rooted in design innovation and social awareness. DO has since engaged over 400 SUTD students and collaborated with more than 600 students from polytechnics, secondary schools, and overseas institutions.

More information can be found [here](#)

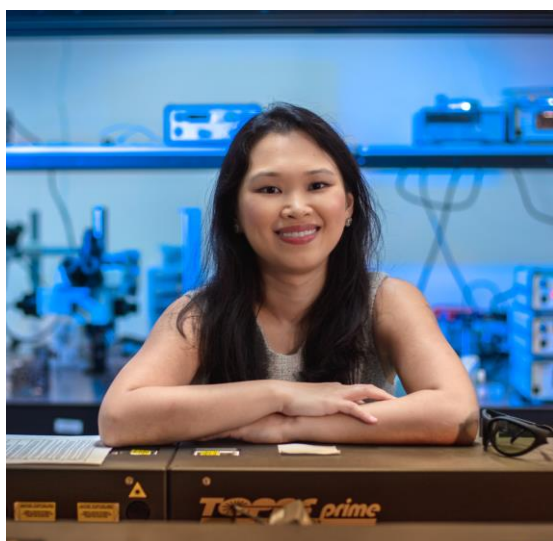
SUTD Faculty Members Received Distinguished Paper Award



Prof Lucienne Blessing and Assoc Prof Arlindo Silva from the EPD Pillar were recently honoured with the 'Distinguished Paper Award' at the 8th International Conference on Research in Design. The paper titled 'Innovation by Design – A new post-graduate programme at SUTD' describes their experience in implementing and running the new Master programme in Innovation by Design.

More information can be found [here](#)

Assoc Prof Dawn Tan Elected as Fellow Member of The Optical Society



Assoc Prof Dawn Tan from the EPD Pillar has been elected as a member of The Optical Society's (OSA) 2021 Fellows Class for her pioneering and significant contributions to CMOS-compatible nonlinear optics and integrated photonics, as well as sustained outreach to advance diversity and inclusion in optics.

The OSA announced the 118 members of the 2021 Fellows Class on 7 October 2020, and Assoc Prof Tan is one of four elected Fellows from Singapore. She is also one of 23 female members of the 2021 Class, which is the largest number of women ever elected in one year.

More information can be found [here](#)

Asst Prof Soujanya Poria Received 2020 IEEE CIM Outstanding Paper Award



Asst Prof Soujanya Poria from the ISTD pillar and his research team mates received the 2020 IEEE CIM Outstanding Paper award for their paper entitled '[Recent Trends in Deep Learning Based Natural Language Processing](#)', published in the IEEE Computational Intelligence Magazine. At SUTD, Asst Prof Poria continues to conduct studies in sentiment and commonsense aware multimodal dialogue systems at the DeCLaRe Lab.

More information can be found [here](#)



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