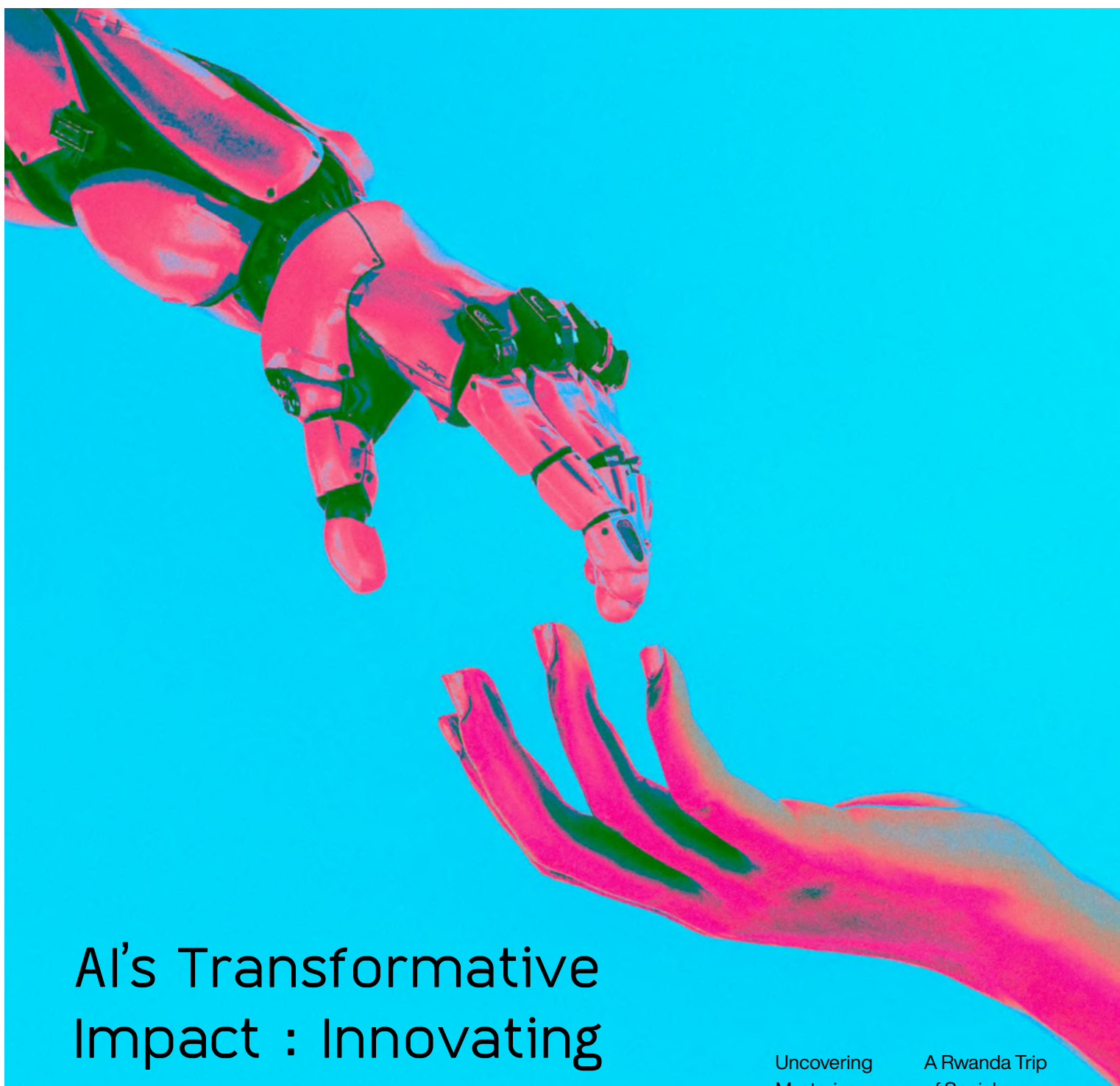


ExcelXImpact



AI's Transformative
Impact : Innovating
for a Better Tomorrow

Uncovering
Mysteries
of the Moon

A Rwanda Trip
of Social
Responsibility

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2024 Issue 15

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AI's Transformative
Impact: Innovating for
a Better Tomorrow



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President's Message



Jin-Guang Teng
President
The Hong Kong Polytechnic University

We find ourselves at a pivotal juncture in Hong Kong's development. The Chief Executive recently emphasised the significant role our city can play in supporting the country's progress by embracing the spirit of the Third Plenary Session of the 20th Central Committee of the Communist Party of China. This Session announced a comprehensive reform plan to advance the country's modernisation and high-quality development in the coming years.

PolyU has always been an enthusiastic supporter of integrating Hong Kong into the overall development of the country. Our latest initiative to establish translational research institutes in various cities across the Mainland to address their industrial and societal needs is a testament to this commitment. We are also proud to be contributing to Hong Kong's development as a global talent hub by recruiting outstanding academic talents from around the world through initiatives such as the Global STEM Professorship Scheme and the University's Strategic Hiring Scheme.

Beyond pursuing academic excellence, we are dedicated to nurturing socially responsible professionals and leaders who will drive positive change. Our flagship Service-Learning programme is instrumental in this endeavour, and I had the privilege of witnessing its impact firsthand by joining a PolyU delegation led by our Council Chairman Dr Lam Tai-fai to Rwanda recently. During our trip, we observed PolyU staff and students tirelessly engaged in Service-Learning projects to empower local communities, including installing solar panels to bring light to villages without electricity and improving the clothing-making skills of local residents.

As we move forward, PolyU will continue to harness its educational and research excellence to drive innovation and further propel the development of Hong Kong, the Nation, and the world. We are excited to play a part in shaping a brighter future for all.

Edge AI: The Smart Way to Build Smarter Cities

How Edge Computing and Artificial Intelligence enables cities' digital infrastructure and quality of life

Rainfall prediction...

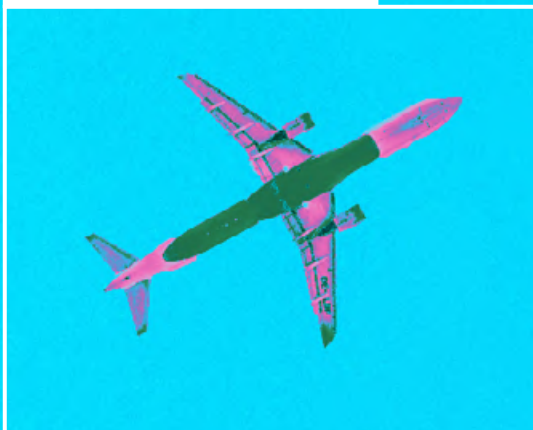


Warning:

Smoke detected



Curating inflight content...



Monitoring air quality...

AQI = 58
Moderate



Counting people...

87 people on level 18

The HKSAR Government's ambitious Smart City Blueprint for Hong Kong set out a host of far-reaching initiatives – from Smart Travel to Smart Environment to Smart Economy – all designed to transform Hong Kong from an iconic urban location into a world-class smart city. Professor Cao Jiannong is now leading a series of PolyU research initiatives to help realise that vision.

The smartest cities aren't necessarily the ones with the most gadgets, but those that use technology intelligently to improve the efficiency of organisations and quality of lives of citizens. Most smart city developments rely heavily on cloud connectivity and Internet-of-Things (IoT) technology to provide the infrastructure and scalability required to process vast amounts of data. But, according to Professor Cao Jiannong, Director of PolyU's Research Institute for Artificial Intelligence of Things (RIoT), that won't be enough for today's emerging and future smart city applications.

Edge computing takes centre stage

"Cloud computing runs computation tasks and applications on cloud servers in data centres, with all the data collected from end devices. That consumes network bandwidth, creates processing delays, and raises privacy concerns," Professor Cao said during a recent TechTalk hosted by the Hong Kong Academy of Engineering Sciences, entitled "Collaborative Edge Computing for Ubiquitous AI".

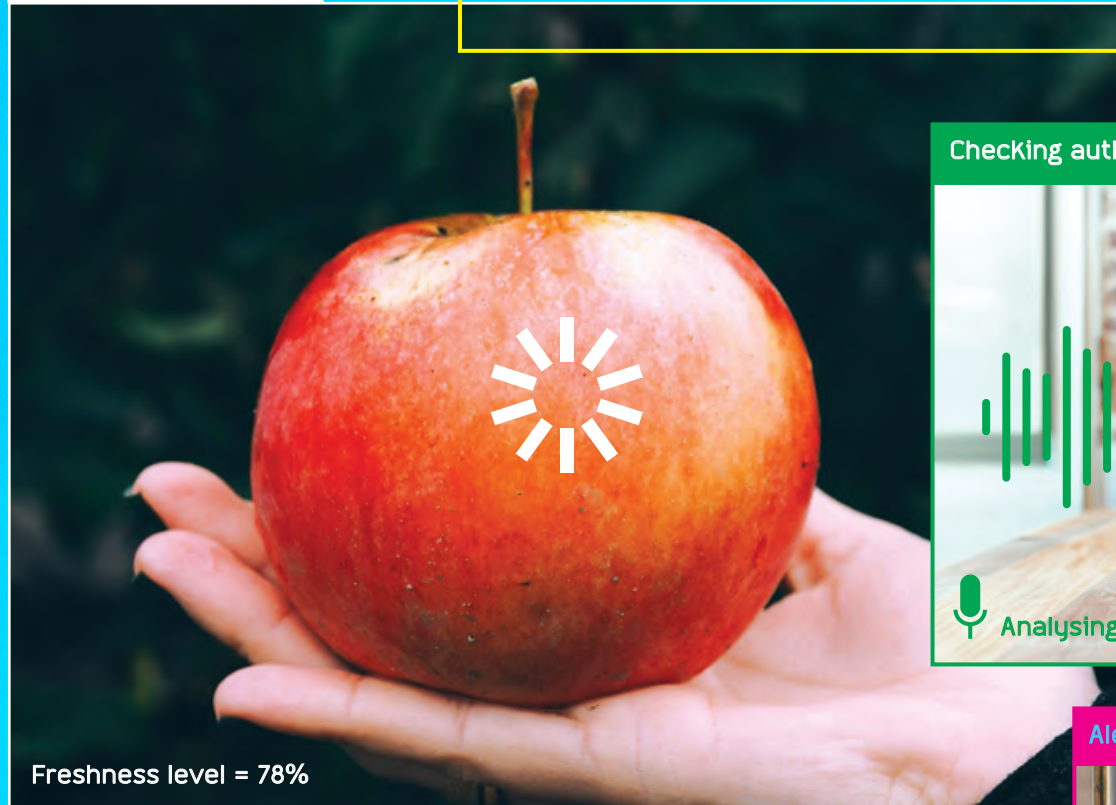
"Current centralised architectures can cause bottlenecks in the performance of systems and applications. Since 2021, edge computing has become the trend and the real battleground is now at the edge," he remarked.

"Edge computing pushes computation out to base stations, edge servers, and gateways at the periphery of the network. Offloading computation tasks from resource-limited IoT devices to more powerful, resource-rich edge nodes can lower costs, deliver results in real time, and preserve privacy."

When it comes to smart cities, the real game changer could be Edge AI, which enables distributed IoT devices to use embedded AI models to analyse data and make intelligent decisions autonomously. While IoT sensors and devices gather the data, AI analytics at the edge of the network identifies patterns, makes predictions, unifies data streams, and improves data quality.

"In this setting, AI computation is done near the user at the edge, close to where the data is located and used. It doesn't even need a network connection," Professor Cao said. "Through the fusion of IoT and AI technology in edge devices, smart cities could soon become even smarter."

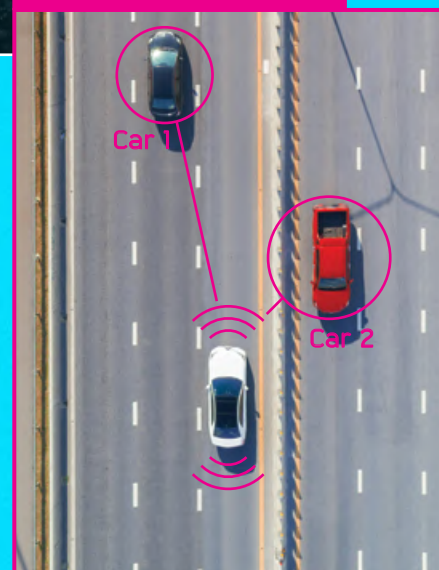
Analysing freshness...



Checking authenticity...



Alert: Mind the distance



Patient monitoring...



Edge AI-powered autonomous pipeline robots

Edge AI is also transforming how, where and when we use robots. Professor Cao and his team at RIAIoT recently showcased a novel, Edge AI-empowered robot designed to autonomously inspect critical underground pipelines, such as sewers and storm water drains.

Equipped with a high-resolution camera and a searchlight, the highly mobile six-wheeled device easily traverses horizontal and vertical pipe systems. While the previous generation of inspection drones required a communications link to a data centre, the RIAIoT design is completely autonomous.

"Conducting all of the data processing and control on the robot itself allowed us to replace manual detection with sophisticated machine learning intelligence that can automatically identify and classify defects. Therefore, our robot can provide convenient, intelligent, and effective service for current pipeline inspection," Professor Cao explained.

Inspecting pipeline...



Collaborative edge computing

Emerging advanced applications demand more computing power at the edge, and impose higher requirements in terms of real-time responses and intelligence. Professor Cao and researchers at RIAIoT are now working on developing the next generation of smart AIoT solutions, with the goal of overcoming obstacles to building a smart, connected society.

One of the most promising areas of interest is Collaborative Edge Computing, where cloud, edge and terminals join forces to support AIoT applications. Professor Cao and his team are pushing the development of smart city applications such as autonomous vehicles, industrial IoT and the metaverse, with a project entitled "High-performance Collaborative Edge Computing Enabling Smart City Applications: Framework and Methodologies". The study addresses key challenges, including large-scale resource management, performance-guaranteed task scheduling, resource-aware Edge AI and secure data sharing.

"This project aims to build a new smart city computing infrastructure, which is supported by Collaborative Edge Computing, including edge/cloud

collaboration, city-scale edge network deployment, and built-in AI services," Professor Cao explained.

Current initiatives include research into the "Efficient Scheduling of Integrated Cloud-Edge-End Computing Power for AI-enabled Applications." This project proposes a systematic framework for the management and scheduling of integrated-Cloud-Edge-End computing power to support resource-hungry and latency-sensitive AI-empowered applications, and contributing to the construction of the national computer power network.

More recently, large language models (LLMs) have attracted a lot of attention and shown great potential in AIoT applications. However, current LLMs heavily rely on cloud, and it is very challenging to deploy them on heterogenous edge devices. Professor Cao's team is developing a general edge-LLM inference framework using Collaborative Edge Computing.

"Ultimately, our work at RIAIoT will enable emerging advanced smart city applications to flourish in Hong Kong, and establish a first-mover advantage for the city in new computing infrastructure," he added.

Detecting defect...

Defect found: 0



Through the fusion of IoT and AI technology in edge devices, smart cities could soon become even smarter. //

Professor Cao Jiannong



Professor Cao Jiannong

- // Dean of Graduate School
- // Otto Poon Charitable Foundation
- Professor in Data Science
- // Chair Professor of Distributed and Mobile Computing
- // Director of Research Institute for Artificial Intelligence of Things
- // Director of University's Research Facility in Big Data Analytics

GeoAI is Changing Everything

From responding to disasters and combatting climate change, to keeping the global economy running

In 1972, the iconic “Blue Marble” photo taken by the crew of Apollo 17, fundamentally changed the way we think about our planet. Fast forward 50 years, and the flood of Earth observation (EO) data, coupled with dramatic advances in artificial intelligence, is transforming how the world does almost everything — from responding to disasters and combatting climate change, to keeping the global economy running smoothly.

Image generated with AI

Known as Geospatial Artificial Intelligence (GeoAI), this emerging field combines the vast amount of data received daily from satellites, aircraft, and ground-based sensors with robust computing and AI solutions. By uncovering hidden patterns and predicting trends, this fusion of technologies presents remarkable and transformative possibilities in numerous critical areas.

GeoAI can pinpoint connections between environmental factors and disease outbreaks, facilitating the creation of more efficient public health strategies. At the same time, it can make cities more liveable, by helping planners optimise infrastructure by forecasting population growth and movement patterns. GeoAI can also help emergency responders save lives by predicting potential disaster scenarios and providing best rescue routes and response strategies, well ahead of time.

The World Economic Forum believes that the integration of AI with cost-effective, high-performance computing will revolutionise EO data analysis, in a similar way to how large language models (LLMs), such as ChatGPT, have transformed text processing. Businesses are keenly exploring the potential of GeoAI in driving growth, particularly in areas like carbon credits trade, improved logistics, efficient supply chain management, and precisely predicting and targeting consumer behaviour.

Harnessing the potential of GeoAI

PolyU is leading the way in unlocking the potential of GeoAI and spearheading its advancement, creativity, and acceptance. Professor Weng Qihao, the University's Chair Professor of Geomatics and Artificial Intelligence founded the Research Centre for Artificial Intelligence in Geomatics (RCAIG), with the aim of establishing PolyU as an internationally recognised GeoAI research and development hub.

RCAIG concentrates on creating novel and inventive AI approaches and technologies for geomatics, focussing specifically on their implementation in urban areas.

“Earth observation is important as a guiding compass for understanding changes in the environment and society. Our research focuses on diverse fields, including geospatial big data and AI, remote sensing, ground-based sensors, navigation and positioning, surveying and geodesy, laser scanning and photogrammetry. These technologies play a crucial role in addressing and resolving key issues,” said Professor Weng, who was recently awarded the 2024 American Association of Geographers (AAG) Wilbanks Prize for Transformational Research in Geography, and the 2024 AAG Remote Sensing Specialty Group Lifetime Achievement Honor Award for his groundbreaking contributions in geography and remote sensing.

A satellite collecting Earth Observation data

Analysing urbanisation impacts

Cities are an obvious focal point for many aspects of human activities and progress. These include the development of safe, efficient, and economically viable urban infrastructures, environmental conservation, and mitigating the effects of climate change. GeoAI is perfectly placed to transform all these areas.

According to Professor Weng, GeoAI has a crucial role to play in increasing urban resilience and improving public health. “Satellite observations are invaluable tools that help us understand the impact of events, such as extreme heatwaves, and support informed decision-making. Real-time data acquisition also facilitates prompt action to challenges, like traffic congestion, air quality, natural disasters, population movement and urban land use monitoring,” he said.

GeoAI is already revolutionising building monitoring. By automatically learning thousands of parameters, such as size, shape, and colour, it can easily detect the appearance of illegal structures, identify disaster-damaged buildings, and estimate a building's energy consumption.

RCAIG has now developed a model that can simulate the impact of changes in urban development using data from satellite imagery. “Characterising the historical pathways of urban area growth under different levels and pathways of urbanisation, our model captures the dynamics of urban sprawl more effectively and offers more detailed insights than traditional binary classification models — at regional and even global levels,” Professor Weng explained.

Tackling moving targets

GeoAI excels in addressing dynamic challenges like traffic congestion. The fusion of machine learning and deep learning enables rapid analysis of complex data. This unlocks a multitude of fresh opportunities, including the ultimate goal for contemporary highway managers — real-time traffic management.

By integrating diverse data types such as text, images, videos, and knowledge graphs, the longstanding aspirations of precise traffic flow predictions, automated route optimisation, proactive accident alerts, and efficient long-term traffic network planning become a genuine reality. By integrating smart traffic and smart city technologies, we can create a safer environment for pedestrians, particularly in vulnerable areas like school zones. By leveraging real-time data, connected systems, and intelligent infrastructure, cities can significantly reduce the risk of pedestrian accidents and enhance overall traffic safety.

GeoAI makes real-time traffic management possible.



Professor Weng Qihao

/// Chair Professor of Geomatics and Artificial Intelligence, Department of Land Surveying and Geo-Informatics
/// Director of the Research Centre for Artificial Intelligence in Geomatics



GeoAI could help mitigate the “Triple Planetary Crisis”.

GeoAI has the potential to revolutionise environmental monitoring, management, and decision-making by providing critical insights and predictions. //

Professor Weng Qihao

The RCAIG research team has put GeoAI theory into practice with the development of MAMR – a multi-agent order matching and vehicle repositioning solution that offers ride-hailing platforms a way to enhance the overall efficiency of their services.

“By assigning orders to available vehicles, and strategically deploying idle vehicles to regions with potentially high demand, operators can achieve dramatic results, including major reductions in passenger rejection rates and driver idle time,” said Professor Weng.

Addressing global environmental challenges

Climate is often cited as the world's most pressing problem. However, the United Nations believes we face an even bigger challenge from interconnected environmental issues – climate change, nature and biodiversity loss, and pollution – which it calls The Triple Planetary Crisis. The organisation is also convinced that “AI can make a difference”.

Professor Weng agrees wholeheartedly. “GeoAI has the potential to revolutionise environmental monitoring, management, and decision-making by providing critical insights and predictions. As the field continues to evolve, we can expect to see even more innovative applications of GeoAI in environmental conservation and sustainability,” he said.

RCAIG's research combines advanced AI techniques like deep neural networks, with remote sensing methods, to detect and track changes in habitats and deforestation patterns. Additionally, it is monitoring the crucial role that carbon uptake by vegetation plays in combating climate change, with the goal of developing effective mitigation strategies.

“Leveraging the latest geospatial technology and artificial intelligence, PolyU stands at the forefront of addressing global environmental change and societal challenges. Encompassing a wide spectrum of subjects in the fields of earth observations and geoinformatics, RCAIG is helping us to understand and address the impacts of extreme climate change,” Professor Weng concluded.

When Infectious Diseases Resist Drugs

AI platform developed in-house to help find new drugs

It is estimated that bacterial antimicrobial resistance (AMR) was directly responsible for 1.27 million global deaths and contributed to 4.95 million deaths in 2019. By 2050, antimicrobial infections are projected to cause 10 million deaths worldwide, outracing cancers, and the World Bank estimates that AMR could result in US\$1 trillion additional healthcare costs. No doubt, AMR is a top threat to global public health and development.

Antimicrobial resistance (AMR) happens when microorganisms such as bacteria, viruses, fungi, and parasites develop the ability to resist drugs that were once effective against them due to mutations or acquired drug-resistant genes.



Dr Ma Cong

// Associate Professor, Department of Applied Biology and Chemical Technology
// Co-founder, Ynno Med Limited

Dr Ma Cong, Associate Professor of the Department of Applied Biology and Chemical Technology, is braving deadly microorganisms to find a cure. With an award-winning AI-assisted platform, Dr Ma is steering Ynno Med Limited, a PolyU drug research startup company he co-founded, to accelerate the discovery of novel antimicrobials while suppressing resistance generation, all at a low cost.

Quick search and accurate analysis

Drug discovery using traditional methods can be a time-consuming process. However, with the help of deep learning algorithms, AI can quickly and accurately analyse large sets of genomic, proteomic, and clinical data to identify potential targets. It can also evaluate diverse bioactive structures to generate new molecules and learn from these structures to predict the best drug candidates with optimal bioactivity, safety, and drug-likeness.

The deployment of Ynno Med's in-house developed AI-assisted platform significantly shortens time, streamlines processes, and ultimately reduces costs and failure rates involved in the discovery and pre-clinical stages of drug development.

The startup has pioneered the development of bacterial transcription inhibitors as new antimicrobial agents. A new class of cutting-edge antibiotic agents protected by patents have been developed and proven to effectively combat drug-resistant pathogens. These antibiotics show great potential for use in clinical settings.

First-in-class antimicrobial medicines made in Hong Kong

Ynno Med has formed a strategic partnership with Shanghai Pharmaceuticals Holding to expedite

the approval process of the new drugs in Mainland China.

"The world is so desperate for novel antibiotics that regulatory bodies are under enormous pressure to accelerate their approval process," Dr Ma said. "We target to obtain accreditation for the new product from the drug administration agencies in Mainland China and USA, and to commence clinical trials in 2026."

Earlier in June, Dr Ma led Ynno Med to participate in the BIO International Convention 2024 in San Diego, USA. As the world's largest and most comprehensive event for biotechnology, the convention provided an ideal platform for Ynno Med to unveil its groundbreaking drug candidates.

"Our goal is to design, develop, and distribute first-in-class antimicrobial medicines made in Hong Kong," Dr Ma said.

Ynno Med also gained international acclaim by winning the Science Breakthrough of Year 2023 in the Falling Walls Science Summit, a global platform held in Berlin, Germany, which provides a stage for pioneering science-based startups to prove how their entrepreneurial solutions can help solve today's most pressing challenges. Additionally, the company was selected to be featured on Nature's website as one of the six science startups representing the "next generation of groundbreaking scientists".

"Being the only winner from Hong Kong and the only biotech from Asia for this science startups award, we consider this to be an encouragement and recognition of Hong Kong's prowess on the international stage. Through this opportunity, we aim to demonstrate our dedication to knowledge transfer from the University and make impactful contributions to society," Dr Ma said.

Web 3.0 AI: Transforming the Future of Business

Research collaboration to
unlock the potential of AI
and tokenisation technology

Web 3.0 is the future of the internet. At its core lies decentralisation, which means users can take better control of their online experience and data privacy. When Web 3.0 meets AI, the powerful synergy can provide businesses with unmatched security and intelligence. PolyU's Faculty of Business (FB) is at the forefront of exploring the possibilities.

Blockchain
is a distributed digital ledger that stores data of any kind. It keeps track of who owns what and when via a secure, transparent network of transactions.

Tokenisation
is the process of converting real-world assets, such as stocks, bonds, or real estate into digital tokens that can be traded on a blockchain platform.

The PolyU-OSL collaboration is paving the way for a future where blockchain is a cornerstone of innovation.



Research partnership harnessing security token offerings

The Centre has set a mission to develop and make use of new blockchain technologies and innovations to increase efficiency and cost-effectiveness in financial market infrastructure and capital markets – including RWA tokenisation as a channel for financial product issuance, asset allocation and even capital raising.

As Hong Kong's first SFC-licensed digital asset platform, OSL Digital Securities is at the cutting edge of research and innovation in the area of security token offerings (STOs). Its commitment to excellence and industry advancement makes it an ideal collaboration partner to make digital assets more accessible and useful in everyday life, with the potential to transform investment and capital markets.

Setting the stage for a new digital revolution

Besides exploring the frontier of what blockchain technology can achieve, the research centre serves as a platform for education. The partnership aspires to improve the public's understanding of Web 3.0 AI and tokenisation by organising joint initiatives, workshops, and outreach programmes, thereby empowering more people to use these new digital technologies.

It also seeks to boost students' career prospects in the industry by offering them experiential learning of and real-world exposure to the dynamic landscape of the digital era.

Professor Brian Kei, Professor of Practice (Fintech) of the School of Accounting and Finance said, "This groundbreaking partnership will shape the future of AI and tokenisation in Hong Kong. Synergising the strengths of both parties, the Centre will contribute to innovation and revolutionise the capital markets."

Based on blockchain technology, Web 3.0 offers a decentralised environment where users will have more control over their own data and identity, and can access more diverse and trustworthy information and services. Integrating Web 3.0 with AI can help businesses streamline operations, raise customer satisfaction, upgrade data security, automate processes, and discover new business models, among other functionalities that enhance digital transformation.

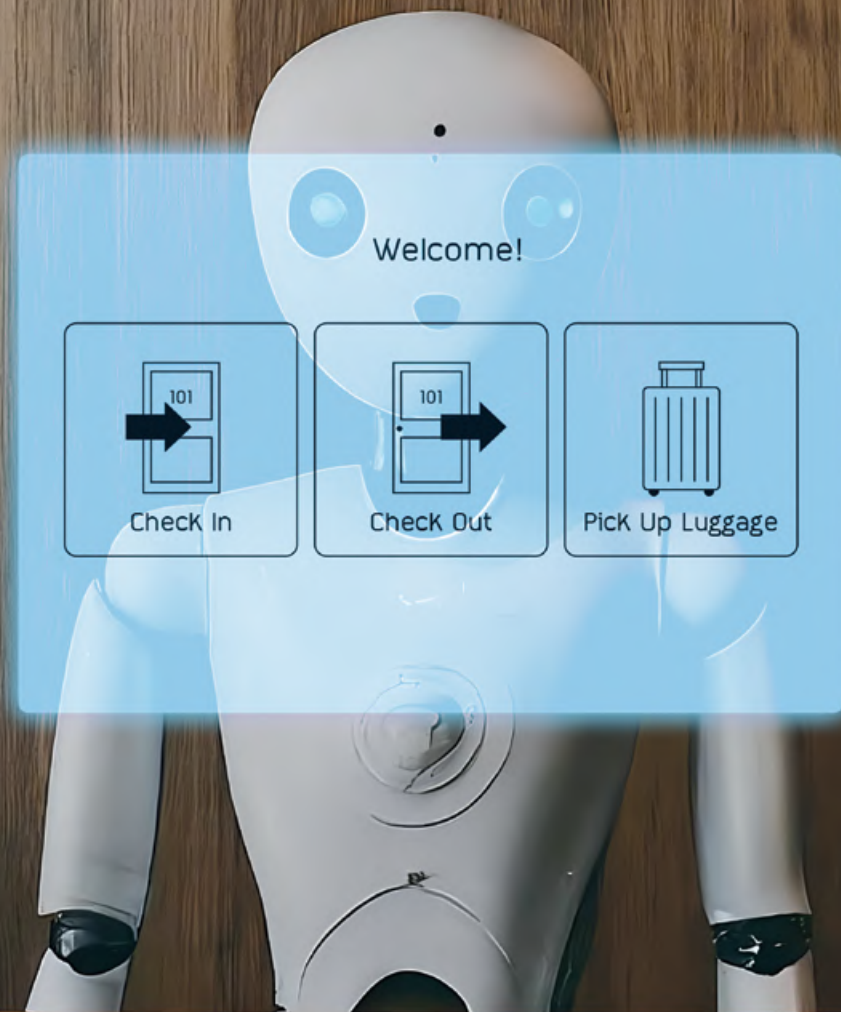
A pioneer of cutting-edge research in business, FB has recently joined forces with OSL Group, listed on the Main Board of The Stock Exchange of Hong Kong, and operator of Hong Kong's first licensed digital asset trading platform, to establish the "OSL-PolyU Faculty of Business Research Centre for Web 3.0 AI". The Centre specialises in the tokenisation of real-world assets (RWA).

Professor Brian Kei Chi-wing
// Director of the OSL-PolyU Faculty of
Business Research Centre for
Web 3.0 AI
// Professor of Practice (Fintech),
School of Accounting and Finance



As the OSL-PolyU collaboration unfolds, it will send a subtle yet powerful message: anticipate, engage, and be part of the digital transformation. By collaborative research on related technologies and actively addressing the challenge of mass adoption, FB and OSL are setting the stage for a new digital revolution.

AI-powered
service robots
as concierges



Travelling with AI

AI is transforming the tourist experience, and how the industry delivers it

When was the last time you went on a trip? From searching for a destination and picking a hotel to enjoying a scenic spot and sharing travel photos, did you know that artificial intelligence (AI) was in place to work for your convenience and fulfillment?

Image generated with AI

The tourism and hospitality industry is undergoing a digital transformation with the integration of AI, leading to increased automation, personalisation, and smart recommendations for tourists. Behind the scenes, industry professionals are using AI for tourism demand and sentiment analysis with a view to providing an enhanced customer experience.

Calling for new theories and methods

According to Professor Song Haiyan, Director of the Research Centre for Digital Transformation of Tourism (RCDTT), the decision-making process for tourists is now heavily influenced by web search information, reviews, ratings, travel blogs, photos, and interaction in Internet communities.

“New interdisciplinary theories are needed to understand how these factors affect tourism demand,” Professor Song said. “For example, the emotional contagion theory borrowed from psychology can to a certain extent help researchers understand how the sentiments brewing in online discussion forums affect demand.”

New methods have also been employed to forecast tourism demand. A comprehensive review of forecasting methodologies and their evolution conducted by Professor Song in 2019 found that AI techniques have been widely used over the past 20 years in tourism demand forecasting.

“More and more AI models which have significant advantages in processing large-scale data, such as convolutional neural networks and long short-term memory networks, are being applied to tourism demand forecasting with excellent results,” Professor Song added.

Enhancing customer experience

AI is also shaping customer experience in the travel industry – from facial recognition for check-ins to travel assistants for personalised travel planning to robots for concierge services.

Recently, RCDTT established under the leadership of the School of Hotel and Tourism Management (SHTM) signed a memorandum of intent for cooperation with Yunji Technology, a major hotel robots provider. Both parties will collaborate on the research of SHTM's important project “Artificial Intelligence and Robotics Technology to Improve Business Operation Efficiency and Consumer Experience”, which promotes the use of service robotics in the hospitality and tourism industry in Hong Kong.



Professor Song Haiyan

Mr and Mrs Chan Chak Fu
Professor in International
Tourism
Associate Dean and Chair
Professor, School of Hotel
and Tourism Management
Director of the Research
Centre for Digital
Transformation of Tourism

Yunji owns more than 400 invention patents in the fields of robot movement and IoT control. Both parties will give full play to their academic, technical research, and industrial application advantages in the field of AI+robots.

Trust in AI

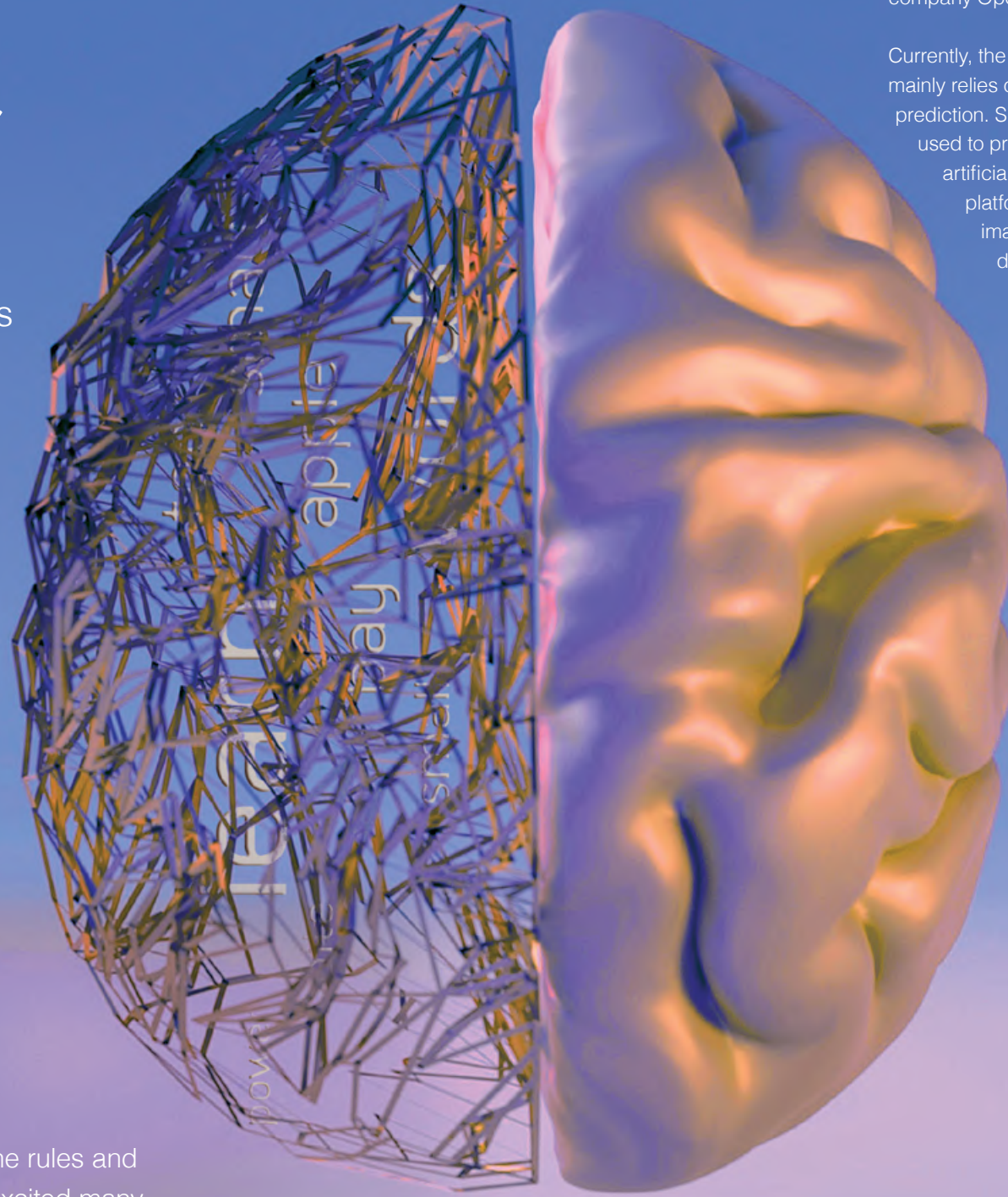
AI's prevalence in the industry impacts AI-employee collaboration, creating value for businesses and customers. A recent study by Professor Kaye Chon, Dean and Chair Professor of SHTM, highlights AI's positive role in employees' autonomy and work outcomes. The findings offer suggestions for hotel practitioners to help potential employees experience the benefits of human-AI interaction in the workplace.

While AI has many opportunities to offer, Professor Song emphasises the importance of retaining the human-centric nature of tourism. “In a heavily automated environment powered by AI, we must not lose sight of the essence of hospitality, the human touch,” he remarked.

Making AI Smarter

Training AI models like humans can inspire studies on the human brain

The amazing power of AI to learn the rules and patterns of human languages has excited many people. But for Professor Li Ping, Dean of the Faculty of Humanities and Sin Wai Kin Foundation Professor in Humanities and Technology, it is even more exciting to find an improved way to train Large Language Models (LLMs) to process language and perform like human brains.



LLMs are AI models pre-trained on a vast amount of data to become capable of generating human-like languages. An example of LLMs is ChatGPT, a chatbot developed by the company OpenAI.

Currently, the pre-training of LLMs mainly relies on contextual word prediction. Similar methods are used to pre-train many generative artificial intelligence (GenAI) platforms, which can generate images, videos and other data apart from text in response to written prompts, to process

language. However, word prediction is only one of the ways the human brain deals with language. Humans also integrate high-level information, such as words, sentences, and the larger context of the narrative in natural language to fully comprehend a discourse.

Sentences are better than words

The PolyU research team led by Professor Li Ping investigated the use of next sentence prediction (NSP) in training LLMs. They found that LLMs trained with NSP matched human brain activity in multiple areas much better than those trained only with contextual word prediction. This is because the NSP task required the LLMs to understand the connections between sentences. The improved model with the NSP mechanism also nicely maps onto established neural models of human discourse comprehension.

The results, on the one hand, enable researchers to stimulate LLMs' discourse comprehension through NSP, helping AI get closer to the human cognitive process. On the other hand, they also give new insights into

The recent study on training LLMs led by Professor Li Ping gave insights into brain studies and the development of AI models.



how human brains process language. For example, scientists can better understand how the brain processes full discourse such as conversations.

Inspiring researchers in AI and neurocognition

Professor Li said, "Our findings suggest that diverse learning tasks such as NSP can improve LLMs to be more human-like, and potentially more efficient like the human brain without needing a massive amount of data. The study can also bring about interactions and collaborations between researchers in AI and neurocognition. This will stimulate future studies on AI-informed brain and brain-inspired AI."

The study conducted by Professor Li and his team has been published in the academic journal *Science Advances*.

Research Centre Founded to Aid AI Model Training

PolyU has established the Centre for Large AI Models (CLAIM) under the Research Centre for Data Science and Artificial Intelligence to meet the high demand for computing resources necessary for training large AI models with the primary objective to provide PolyU researchers with the essential infrastructure to train AI models effectively.

While fostering advancements in AI research and application across art, science, engineering, and other fields, CLAIM will also play a crucial role in promoting the sharing of AI technology within the University.



Professor Li Qing *left*

// Co-director of CLAIM

// Chair Professor of Data Science and Head, Department of Computing

Professor Zhang Lei *right*

// Co-director of CLAIM

// Chair Professor of Computer Vision and Image Analysis, Department of Computing

Nurturing Future-ready Professionals in Emerging Technologies

PolyU students are getting prepared for the technology-driven future

We are experiencing significant technological advancements that are reshaping our daily lives and careers. The development of technologies such as artificial intelligence (AI), data science and Web 3.0 is impacting many industries. As AI and other emerging technologies become more integrated into the workplace, students must prepare themselves with essential technical knowledge and skills to prepare for the future.

PolyU students are getting future-ready for the technology-driven world thanks to the University's many well-planned initiatives, including:

Mandatory courses

All PolyU undergraduates must fulfil the mandatory "Artificial Intelligence and Data Analytics" and "Innovation and Entrepreneurship" requirements to understand the cutting-edge technologies and mindset needed to navigate the modern technological landscape. They can also enrol in these programmes as their Secondary Major or Minor.

New department

At the same time, a new Department of Data Science and Artificial Intelligence has recently been established as a constituent academic department under the Faculty of Engineering. The department will strengthen PolyU's position as a leader in the teaching and application of AI-based technologies in the world.

Integrating AI in teaching and learning

In addition, the University leverages advanced educational technologies such as Generative AI, virtual reality, augmented reality, and robotics for students and staff to explore and apply in learning, teaching, and research. The Institute for Higher Education Research and Development (iHERD) was established in 2023 to pioneer higher education research and

development, with a particular focus on the integration of AI in education.

Immersive learning experiences

PolyU students have the opportunity to gain special learning experience in the Hybrid Immersive Virtual Environment (HiVE), known to be the world's first fully immersive hybrid classroom, which represents a groundbreaking development in educational technology. The virtual training environment enables students to experience and practise critical hands-on skills in realistic scenarios such as fire outbreaks, medical procedures, and aircraft maintenance that are not easily accessible in the actual world.

Programmes related to emerging technologies

Students enrolling to PolyU have many programmes to choose to develop their expertise in cutting-edge technologies. Some examples include:

- ✓ Master of Science in Artificial Intelligence and Big Data Computing
- ✓ Master of Science in Blockchain Technology
- ✓ Master of Science in Generative AI and the Humanities
- ✓ Master of Science in Metaverse Technology
- ✓ Bachelor of Science (Honours) in Artificial Intelligence and Information Engineering
- ✓ Bachelor of Science (Honours) in Financial Technology and Artificial Intelligence



Students will gain a unique and immersive learning experience at HiVE.

Research and innovation for undergraduates

Since 2021/22, undergraduates have had the opportunity to undertake research projects under the guidance and supervision of experienced scholars through the Undergraduate Research and Innovation Scheme (URIS). These projects cover a diverse range of areas including Business, Engineering, Design, Linguistics, Medical Laboratory Science, Nursing, and Rehabilitation Sciences. Through URIS, students' academic curiosity and enquiry-based learning are strengthened.

PolyU's commitment to nurturing future-ready graduates is evident in its innovative educational initiatives. By equipping students with a strong foundation in emerging technologies, PolyU prepares the next generation of tech-savvy professionals to thrive in an increasingly technology-driven world.

From Fashion to Electricity: A Meaningful Service-Learning Journey in Rwanda

PolyU has pioneered the integration of social responsibility and civic engagement into undergraduate education through its flagship Service-Learning initiative. This summer, more than 110 PolyU students and staff embarked on a transformative mission to Rwanda, installing solar power systems and sharing clothing-making and design skills in rural villages.



Dr Lam Tai-fai, Council Chairman (left); Professor Jin-Guang Teng, President (back row, second from right); and Professor Ben Young, Vice President (Student and Global Affairs) (back row, right), hope that PolyU's Service-Learning project in Rwanda will have a positive impact on the local community and children.

This exceptional journey was conducted under the "Wong Tit Shing Sustainability Education Project: Habitat Green in East Africa" programme, a highlight of PolyU's Service-Learning initiatives. Students applied classroom knowledge to address real-world challenges, supporting local communities, expanding their global perspectives while discovering the essence of social responsibility.

Now in its 11th year, the programme featured two projects: installing solar power systems and launching a new fashion design project. After completing lectures and training in Hong Kong, participants spent two weeks in rural Rwandan villages, successfully delivering these services at the end of July.



Watch video

Harnessing solar power

Students from the Service-Learning subject offered by the Department of Electrical and Electronic Engineering and the Department of Computing formed an impressive team to install solar power systems. Marcus Wan Long-ting, a first-year Bachelor of Science (Honours) in Radiography student, was among the 47 PolyU students involved. They also taught local youth how to install, repair and fix solar panels, enabling them to access sustainable green energy.

"It is my first time in Africa. Everything felt like a challenge at first, but I quickly adapted to the culture, language, and even the diet!" Marcus said.

Rwanda's breathtaking landscape, known as "the land of a thousand hills", presented unique challenges. The stunning scenery made visiting hillside houses difficult. Students often trekked

The PolyU senior management delegation led by Dr Lam Tai-fai, Council Chairman; alongside Professor Jin-Guang Teng, President; Professor Ben Young, Vice President (Student and Global Affairs) and Professor Kwok-yin Wong, Vice President (Education), joined the staff and students in the services to show their support and encouragement.



PolyU students and the locals are thrilled when the lights come on after fixing the solar panels!

long distances uphill under the blazing sun, carrying solar panels and a full set of equipment.

Marcus and his team, alongside a local community college student, worked up a sweat setting up solar power systems for nearly twenty houses in two weeks. Their dedication, combined with the efforts of students, staff and local partners, brought solar power to over 400 impoverished families.

These systems provide the villagers with lights and basic electricity, connecting them to the world through radios and mobile phones.

Before this summer, PolyU's Service-Learning projects had already installed solar panels for over 1,200 Rwandan homes. Marcus reflected, "This journey changes how I see myself. I am now braver and prepared to take on challenges I never imagined."

Reflecting on her visits to the rural villages, Dr Grace Ngai, Head of PolyU's Service-Learning and Leadership Office, shared, "City dwellers take for granted turning on the lights when they get home, but for villagers in rural areas, returning home brings fear because they cannot see in the dark." In many remote villages, people have never experienced artificial light, describing the illumination provided by PolyU students as "a gift from the heavens".



A beneficiary of the solar project shared, "It used to be difficult for us. Entering the house in the dark felt dangerous, as if a snake could bite us. Now, with the solar system, I am relieved and no longer scared of snakes."

A creative remake of authentic customs

In a village school, students from the Service-Learning subject offered by the School of Fashion and Textiles collaborated with local artisans using vibrant Rwandan fabrics. This project, debuting in Rwanda, aimed to enhance villagers' clothing-making skills by transferring knowledge and skillsets in textile arts. Students prepared designs in Hong Kong, purchased local fabrics in Rwanda, and co-created stylish outfits and accessories with the local community, blending the ethnic traditional elements with modern design.

Karly Wong Kai-yu, a first-year Bachelor of Arts (Honours) Scheme in Fashion student, said, "The Programme is about exchanging fashion knowledge. We teach them how to use tech packs to increase income and communicate with factories." Ashlee Lee Pui-shuen, another student, added, "The patterns they taught us to draw are quite different from what we learned. They use a simpler way and need less data, making it easier for us to sew that we had never imagined."



Mr Wang Xuekun, Chinese Ambassador to Rwanda (seventh from right) and Professor Kwok-yin Wong, Vice President (Education) (fourth from right), joined the community celebration and fashion show, sharing their happiness with PolyU students and staff, as well as the local community.



PolyU students teamed up with local tailors and community school students to make clothes for themselves and for a community mama, proudly showcasing their design at a fashion show.

Rwandan fabrics, known for their vibrant colours and exotic patterns, became the canvas for our students' creativity and the local artisans' craftsmanship. Collaboratively, they designed garments for a community 'mama' and themselves, culminating in a fashion show to showcase their creations and celebrate the project's success.

A service recipient of the fashion project shared, "Collaborating with these students provided us with a wealth of knowledge. We didn't know that mixing different cloth materials could produce beautiful colours. Now, we will be mixing these cloths to create new designs for different clients."

I saw our students deeply engaged in building solar power systems and teaching local villagers how to sew and design clothes. I believe this is greatly beneficial for both our students and the local community. I hope these skills will help them earn a living, bring them a better future, and contribute to the development of Rwanda.

Dr Lam Tai-fai,
Council Chairman of PolyU

Service-Learning: an integrated experiential learning pedagogy

PolyU's projects in Rwanda are part of its extensive Service-Learning offerings, featuring over 110 subjects in the 2023/24 academic year. As the first local university to embed social responsibility and civic engagement into its undergraduate curriculum, PolyU has seen over 42,000 students participate in Service-Learning since 2012, dedicating more than 1.68 million service hours to communities in China, Cambodia, India, Indonesia, Japan, Kazakhstan, Kyrgyzstan, Myanmar, the Philippines, Rwanda, South Africa, Thailand, Vietnam, and other areas.

The Service-Learning and Leadership Office collaborates with academic units to provide diverse opportunities,



Dr Lam Tai-fai, Council Chairman (front row, second from right); Professor Jin-Guang Teng, President (second from left); Professor Ben Young, Vice President (right); led a 100-strong team to Rwanda, hoping that PolyU students and staff can help improve the lives of villagers through the Service-Learning projects.

educating students about social issues, nurturing a global outlook, and empowering them to apply classroom knowledge in real-world settings. Students from different disciplines can choose from a wide array of Service-Learning subject options taught by more than 30 academic units.

The University is dedicated to advancing Service-Learning and nurturing youth leadership, preparing students to become civic-minded professionals. Equipped with leadership skills, cross-cultural capabilities, a global perspective, and a heart to serve, students at PolyU are well poised to make a meaningful impact in Hong Kong, the Mainland, and beyond.

PolyU's Service-Learning Programme

Since 2012
>42,000
students contributing

Since 2012
>1.68M
hours of service to communities around the world



Imbued with the Olympic Spirit

Students excelling in sports and other areas have special opportunities for admission and support



Cheung Ka-long

Cheung Ka-long's spectacular triumph in winning the Gold medal for Men's Individual Foil at the Paris Olympics is the latest testament to his extraordinary talent and unwavering dedication. He, alongside Karen Tam Hoi-lam and Felix Diu Chun-hei, two PolyU elite athletes who made their way to the Games, has demonstrated the Olympic values of striving for excellence to become the best one can be.

The achievements of these distinguished sportspersons not only serve as an inspiration to the University's students, staff, and alumni, but also resonate with PolyU's commitment to promoting a sports culture on campus.

Ka-long has etched his name in history by achieving victory in the same event at two consecutive Games. Acknowledging his exceptional achievements and influence that transcends the realm of sports, PolyU conferred upon him an honorary Doctor of Humanities in 2022. This prestigious accolade not only celebrates Ka-long as a sporting icon but also highlights his profound impact both on and off the sports arena.



Felix Diu

PolyU athletes in Paris Olympics

Ka-long is not the only PolyU member who competed in the Paris Olympics. Karen, a Master's student in Rehabilitation Sciences, participated in the Women's 4x100m Freestyle Relay and Women's 4x100m Medley Relay. In the last Asian Games in 2023, she clinched two bronze medals in the same events. Karen also represented Hong Kong to compete in the Tokyo Olympics in 2021.

Felix, an alumnus of the School of Accounting and Finance, was Hong Kong's sole track and field athlete at this year's Olympics. He became only the third Hong Kong sprinter ever to compete in the 100m race at the Games. In his Olympic debut, Felix demonstrated remarkable composure and focus under pressure, showcasing the qualities fostered during his time at PolyU.



Karen Tam

\\ Dedication and hard work are the keys to achieving your goals. Believe in yourselves and become the best version of you. //

Karen Tam

\\ Persevere and believe in yourself. //

Felix Diu

Student-Athlete Learning Support and Admission Scheme

Hong Kong student-athletes would have noted PolyU has a long-standing tradition of nurturing the development of local sports talent. To provide opportunities for outstanding student-athletes to study at PolyU while continuing their pursuit of excellence in sports, PolyU launched the Outstanding Sportsmen Recommendation Scheme (OSRS) in 1998.

To take its commitment a step further, PolyU has been participating in the Student-Athlete Learning Support and Admission Scheme (SALSA) initiated by the University Grants Committee as a sub-scheme of OSRS since the 2022/23 academic year.

Students admitted through SALSA will receive a scholarship with the maximum amount of HK\$400,000 during their studies and other support from PolyU, including individual academic consultation, flexibility in learning and study arrangements, and extension of study periods.

In the current year, 13 outstanding student-athletes have enrolled to PolyU's undergraduate programmes through SALSA, including

- ✓ Hong Kong Premier League player Poon Pui-hin - Bachelor of Arts (Honours) Scheme in English and Applied Linguistics
- ✓ Squash athlete Leung Ka-huen - Bachelor of Science (Honours) in Physiotherapy

✓ Wushu player Tai Lok-ming - Bachelor of Arts (Honours) Scheme in Applied Social Sciences (Social Work / Social Policy and Social Entrepreneurship)

Supporting students with special talents

PolyU offers scholarships to student-athletes to recognise their sports achievements. To support their talent and holistic development, the University also provides them with residential college accommodation imbued with a vibrant living and learning experience.

One of these arrangements is the STARS Residential College established under the Special Talents Admission and Recognition Scheme (STARS). Through STARS, PolyU offers favourable admission consideration to outstanding students with special talents not only in sports, but also in arts and culture, leadership and community services, and STEM.

STARS students residing in the residential college gain the University's support to participate in various competitions, and can join training sessions, coaching, mentoring, and action learning projects, helping them to become future leaders and lifelong learners.

In delivering the best holistic education for the benefit of society, PolyU will continue to render its full support to students with diverse special talents to help them grow and shine.



Poon Pui-hin



Leung Ka-huen



Tai Lok-ming

An Enchanting Showcase of Chinese Arts and Culture

The University has organised the PolyU Chinese Culture Festival to showcase the splendour and importance of diverse facets of Chinese culture. At the heart of the Festival lies the mission to inspire and engage the younger generation, strengthen a sense of pride and belonging to the Nation, and contribute to the development of Hong Kong into an East-meets-West centre for international cultural exchange.

Since the launch of the Festival in March 2024, PolyU successfully organised various exhibitions showcasing Chinese traditional porcelain, embroidery, indigo dyeing, and other captivating art forms as the themes for the Festival. Through the workshops, University members and the wider community were also captivated by the intricate beauty and profound richness of Chinese traditional art, as well as gaining insights into the unwavering enthusiasm and tireless efforts demonstrated by the artists.



Officiating at the Opening Ceremony: Dr Choi Yuk-lin, Secretary for Education of the HKSAR (centre); Dr Lam Tai-fai, PolyU Council Chairman (fourth from left); Professor Jin-Guang Teng, PolyU President (fourth from right); and senior members and representatives from the co-organisers including Tiangong University, Zhejiang Industry & Trade Vocational College and the Hong Kong Palace Museum.

Artworks Exhibition of the International Innovation Centre of Chinese Traditional Culture and Artistry Inheritance

Eight artists from Tianjin were invited to display their artworks. The exhibition featured the works of HuLian Art Studio (Professor Zheng Yong's Studio), three unique intangible cultural heritages of Tianjin (Clay Figurines Zhang, Tianjin Kite Wei, and Yucheng Hao New Year Painting), Hezhen Handmade Incense, Guanzhao Xuan, Zhao's Gourd-making, and Tianjin Musical Instrument Zhang.

The pottery lacquerware by Professor Zheng Yong, Deputy Director of the International Innovation Centre of Chinese Traditional Culture and Artistry Inheritance, Tiangong University (photo below), has drawn the attention of many ceramic lovers. In particular, he created a pottery lacquerware piece for this exhibition, combining the characteristics of Hong Kong (Bauhinia blakeana) and Tianjin (China rose), which was donated to PolyU after the exhibition.



A Yangliuqing New Year painting by Ms Zhang Hong



A clay figurine by Mr Zhang Yu



Splendid China Embroidery – Traditional Chinese Embroidery Crafts and Ou Embroidery Works Exhibition

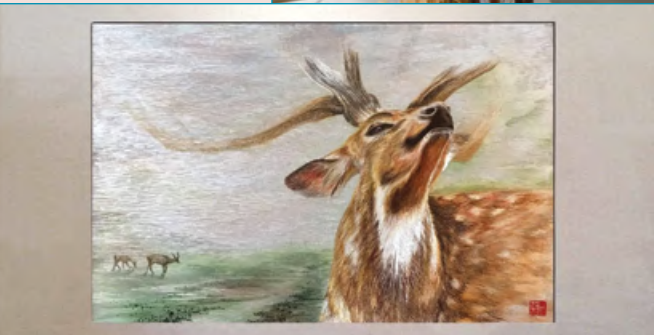
The art of Chinese embroidery carries profound cultural and historical significance and is part of China's intangible heritage. Among the many styles, the renowned Ou embroidery from Wenzhou in Zhejiang province stands out. Its complex stitching, vibrant and colourful textures, and exceptional fine craftsmanship make it a cultural treasure worth exploring. PolyU presented this exhibition in collaboration with the Wenzhou Municipal Culture, Radio, Television

and Tourism Bureau, and the Zhejiang Industry and Trade Vocational College.

Ms Zou Shengzhu, a Senior Arts and Crafts Artist at the Zhejiang Industry and Trade Vocational College and a Zhejiang Arts and Crafts Master (right photo), explained that Ou embroidery is based on stitching, and is like drawing. It reflects people's lifestyles, culture, and emotions. It is special as it has a strong theme, adopting vibrant colours and a sophisticated composition.



"North Stream Bridge"



"Lost Deer"

Indigo Dyeing from the Blue – The Silk Road Textile Dyeing Enters Hong Kong Exhibition

The exhibition offered a window into traditional Ranxie techniques. Ranxie is more than just an art form; it symbolises the lasting connections established along the ancient Silk Road, holding immense cultural value today and fostering a broad network of cultural exchange. The exhibition was collaboratively organised by Beijing Union University, Lanzhou Jiaotong University, and PolyU.

Much patience and precision are required for the exquisite techniques, including the Ranxie "Four Techniques": twist-dyeing, wax-resist dyeing, clamp-dyeing, and ash-dyeing, to produce the artworks. Professor Guan Lansheng, Professor at Beijing Union University and an Inheritor of the intangible cultural heritage "Ranxie Tie-dye Technique", shared his valuable experiences at the exhibition. Each art piece took nearly half a year to produce. Achieving the precise colour changes, particularly the blues, was a formidable challenge. Appreciating these artworks means recognising both their intricacy and the dynamic play of colours.

"Yellow River" — Professor Guan Lansheng uses real soil and mud to extract colours to capture the river's golden hues, while the indigo-dyed sky exhibits artistic mastery.



"Walking through the Kunlun Mountains"



The PolyU Chinese Culture Festival reflects the University's commitment to preserving and promoting Chinese heritage, a journey that requires determination, perseverance, and a shared passion for the richness of Chinese culture.

Leading with Innovation: The Visionary Path of PolyU

Professor Jin-Guang Teng has commenced his second term as President of The Hong Kong Polytechnic University (PolyU). In charting the University's future growth, he consistently prioritises the developmental needs of Hong Kong, the Nation, and the global community to guide the strategic direction of PolyU in education and research, embodying its motto: "To learn and to apply, for the benefit of mankind."



\\ We position The Hong Kong Polytechnic University as an innovative world-class university. This is our positioning, and it can also be regarded as our goal. //

Professor Jin-Guang Teng

Professor Teng commenced his second five-year term as President on 1 July 2024. This special report provides a review of his accomplishments during his initial term and outlines how PolyU will continue to progress in innovation and excellence under his leadership, striving for even greater achievements.

You joined the Hong Kong Polytechnic, a predecessor of PolyU, in October 1994. In November of the same year, the Polytechnic attained full university status. How do you describe the development of PolyU during your 30 years of service at the institution?

I began my career at PolyU as a lecturer (retitled as Assistant Professor later on), and have held various positions at PolyU, including leadership roles such as Dean and Associate Vice President. I have a deep understanding of the significant mission of this institution, which was founded in 1937. For over 85 years, this institution's teaching and research have been intricately connected to Hong Kong's social and economic development. PolyU nurtures professional talent, advances knowledge, and translates research results into real-world solutions that address societal and economic challenges.

Since assuming the role of President on 1 July 2019, under the strong leadership and staunch support of the University Council led by Chairman Dr Lam Tai-fai, I have worked with the management team to steer PolyU along a distinctive and innovative trajectory. Over the past five years, PolyU has achieved substantial advancements across various domains. It has been recognised among the top 100 universities globally by multiple international organisations, securing the 57th position in the 2025 QS World University Rankings. By capitalising on its unique strengths, PolyU aspires to be an innovative world-class university committed to pursuing excellence in education, research, and knowledge transfer to make an even greater contribution to society.



The President (front, fifth from left), together with other members of PolyU senior management, welcomed new students of the 2024/25 academic year.

What is the essence of PolyU's education? What are the key attributes that define a PolyU graduate?

I strongly believe that the responsibility of education extends beyond imparting professional skills and academic knowledge to the next generation; it also encompasses the cultivation of a positive outlook on life and the instillation of commendable values. Talents nurtured by PolyU should embody both virtue and competence, with an emphasis on virtue. PolyU students are expected to exhibit a sense of national pride, possess a global perspective, and demonstrate a sense of social responsibility.

To foster students' sense of national pride, PolyU has implemented a series of initiatives. For example, we have mandated that every undergraduate student complete at least one 3-credit subject in the area of Chinese history and culture since the 2022/23 academic year. Additionally, PolyU has established the Research Centre for Chinese History and Culture to strengthen students' understanding and appreciation of Chinese history and culture.

To address the growing demand for talent and technology in the era of artificial intelligence, PolyU plans to establish its tenth faculty/school, called the Faculty of Computer and Mathematical Sciences, in January 2025. This new faculty will initially comprise three departments: the Department of Applied Mathematics, the Department of Computing, and the Department of Data Science and Artificial Intelligence newly founded in July 2024.

Furthermore, since the 2012/13 academic year, every PolyU undergraduate is required to undertake a 3-credit Service-Learning subject. Service-Learning is an experiential pedagogical approach that encourages students to apply their own professional knowledge and skills to support communities in need, thereby promoting societal progress. It combines meaningful community service with academic learning and self-reflection.

The essence of Service-Learning lies in applying professional knowledge to serve society, cultivating socially responsible young talents with a strong sense of national pride and a global perspective. It can also deepen students' understanding of their own professional studies. In July this year, Council Chairman Dr Lam Tai-fai and I, as well as other PolyU colleagues, visited and supported our students who were participating in Service-Learning projects in rural Rwanda. The trip allowed me to personally witness the transformative impact of Service-Learning on students. PolyU has conducted two Service-Learning projects in Rwanda this year. While some of our students installed solar power systems in homes lacking electricity, providing them with night-time lighting, others exchanged clothing-making experiences with local villagers and shared their knowledge about textile arts. It was gratifying to observe how Service-Learning significantly contributes to student development. The solar power system installation project has been running for years and has illuminated approximately 1,300 households in Rwanda.

PolyU has made significant strides in innovation and research in recent years. Could you please share with us PolyU's achievements in this area?

In the realm of research, we actively pursue world-leading impactful research and are dedicated to attracting top talent. Currently, 232 PolyU scholars are ranked among the top 2% most-cited scientists globally in an index by Stanford University based on career-long citation impact. Notably, in the two fields of "building and construction" and "civil engineering", PolyU has the highest and second highest number of top 2% scientists in the world respectively. In 2023/24 (from April 2023 to March 2024), the total amount of funding PolyU received from the Research Grants Council was the second highest among the higher education institutions in Hong Kong. Furthermore, PolyU is the only university in Hong Kong that has made significant contributions to various national space exploration missions, including four lunar missions and the first Mars exploration mission.

PolyU is honoured to have contributed to the Nation's Chang'e-6 historic lunar far side sampling mission and to have acquired Chang'e-5 lunar soil samples.



Ensuring that research can be practically applied in real life to benefit society is a requirement for our researchers.

Professor Jin-Guang Teng

PolyU prioritises innovation and translating research to address critical societal issues, such as climate change, energy shortages, the ageing population, food safety, diseases, and sustainable development. In 2021, we established the PolyU Academy for Interdisciplinary Research (PAIR), the largest collaborative research platform of its kind in the Guangdong-Hong Kong-Macao Greater Bay Area. PAIR comprises 19 research institutes and centres, with the aim of promoting interdisciplinary research and industry collaboration. Through both basic and applied research, it contributes to Hong Kong's innovation and technology development as well as the Nation's self-reliance in science and technology.

How has PolyU's technological research benefited society? Could you name a few examples?

The University is committed to knowledge transfer, innovation and entrepreneurship, empowering staff, students, and alumni to convert research outcomes into technologies and solutions that drive societal and economic development. One notable example is the development of myopia control lenses for children. Research estimates that by 2050, half of the global population will be myopic. The PolyU invention can reduce the progression of myopia in children by 60%. This technology has been mass-produced in collaboration with leading industry partners. Over 32 million pieces of these innovative lenses designed to slow myopia progression have been sold worldwide, improving the vision health of millions of children and young people.

PolyU also actively integrates itself into overall national development by harnessing the University's science and technology capabilities to address the diverse economic needs of cities across the Mainland. We are establishing technology and innovation research institutes in various Mainland cities, creating a cooperative model for technology transfer defined by the equation: "PolyU research + Mainland industrial chain + Mainland market = societal benefit". To date, agreements have been signed with over ten cities, including Jinjiang, Wuxi, Hangzhou, Wenzhou, Huizhou, Nanjing, Zhongshan, Wuhan, Shaoxing, Ningbo, Shenzhen (Guangming), Hefei, Ganzhou, and Zibo, to establish research institutes. Several of these institutes are already operational. This initiative aims to integrate and share resources effectively, leveraging PolyU's research strengths and outcomes to develop technologies and products and incubate technological enterprises to meet local industrial and societal needs, thereby contributing to sustainable development.

The PolyU-Jinjiang Technology and Innovation Research Institute was officially unveiled in September 2023.



What is your plan for PolyU regarding its development in the next five years?

In anticipation of future challenges, the University has developed the Strategic Plan for 2025/26 to 2030/31, titled "Unite to Meet Challenges, Innovate to Benefit Society". This plan sets a clear direction for development. During the consultation process of more than one year, we incorporated the insights of staff, students, and alumni, as well as Council and Court members to determine the University's development goals and strategies in various fields.

Furthermore, the HKSAR Government's Northern Metropolis development, with a projected population of 2.5 million, will create a heavy demand for medical services. PolyU will strive to establish a new campus in the Northern Metropolis, in which we will set up a medical school that leverages PolyU disciplines such as rehabilitation sciences, medical laboratory science, radiography, nursing, and optometry, with a commitment to providing comprehensive medical services to the Northern Metropolis community. We also hope to develop the new campus into PolyU's main hub for innovation and technology, assembling many researchers and doctoral students and building several large-scale research facilities there to contribute to the development of Hong Kong's innovation and technology industry. We will also strive to set up a large-scale teaching hotel with a conference and exhibition centre on the new campus to foster the development of the tourism, convention and exhibition industries in the Greater Bay Area.

Professor Jin-Guang Teng — An accomplished scholar in structural engineering

President Teng is an accomplished structural engineering scholar, primarily engaged in research in the fields of fibre-reinforced polymer (FRP) composites in civil engineering and steel structures, with particularly notable contributions in the area of FRP composites in civil engineering. He started to explore the application of FRP composites in civil engineering in the mid 1990s, initially for the strengthening of structures and later on also for the construction of new structures. In the field of FRP strengthening, he has made systematic and pioneering contributions to its design theory. As the sole or primary inventor in the field of FRP-based structures for new construction, he has proposed several innovative technologies or concepts, including FRP-reinforced seawater sea-sand concrete (SCC) structures, FRP-concrete-steel double-skin tubular members (beams, columns, towers, arches, etc.), and FRP-coated steel reinforcing bars, leading to a large amount of subsequent work both domestically and internationally. For example, the FRP-concrete-steel double-skin tubular member form he invented has been applied as a primary structural component in a series of bridge projects, pioneering a



Looking forward, PolyU will also nurture more outstanding talents with a sense of national pride, a global outlook, and a strong sense of social responsibility. The University will continue to closely align its research and innovation with societal needs, contributing to Hong Kong's development and the Nation's self-improvement and self-reliance in science and technology. As long as the PolyU community is united to focus on development and innovation, we will surely be able to achieve greater success in education, research, as well as innovation and entrepreneurship. PolyU's reputation as an innovative world-class university will also continue to flourish day by day.

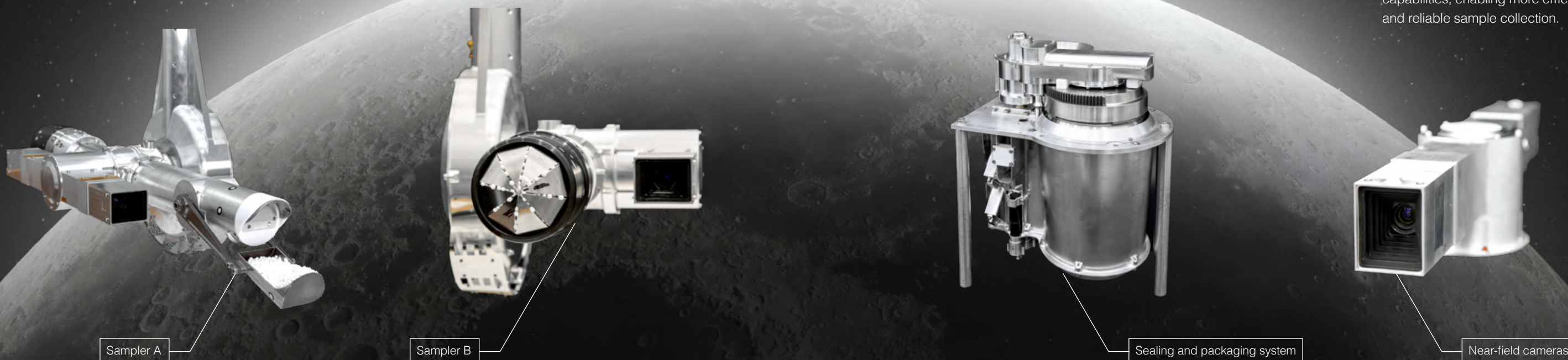
new direction in the research and application of FRP-based structures.

President Teng has authored/co-authored one book and over 200 SCI journal papers, which have been widely cited by researchers globally. Many of his research findings have been adopted in relevant design codes or guidelines in China, the United States, Europe, the United Kingdom, and Australia. According to Stanford University's list of top 2% most-cited scientists globally based on career-long citation impact, he has been ranked among the top 10 in the world, and 1st or 2nd in China, in the field of civil engineering for many years. President Teng's outstanding academic achievements are internationally renowned and have been widely recognised. In 2017, he was elected a Member of the Chinese Academy of Sciences. He is also a Fellow of the Hong Kong Academy of Engineering, a Member of the Hong Kong Academy of Sciences, and a Corresponding Fellow of The Royal Society of Edinburgh.

In recent years, President Teng has been actively promoting innovation and technological development in Hong Kong and other regions. He currently serves as the President of the Hong Kong Academy of Engineering, a Member of the Committee on Innovation, Technology and Industry Development of the Hong Kong SAR Government, Vice-Chair of the Council of the Greater Bay Area Association of Academicians, and Vice President of the Federation of Guangdong Academicians. In 2023, he was appointed as a Member of the 14th National Committee of the Chinese People's Political Consultative Conference.

Uncovering Mysteries of the Moon

PolyU's pivotal support for the Nation's historic Chang'e-5 and Chang'e-6 missions



The PolyU-designed system

for the Chang'e-6 mission

The Moon's far side is quite unlike the side facing Earth, and man is just beginning to unlock its mysteries. Recently, China made history by becoming the first country to collect soil samples from there and return them to Earth. This landmark achievement unveils secrets of the hidden hemisphere, offering valuable insights into lunar geological and thermal history. The nearly two-month-long Chang'e-6 mission, despite uncertainties and risks, accomplished this unprecedented task of automated regolith sample collection by using the PolyU-developed Surface Sampling and Packing System.

The Surface Sampling and Packing System was developed in collaboration with the China Academy of Space Technology (CAST). Unlike previous methods adopted by other countries involving drilling or manual excavation, the groundbreaking system is designed for fully automated multi-point lunar surface sampling and has a packaging mechanism.

The mastermind behind the system is Professor Yung Kai-lung, Director of the PolyU Research Centre for Deep Space Explorations (RCDSSE). He and his research team have spent days and nights tackling all the challenges and difficulties arising from the daunting mission.

Unprecedented challenges

Sampling on the lunar far side presents unique difficulties. "The rugged terrain, dominated by giant craters and scarce flat surfaces, poses special challenges to the sampling task. Additionally, direct communication with Earth is impossible;

the probe has to rely on the relay satellite Queqiao-2 for communication," Professor Yung explains.

"Drawing on our experience from previous projects, we successfully integrated numerous enhancements into the system, enabling timely sampling within a more restricted timeframe," Professor Yung adds.

It was not the first time the PolyU system has been pivotal in lunar missions. In 2020, an earlier version of the system played a key role in the Chang'e-5 mission, collecting and returning the Nation's first lunar soil sample from the near side. The enhancements for the Chang'e-6 mission in 2024 have improved its capabilities, enabling more efficient and reliable sample collection.

The PolyU-designed system features two samplers for collecting both loose and sticky lunar soil, with two high-temperature near-field cameras capturing sample images from multiple points on the lunar surface. The automatic vision guidance ensures accurate sampling, deposition, and placement into the ascender. A specialised container operates with a sealing mechanism to secure and package the samples.

PolyU's pioneering Industrial Centre was integral to the manufacturing and quality control of these complex instruments. "The manufacturing of the system parts requires a very high level of precision, accuracy and reliability," Dr Robert Tam, former Associate Director of PolyU's Industrial Centre, says.

The sampling process begins with the near-field cameras guiding the collection and deposition of lunar soil samples into the container. Once the sampling is complete, the sealing and packaging device securely seals the container. Guided by the near-field cameras, the sampler then inserts the sealed container into the ascender for its return journey to Earth.

PolyU has participated in a number of national space mission projects, and all space instruments are manufactured at PolyU's Industrial Centre.



Analysing soil samples with state-of-the-art technology

In a remarkable nod to its deep space research prowess, PolyU has obtained lunar soil samples collected by the Chang'e-5 mission, approved by the China National Space Administration's Lunar Sample Management Office.

The PolyU research team has received two distinct lunar soil samples: a surface soil sample weighing 400mg, collected by the Surface Sampling and Packing System the team designed, and a subsurface soil sample totalling 42.6mg.

These precious samples are currently stored in the lunar regolith storage and analysis system at PolyU's RCDSE, under stringent conditions of 99.999% high-purity nitrogen to prevent contamination or oxidation.

This unique, state-of-the-art facility boasts an integrated multifunctional system equipped with nine advanced instruments. It allows researchers to conduct comprehensive in-situ analyses of the lunar regolith in 12 different ways without exposure to uncontrolled environment during transfer.

Two sets of the lunar soil samples collected by China's Chang'e-5 mission are stored in the Space Resources Laboratory of the RCDSE. The laboratory has set up a lunar regolith storage and analysis system to properly store and analyse the lunar soil in depth.



Professor Yung Kai-leung *left*

// Director of the Research Centre for Deep Space Explorations
// Sir Sze-yuen Chung Professor in Precision Engineering
// Chair Professor of Precision Engineering and Associate Head, Department of Industrial and Systems Engineering



Professor Wu Bo *right*

// Associate Director of the Research Centre for Deep Space Explorations
// Fiona Cheung Professor in Spatial Science
// Associate Head (Research) and Professor, Department of Land Surveying and Geo-Informatics



Finding water in lunar soil

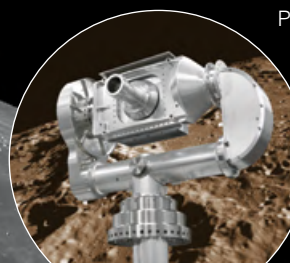
Leading this groundbreaking research is a team of seasoned PolyU experts, spearheaded by Professor Yung and Professor Wu Bo, Associate Head of the Department of Land Surveying and Geo-Informatics (LSGI) and Associate Director of RCDSE. They are joined by Dr Wang Xing, Postdoctoral Fellow, and Dr Sergey Krasilnikov, Research Assistant Professor, both from LSGI. Their research focuses on analysing the micromorphology of agglutinate fragments in the lunar soil samples and investigating the sources of its water content.

Professor Wu highlights the importance of these findings for the sustainability of future human activities on the Moon. For instance, part of the upcoming Chang'e-7 and Chang'e-8 missions will be to form the basis for an international research station on the Moon. Water resources will be important for the sustainability of such a research station.

Professor Wu elaborates, "The lunar water can originate from several sources such as solar wind implantation, comet or meteorite impacts, or volcanic activity on the Moon." He believes that "a single grain of lunar soil" may hold the key to unlocking the mysteries of the Moon's formation, evolution, and dynamic environment.

Laying the groundwork

As space exploration evolves and space resource utilisation becomes a priority, the Space Resources Laboratory at RCDSE leads the way. Equipped with advanced capabilities such as high-purity nitrogen protection devices, the Laboratory excels in preserving and studying these invaluable extraterrestrial materials for long-term interdisciplinary research. With a vision for the future, the Laboratory is not just prepared, but well poised to handle samples from Mars and asteroids, laying the groundwork for the Nation's further aerospace development.



Chang'e-3 mission

2013

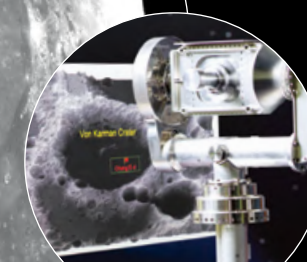
Professor Yung's team developed the Camera Pointing System with CAST, while Professor Wu's team worked on the 3D mapping model and landing site analysis.



Long March-6's "20 satellites in one rocket" mission

2015

PolyU developed the microsatellite platform and deployment system with Aerospace Dongfanghong Development Ltd, Shenzhen. The instrument is installed in the Kaituo-1B microsatellite.



Chang'e-4 mission

2019

The Nation made history with the first soft landing on the far side of the Moon. PolyU helped select the landing site through topographic and geomorphological characterisation and analysis; and captured and monitored the operation of the lunar rover Yutu-2 and took images of the Moon using the Camera Pointing System.



Chang'e-5 mission

2020

In collaboration with CAST, PolyU developed and manufactured the Surface Sampling and Packing System for the mission, the world's first fully automated multi-point lunar surface sampling and packaging system. The system automatically collected and packed approximately 1.5kg of surface lunar soil samples and returned to Earth.



Tianwen-1 mission

2021

PolyU developed the Mars Landing Surveillance Camera for monitoring the deployment of the Mars rover Zhurong and identified possible landing sites using advanced topographic mapping and geomorphological analysis technologies.

Electric Vehicles: Driving Towards a Better World

Asia's leading EV guru offers insights into the automotive revolution's contributions to a smart society



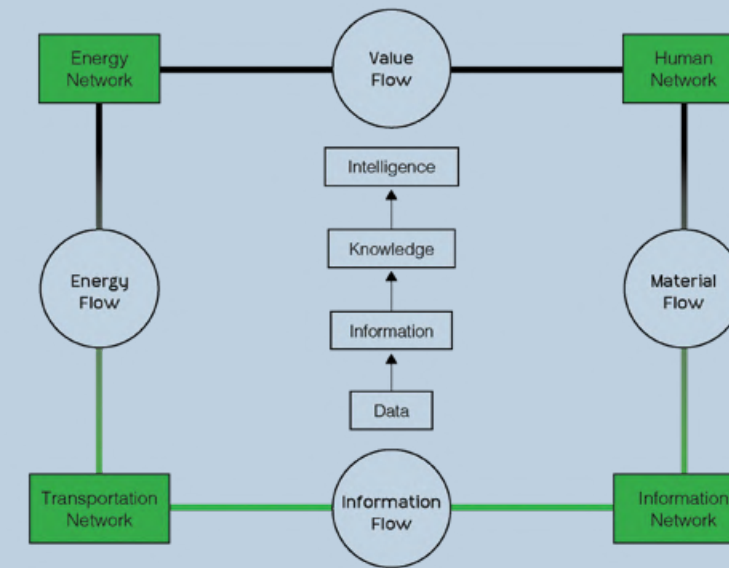
Before the internal combustion revolution of the 20th century, most people lived their entire lives within a few miles of their birthplace. The switch from horses to horsepower in the early 1900s changed that bucolic picture almost overnight. Mass-produced cars gave countless millions the freedom to travel and explore new horizons and happiness. Today, the automotive landscape is changing again.

But this time the transformation will be even faster, as a new generation of intelligent electric vehicles (EVs) overtakes the outdated fossil-fuelled dinosaurs.

Paving the way for a smart society

According to Ir Professor Chan Ching-chuen, Distinguished Chair Professor of Electric Vehicles and Smart Energy, the ongoing automotive revolution is part of a wider integration of the physical and cyber worlds with the human one. This will ultimately promote a smart society that leverages digital technologies to enhance people's well-being. Currently, his team is developing AI engines guided by his philosophy of integration of the three worlds.

His "Four Networks and Four Flows (4N4F)" theory identifies energy, information, and transportation networks as the three pillars of the digital economy, while the human network touches policies and every aspect of public and private life.



4N4F

Four Networks and Four Flows

According to Professor Chan, through the integration of the four networks and the four flows, data can be turned into intelligence essential to building a smart society.



Ir Professor Chan Ching-chuen

- // Distinguished Chair Professor of Electric Vehicles and Smart Energy, Department of Electrical and Electronic Engineering
- // Director of the Research Centre for Electric Vehicles
- // Academician, Chinese Academy of Engineering
- // Fellow, Royal Academy of Engineering, U.K.

Hailed as "The Father of Asian Electric Vehicles", Professor Chan Ching-chuen was elected as a Fellow of the Institute of Electrical & Electronics Engineers in 1992, awarded an Honorary Doctor of Science degree from the Polytechnic University of Odessa in 1993, and made Honorary Doctor of Technology by the Loughborough University U.K. in 2008 for his prominent contribution to modern electric drives and EVs. His research and leadership have significantly advanced the development of EVs and smart energy systems worldwide. A founder and rotating President of the World Electric Vehicle Association, he has been actively involved in major EV projects in China, India, Japan, U.S.A., and Europe.

Professor Chan is currently Director of the Research Centre for Electric Vehicles at PolyU, a cutting-edge research platform established to address challenges in the new journey of the EV revolution presented by modern electric vehicles.

Through their interaction and the integration of the corresponding flows, namely energy, information, material, and value, "we can turn data into information, information into knowledge, and knowledge into intelligence," said Professor Chan.

Regarded as one of the international EV community's "Three Wise Men," Professor Chan believes the key to unlocking a new era of safer and sustainable electric transportation depends on a few critical elements. They include new digital technology, increasingly ubiquitous cloud connectivity, and an advanced energy infrastructure.

Integrating people, vehicles, energy and the cloud is a complex process, and requires the development of a host of new standards. "That's why we have extended the scope of our research, to cover devices, systems, hardware and software that will pave the way from today's intelligent-connected vehicles to tomorrow's intelligent transportation, smart cities and a global smart society," he said.

Infrastructure means everything

The biggest challenge for EVs is not the electric motor; it is everything else. That includes making vehicles intelligent, internet-connected, and ensuring convenient access to infrastructure that can recharge them as fast as a smartphone. The latter calls for easy interaction between EVs and power grids to make EV charging easier and smarter than refilling it with gas. This V2G – Vehicle-to-Grid – interaction requires close collaboration among users, the business community and local governments.

“Establishing effective energy-sharing platforms makes profound commercial sense. But the extensive benefits, including safe and cost-effective transport solutions that support green development, impact everyone,” said Professor Chan.

Encouraging innovative business models is also crucial. For example, initiatives like battery leasing allow for centralised energy storage, reduce the burden on EV operators, lower the total-cost-of-ownership, and accelerate the adoption of EVs.

Concepts such as Vehicle-to-Everything (V2X) take things even further. Bi-directional charging now allows EV owners to use energy from their car batteries to power their homes. Or, they can send it back to the grid during peak hours, reducing the strain on generating capacity and earning useful revenue.

Smarter cars are good business

The merger of mobility, digital connectivity and battery technology has turned EVs into a combination of a taxi, smart phone and portable power station. This is redefining both the automotive industry and the ways people live, work and travel.

SDVs, or software-defined vehicles, are at the heart of this transformation. They operate, add functionality, and introduce fresh features mainly or completely via software. In essence, SDVs represent the next stage in the automotive industry’s development, laying the foundation for almost every other step towards the goal of smart transportation.

“The emergence of smart cars and the internet of vehicles offers a unique opportunity to switch to a new, and potentially far more profitable, mixed product and services model based on software. This extends the revenue stream throughout an EV’s entire life, and across multiple owners,” said Professor Chan.

Driven by ambitious renewable energy targets and significant investments in clean energy technologies, China has emerged as a global leader in the new energy sector. That includes the electric vehicle market, where it has won a substantial 60% share of global EV sales and accounts for over 50% of the world’s EV inventory.

“A holistic approach that strikes a balance between energy and information is essential for anyone interested in making the journey to a more sustainable future and achievement of the goal of carbon neutrality as swift, seamless and comfortable as possible,” said Professor Chan. “That will need revolutionising the supply side, demand side, technology and policy of power.”

/// The spirit of science is the freedom of inquiry. As engineers, we must have objectives. We need to know how to put things into practice. Holistic thinking is essential. ///

Professor Chan Ching-chuen



Vehicle-to-Grid makes EV charging easier than gas refill and enables bi-directional flow of power.

Grid Modernisation for Sustainable Energy Solutions

Modernising the power grid is made necessary by recent trends. Extreme weather events and ageing power networks have led to surging power demand and outages. Besides, carbon neutrality commitments intensify the need for the swift, safe and affordable integration of renewable energy systems and new technologies, such as electric vehicles, distributed solar generation, and energy storage, into the existing power infrastructure.

Envisioning a future where grid modernisation plays a pivotal role in achieving sustainable electricity solutions, PolyU established the Research Centre for Grid Modernisation (RCGM) in June to spearhead advancements in power grid modernisation and develop novel electric power systems.

In partnership with 35 government bureaus, research institutes and industry associations, as well as 26 universities from the Chinese Mainland, Hong Kong SAR and Macau SAR, PolyU will steer this initiative to align with the shared goals of achieving carbon neutrality and sustainable energy development.

“RCGM is strategically located in Hong Kong, an international metropolis with a dense population and many

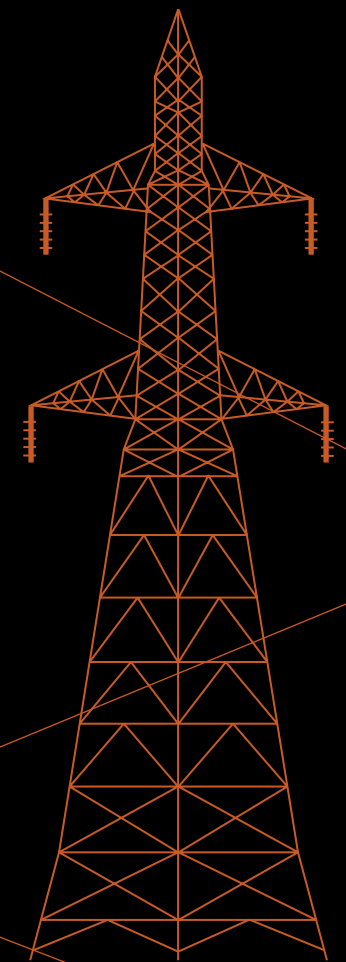
high-rise buildings that require an exceptionally reliable power supply,” said Professor Chung Chi-yung, Head of PolyU’s Department of Electrical and Electronic Engineering. “This provides an ideal backdrop for R&D, including demonstration, testing and application of innovative technologies in grid modernisation for a smart city of the future.”

A global hub for collaborative research

Under the directorship of Professor Chung, RCGM strives to construct secure and sustainable energy systems through impactful multidisciplinary research and development. It will harness emerging technologies such as sensors, 5G/6G communications, artificial intelligence, and big data analytics to modernise power grids and reduce operational risks.

“RCGM represents more than just a research hub. It will serve as an internationally recognised platform to attract and nurture global talents to develop cutting-edge technologies for transfer to overcome the challenges faced by the power and electricity industries,” Professor Chung added.

Subsequent to its official establishment, RCGM announced its partnership with Shenzhen Auto Electric Power Plant Company Limited in setting up the PolyU-Autosun Joint Laboratory for Sustainable PowerTech Research in Modern Grid. This collaborative effort aims to propel research and development in electric vehicle charging technology, smart microgrids, new energy storage systems, and safety and health monitoring systems for power equipment.



Combating Corrosion

Coating biomineralised bacteria on marine infrastructure to keep it intact

Coastal and marine infrastructure has been suffering from microbially induced corrosion (MIC) that leads to structural damage, such as cracking in concrete, and costs a global economic loss of around US\$800 billion annually. By harnessing the natural process called biomineralisation, a research team has found an effective method to control MIC.

Most instances of MIC are related to sulfate-reducing bacteria (SRB), the most significant corrosion-causing microorganisms.

The research team led by Professor Li Xiangdong, Director of the Research Institute for Sustainable Urban Development at PolyU, finds that forming biomineralised films on concrete surfaces as a protective layer can control sulfate diffusion and isolate the concrete from SRB. The biomineralisation treatment effectively inhibits corrosion by reducing the total and relative abundance of SRB.

This protective mechanism significantly extends the lifespan of concrete structures. Moreover, the technique has no negative impact on the native marine microbial communities.

An environmentally friendly method to control corrosion

"The biomineralisation technique serves as an environmentally friendly coating method for controlling concrete corrosion, with minimal impact on the overall biofilm

What is biomineralisation?

Biomineralisation refers to a method that nature produces and sustains biominerals, crystalline materials created by living creatures. It results in the formation of hardened biomineralised film for protection and support.

Professor Li Xiangdong

// Dean of the Faculty of Construction and Environment
// Director of the Research Institute for Sustainable Urban Development
// Chair Professor of Environmental Science and Technology
// Ko Jan Ming Professor in Sustainable Urban Development



// The biomineralisation technique serves as an environmentally friendly coating method for controlling concrete corrosion, with minimal impact on the overall biofilm communities. //

Professor Li Xiangdong

communities. It also utilises carbon dioxide to produce mineral precipitates, enhancing the durability of concrete structures," said Professor Li.

This process not only reduces the carbon footprint and energy consumption of marine infrastructure throughout its lifespan, but also contributes to carbon neutrality and sustainability.

"If the biomineralised film remains intact, repainting the concrete structures is unnecessary. The utilisation of a single coating treatment eliminates the need for multiple treatments, further minimising the cost and carbon footprint," added Professor Li.

The team's innovative strategy has great potential for application in various corrosive environments, such as marine and sewage environments, and water cooling utilities, where concrete corrosion is induced by corrosive microorganisms.

The research was published in *Environmental Science & Technology*.

Cooling Hot Cities

How to reduce the risk of urban overheating by green-blue-grey infrastructure (GBGI)

The rise in urbanisation and global warming is causing cities to overheat and making extreme heat events more frequent and intense. However, the risk of urban overheating can be reduced by using urban GBGI, such as parks, wetlands, and engineered greening, which has the potential to effectively lower summer air temperatures. Professor Guo Hai of the Department of Civil and Environmental Engineering has contributed to a global study that reveals the effectiveness of green interventions for sustainable cooling.

GBGI can cool cities

According to the Intergovernmental Panel on Climate Change, 70% of global carbon dioxide emissions come from urban activities. The implementation of GBGI can not only cool cities, but also decrease energy consumption and improve urban residents' quality of life. In addition, it can enhance biodiversity, reduce climate change impacts, and promote overall sustainability.

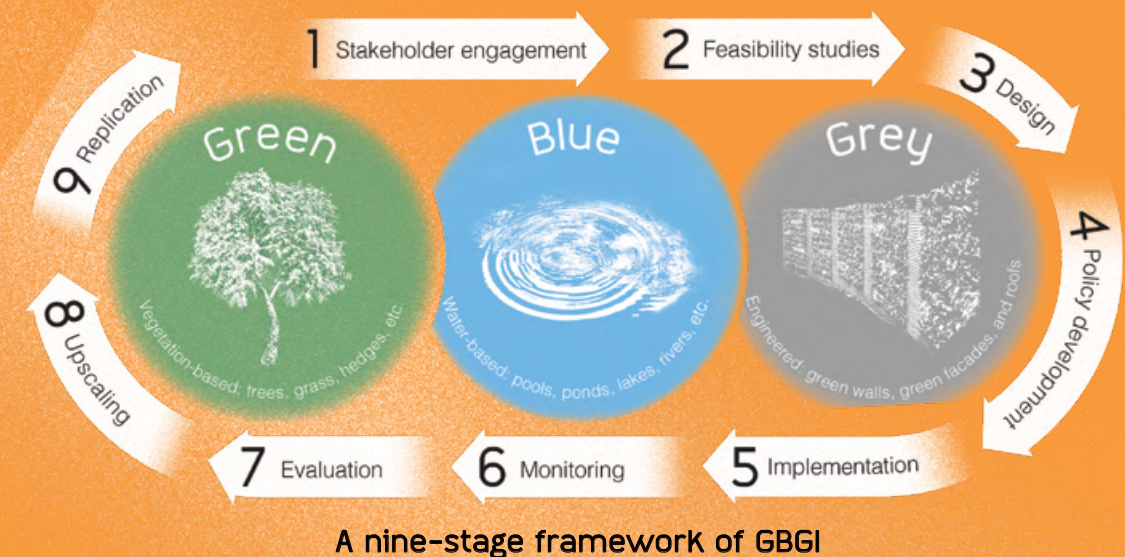
The study conducted by Professor Guo and other researchers around the world revealed regional and city-specific variations in the effectiveness of GBGI in mitigating urban heat.

Overall, GBGI can lower urban temperatures by as much as 18.9°C in Europe, 17.7°C in Asia, 12°C in North America, and 9.63°C in Australia.

While green and blue infrastructures have proven to be highly effective in lowering air temperatures globally, grey infrastructures in Asian cities, especially roof gardens and pergolas, are found to be the most effective for urban cooling. Roof gardens reduce temperature significantly by 17.7°C in Singapore, 16.2°C in Japan, and 10.8°C in South Korea.

The study also showed notable effects of various GBGI features in mitigating urban heat in cities across Mainland China. The most effective means include botanical gardens, wetlands, green walls, and attenuation ponds. In Beijing, botanical gardens could result in a temperature decrease of up to 10°C, while those in the Shaanxi province contributed to a decrease of only 2.7°C.

In Hong Kong, parks, green roofs and golf courses were found to play substantial roles in cooling urban heat, resulting in temperature reductions of 4.9°C, 4.9°C and 4.2°C respectively.



A nine-stage framework for policymakers

The research team has introduced a nine-stage framework to facilitate the implementation of GBGI (see the diagram above).

Professor Guo explains that this framework serves as a strategic roadmap, optimising GBGI implementation to maximise benefits. Policymakers should conduct thorough investigations and planning tailored to the specific context and needs of their cities.

In Asia, the widespread development of GBGI is a response to challenges posed by rapid urbanisation and cultural preferences for green spaces for community activities,

along with environmental goals focused on biodiversity conservation, improved air quality, and mitigating the urban heat island effect. Future GBGI implementation should take a holistic approach to optimise their multifunctional benefits and effectively address sustainability goals.

The study findings have been published in the international interdisciplinary journal *The Innovation*.



Professor Guo's team found that constructed grey infrastructures, especially roof gardens and pergolas, are the most beneficial for urban cooling in Asian cities.

Protecting the Privacy of Central Bank Digital Currencies

Research on privacy-enhancing technologies shows great promise

As the World Economic Forum revealed, over 98% of global central banks are actively engaging in research, piloting, or deploying a Central Bank Digital Currency (CBDC). While the government-backed digital currency holds immense promise for revolutionising financial systems worldwide, how to ensure robust privacy protection becomes a pivotal issue.



Computing scientists at PolyU are at the forefront of exploring the applications of privacy-enhancing technologies (PETs) to safeguard the confidentiality and integrity of CBDC transactions.

Pioneering research in privacy protection

Professor Allen Au Man-ho of the Department of Computing has contributed to a CBDC Expert Group white paper on privacy protection. His research delves into the potential of PETs including pseudonyms, zero-knowledge proofs, ring signatures, and secure multiparty computation, each offering distinct advantages in preserving transactional privacy. For instance, zero-knowledge proofs enable transaction verification without disclosing personal or transactional details.

Professor Au says, "To enhance public and industry confidence in the privacy of CBDCs, we advocate for a comprehensive strategy. It is crucial to bring together advanced PETs to enable transactions while safeguarding user identities and details."

The research also tackles the challenges associated with integrating PETs into CBDC systems, taking into consideration architectural designs and critical factors such as scalability, risk, auditability, and regulatory compliance.

Establishing Hong Kong as a global CBDC benchmark

CBDC is poised for significant advancements in the next five years. To sustain its leading position in CBDC, "Hong Kong should continue investing in research and development while promoting innovation through collaborations among the government, industry and academia," Professor Au emphasises. "The focus is on pioneering new CBDC technologies and use cases that can serve as benchmarks globally."

Since the establishment of the CBDC expert group, PolyU researchers and Professor Au, along with other members, have collaborated closely with the Hong Kong Monetary Authority to examine various aspects of CBDCs and related digital currencies, aiming to accelerate their development and shape a secure and confidential CBDC ecosystem for the future.

The award-winning team

Professor Allen Au Man-ho (left) and his research team triumphed in the prestigious ZPRIZE competition 2023 for the second consecutive year with their groundbreaking technology on zero-knowledge cryptography, which has profound implications for enhancing privacy and scalability in blockchain and Web3 applications.



What are zero-knowledge proofs?

Zero-knowledge proofs, also known as zero-knowledge cryptography, allow a "prover" to convince a person of the validity of computation without leaking any information. It has emerged as a breakthrough technology within the Web3 ecosystem, enabling data privacy protection, efficiency improvement, and scalability.

From Lab to Life-saving Screening: PolyU Startup's Battle Against Liver Disease



Liverscan® is a cutting-edge ultrasound diagnostic solution for liver fibrosis and steatosis.

Chronic liver diseases pose a significant health threat, affecting about 27% of adults in Hong Kong. Known as metabolic dysfunction-associated steatotic liver disease (MASLD), this condition is becoming increasingly common. To tackle this issue, the PolyU-nurtured startup, Eieling Technology Limited, has launched the "LiverCare – Hong Kong 10 Million Liver Scans Program". This ambitious five-year initiative aims to raise public awareness and promote early detection and treatment of MASLD and fibrosis using their flagship product, Liverscan®.

Translating research into real-world applications
MASLD is a type of steatosis that often occurs with metabolic disorders such as obesity, diabetes and "three highs" - high blood pressure, high cholesterol and high blood sugars. This condition is increasingly common due to sedentary lifestyles and easy access to high-calorie foods. While often associated with being overweight, recent studies show that even those who appear to be of normal weight can develop fatty liver.

Founded in 2018 and supported by PolyU, Eieling Technology specialises in advanced medical ultrasound imaging devices for liver disease screening. Their flagship product, Liverscan®, is a palm-sized, wireless, and portable ultrasound imaging guided device that enables affordable liver check-ups anytime, anywhere. This innovative device reduces costs, shortens examination times, simplifies operations, and enhances measurement accuracy, making liver disease screening more accessible to the wider community.

At the programme's launch ceremony, Professor Zheng Yongping, Co-founder of Eieling Technology and Chair Professor of the Department of Biomedical Engineering said, "Liver fibrosis can be caused by long-term inflammation of liver tissue, excessive alcohol intake or long-term fatty liver, and may develop into cirrhosis, liver dysfunction, or even liver cancer. With



Professor Zheng Yongping
// Henry G. Leong Professor in Biomedical Engineering
// Chair Professor of Biomedical Engineering
// Director of Research Institute for Smart Ageing
// Director of Jockey Club Smart Ageing Hub
// Co-founder, Eieling Technology

Liverscan®, we aim to make liver disease screening more accessible, thereby reducing severe liver disease cases."
// With Liverscan®, we aim to make liver disease screening more accessible, thereby reducing severe liver disease cases. // Professor Zheng Yongping

Leading the way to implement the liver screening programme
PolyU has a longstanding commitment to applying its technologies in real-world contexts. The "LiverCare – Hong Kong 10 Million Liver Scans Program" will be rolled out among the PolyU community starting this September. The University will conduct liver fibrosis and fatty liver screenings for its full-time staff using Liverscan®. Participants will also be invited to join a two-year follow-up study. The data collected will help the research team understand the importance of a balanced diet, regular exercise, and routine liver ultrasound examination for monitoring disease progression.

Professor Christopher Chao, Vice President (Research and Innovation), highlighted the impact of the programme, saying, "The launch of the programme marks a milestone for PolyU in contributing to global public health, reflecting the University's commitment to social responsibility and the translation of scientific research outcomes."



Startup for societal benefit
Supported by the PolyU Tech Launchpad Fund, the Incu-Bio Programme of the Hong Kong Science and Technology Parks Corporation (HKSTP), and various industrial partners and private investors, Liverscan® has secured clearance from the US Food and Drug Administration (FDA510k).



Aiming to scan 10 million livers of Hong Kong people in five years, the LiverCare programme will raise public awareness and promote early detection of chronic liver diseases.

Liverscan® is already in use in renowned hospitals and clinics across Hong Kong, Macao, and other locations. Ongoing clinical research and collaborations with hospitals in Mainland China aim to broaden its reach, with plans to enter the Mainland China market in the third quarter of this year with National Medical Products Administration approval expected in September and a global launch in late 2024.

Listed on Forbes Asia 100 to Watch 2023, Eieling Technology's journey from a lab to a global health innovator showcases the power of PolyU's PolyVentures ecosystem. This platform empowers entrepreneurs to transform innovative ideas in universities into successful businesses through funding, networking, incubation programmes, training, and business matching services.

Mitigating Myopia

PolyU and Zeiss join forces to combat progressive shortsightedness for the benefit of children worldwide



By 2050, about half of the world's population, which means nearly 5 billion people, will suffer from myopia. Severe myopia can not only affect people's quality of life but also pose risks of serious eye diseases, such as glaucoma and cataracts, or even blindness. PolyU's School of Optometry (SO) offers an effective solution that is being adopted in the ZEISS lens.

References:

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An impactful solution to manage myopia

Myopia usually occurs when the eyeball overgrows to become too long, causing light to focus in front of the retina rather than on it. The critical period for managing myopia is between 6 to 12 years old.

The partnership between PolyU's SO and ZEISS Vision Care (ZEISS) has resulted in the new Myopia Control Spectacle Lenses. Incorporating the PolyU D.I.S.C. technology and ZEISS Cylindrical Annual Refractive Elements (C.A.R.E.) design, the lens can slow down the average axial length growth in Asian children by up to 70%.

"The new lens has a concentric-ring design with two optical microstructures alternately arranged on its surface," Dr Dennis Tse Yan-yin, Associate Professor at SO and the inventor of the lens, explains.

"One optical structure is for correcting vision. It allows light to focus on the retina and provides a clear image. The other optical structure produces a defocused image in front of the retina, creating a defocus that can slow down the axial length growth of the eyeball."

The PolyU patented technology adopted in the ZEISS new lenses is called Defocus Incorporated Soft Contact (D.I.S.C.) for myopia management. It is non-invasive

and has undergone multiple basic experiments and clinical verifications, and is proven to be safe, effective and without significant side effects.

Long-term collaboration for worldwide benefits

The global partnership, which started when the University and the lens manufacturer began to explore collaboration on research and education some years ago, involves IP licensing and joint research and development.

This partnership aims to advance the understanding and treatment of myopia by combining academic and industry expertise, and paves the way for a long-term collaboration focusing on

The new lens with the concentric-ring design can slow down the average axial length growth in Asian children by up to

70%

Concentric rings due to D.I.S.C.'s multi-zone property are visible only when illuminated.

myopia control and other ophthalmic technologies. The goal is to develop innovative solutions that improve and preserve vision, with the potential for groundbreaking advancements in vision care that will benefit people worldwide.

SO has been at the forefront of addressing myopia with advanced myopia control technologies. In collaboration with leading industry partners, over 32 million pieces of innovative lenses designed to slow myopia progression have been sold

worldwide, improving the vision health of millions of children and young people.

Professor Christopher Chao, Vice President (Research and Innovation), says, "PolyU has always been committed to promoting technology transfer. The D.I.S.C. technology for myopia management is an excellent example to demonstrate how academic research can be transformed into effective industry solutions, offering an additional option in the market for those in need."



Dr Dennis Tse Yan-yin
// Associate Professor, School of Optometry

A Smart Way for Safe Construction

PolyU-nurtured startup uses AI to save lives on construction sites



The risky job nature and challenging site environment make construction work a high-stakes profession in Hong Kong. In 2022, there were an average of 29.1 construction accidents per 1,000 workers, including those that lead to fatalities, more than double the overall economy-wide rate of 13.5. Seventeen workers died due to construction accidents in that year.

viAct's proprietary AI-powered real-time monitoring system helps reduce up to

95%
of construction site accidents

Years ago, a fatal incident at a construction site deeply affected Hugo. One day, he had a discussion with the site contractor well into the night. The next day, he was shocked to learn that the contractor had died in an elevator shaft accident. This tragedy led him to reflect on construction safety.

AI for good

He then discussed his concerns with Gary, whom he knew since their undergraduate years at PolyU. Having worked in an engineering consultancy for several years, Gary believed that the construction industry should introduce innovation and technology to enhance productivity, efficiency, and most importantly the construction workers' safety in their workplace. In 2016, they co-founded viAct, with their mission "viAct to save lives".

It took them three years to understand the pain points of the construction industry. In 2019, they launched a self-developed scenario-based AI algorithm for their "Construction Management Software" to enable remote monitoring of construction sites.

The vision cloud platform automates real-time construction monitoring by connecting all types of IP cameras. It



identifies workers wearing personal protective equipment, spots safety hazards, monitors machinery operation, and manages environmental waste.

Real-time alerts are sent to a mobile app with a simple interface, designed for engineers working in noisy and dynamic environments. Using light and sound to alert construction workers, the platform can reduce up to 95% of on-site accidents. Additionally, the proprietary innovation tracks construction progress and carbon emissions.

viAct's vision intelligence helps the government, property developers and construction enterprises to improve not only safety but also operation efficiency and environmental sustainability.

Entrepreneurial perseverance

There were a lot of technical and operational difficulties at the beginning. These included promoting new technology in a traditional industry, hiring and training skilled staff, and collecting data. Inspired by the PolyU motto "To learn to apply, for the benefit of mankind", the pair always put people first and have persevered when facing difficulties on the road of entrepreneurship.

With the vision of making a safer and more secure work environment in risk prone industries, viAct has developed and deployed over 100 pre-built AI modules since its inception. The startup leverages advanced AI-driven

insights to enhance decision-making, streamline processes, and elevate overall safety, propelling construction projects toward unparalleled productivity and excellence.

"As a leading contech startup in Asia, our world's first scenario-based AI monitoring solution is continuously fostering safety as a non-negotiable part of workplace culture," Hugo added.

The company is now expanding globally with projects in Southeast Asia, the Middle East and Europe, as well as diversifying into other industries such as facilities management and manufacturing, aiming to establish a Hong Kong-based AI brand with global reach.

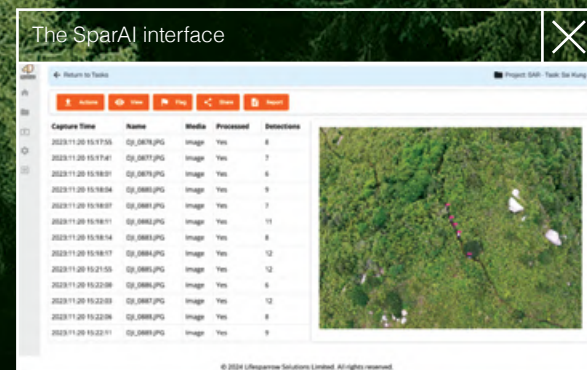
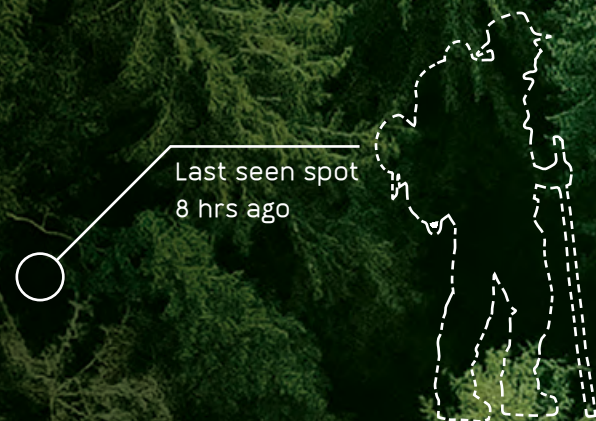
"Over the years, our solution has earned the trust of the World Economic Forum, Forbes Asia, Google, Deloitte and KPMG," Gary said. "viAct's commitment to AI innovation produces a profound impact on workplace safety and the dignity of labour, facilitating the development of intelligent and eco-friendly infrastructures. We collaborate with clients and governments to foster a sustainable environment where cities will allow people to live, learn and thrive."



Gary Ng Chun-kui *right*
// Co-founder and CEO, viAct
// Bachelor of Engineering in Building Services Engineering, 2002

Hugo Cheuk Yuen-hang *left*
// Co-founder and COO, viAct
// Bachelor of Engineering in Building Services Engineering, 2002
// Master of Business Administration (General Management), 2011

Aviation Duo Find Meaning when Finding Missing Hikers



Two Aviation Engineering graduates co-founded a startup that harnesses a self-developed AI algorithm and drone images to locate lost hikers. They have not only gained international recognition but have also achieved personal fulfilment.

Josua and Max seldom went hiking before they co-founded LifeSparrow Solutions in 2022. After they were connected to the Fire Services Department which needed a fast and easy solution to search and save missing hikers, they conquered more than 20 hiking trails in six months to collect nearly 5,000 images with drones.

Max explained the challenge, "Firefighters must review nearly 10,000 drone images from various locations to locate missing or trapped hikers. Even though it only takes about five seconds to process each picture, the large volume of data requires hours or even days of work."

Their dedication led to the creation of SparAI, a groundbreaking system that can reduce search and rescue operation time by over 65%. Utilising advanced AI algorithms, SparAI can spot clothing and silhouettes, even in locations such as under the shade of trees, where the naked eye might miss crucial details.

The entrepreneurial journey

Their partnership was forged when Max sought funding support from PolyU to commercialise his indoor positioning technology. Recognising its potential, he invited Josua, a friend from their shared undergraduate studies, to join forces and bring the innovation to market.



Max Lee Jwo-lem
 // Bachelor of Engineering (Aviation Engineering), 2021
 // Outstanding Young Alumni Award in Entrepreneurial Achievement of PolyU Department of Aeronautical and Aviation Engineering 2024
 // Co-founder and CTO, LifeSparrow Solutions

Josua Chan Wing-hei
 // Bachelor of Engineering (Aviation Engineering), 2020
 // Co-founder and CEO, LifeSparrow Solutions

Throughout their entrepreneurial journey, they received invaluable support from the University, including seed and prototype funding, mentorship, and business networking. LifeSparrow became an incubatee of the Hong Kong Science and Technology Park's three-year incubation programme thanks to PolyU.

Josua said, "Our business goal is definitely launching an IPO (Initial Public Offering). That would qualify our success as a startup."

Impact of PolyU education

Josua did not sign up for PolyU's Aviation Engineering programme to become an entrepreneur; he wanted to be a pilot. His time at PolyU has given him new insight into his career goals.

He reflected on the benefits of the University's education, emphasising how it has honed his critical and creative thinking skills, enhanced his ability to collaborate effectively and equipped him to adapt swiftly to changing circumstances.

Max is passionate about using technology to help those in need and is currently developing an indoor positioning system for the blind as part of his doctoral research under the guidance of Dr Hsu Li-ta, Associate Head and Associate Professor of PolyU's Department of Aeronautical and Aviation Engineering, whose encouragement has left a lasting impact on Max.

"The enlightenment I gained from Dr Hsu is the most valuable thing I've received during my years at PolyU," Max said.

Dr Hsu serves as an advisor and arbitrator for LifeSparrow, stepping in to help the two friends find common ground when they reach an impasse after intense debate.

Forbes 30 Under 30

The pair's exceptional talent and entrepreneurial spirit recently earned them a spot on the Forbes 30 Under 30 Asia: Consumer Technology List 2024, strengthening their confidence in the journey ahead.

Looking forward, LifeSparrow aims to expand to overseas markets and develop new applications, allowing both young PolyU graduates to help more people and lead fulfilling lives.

Continue learning. Embrace mistakes. Persevere, and you will achieve your goal. //

Max Lee

Step out of your comfort zone and take the first step towards your dream. //

Josua Chan

Startup Repurposes Uniforms for Sustainability

PolyU-nurtured young entrepreneur was named in Forbes 30 Under 30



Source: Dress Green

It may not be easy to throw away your school uniform, which holds cherished memories of your school days. Now, besides keeping the uniform or discarding it, Dress Green provides another option: giving it a new life by upcycling it into apparel and accessories.

One of the many PolyU-nurtured startups, Dress Green is co-founded by alumna Emma Yu Sin-wan, a graduate of the Master of Arts in Bilingual Corporate Communication. The design-based social enterprise creatively promotes sustainability through upcycling uniforms, and thus creates job opportunities for the disadvantaged. Its efforts were recently recognised by the esteemed Forbes 30 Under 30 Asia 2024 List, earning it a spot in the Social Impact category for its contribution to society and sustainability.

Emma identified a gap in the recycling market where uniforms were often overlooked. “We estimated that about four million pieces of uniforms were

being discarded every year. However, recycling bins in the community usually do not accept uniforms.”

With a vision to minimise landfill waste, she founded Dress Green with her husband to upcycle discarded school and business uniforms into trendy, eco-friendly apparel and accessories such as bags, hats, ornaments, cushions and other products, significantly enhancing their sustainability.

Job opportunities for disadvantaged

This startup also provides job opportunities by engaging unemployed textile workers, housewives, and disadvantaged groups. Since its launch

in 2021, Dress Green has upcycled 3,000 uniforms into over 4,000 products, providing more than 3,500 working hours. It has partnered with over 20 companies, including Kerry Properties and Veolia, and offers workshops to raise environmental awareness.

“We are also exploring the upcycling of other textiles, such as fabrics from fashion brands, used clothes, and bed sheets, to design diversified products and offer more job opportunities for local workers.”

Success thanks to PolyU’s support

The success of the startup highlights PolyU’s effort in nurturing startups and

The process emits carbon dioxide equivalent to a car travelling

1,200

times around the world



Consumes water enough for all Hong Kong citizens to drink for

3

years



Dress Green, the PolyU-nurtured social enterprise co-founded by alumna Emma Yu, has flourished with substantial support from the University’s funding, resources, and mentorship.



inspiring future entrepreneurs to turn their ideas into reality. Dress Green is a perfect example of benefitting from the University’s funding, resources, and mentorship. It began with substantial seed funding from the PolyU Micro Fund and flourished within the workspace at the PolyU InnoHub. The technical support and

training offered by the Industrial Centre for the use of machines and software also provided a robust innovation environment. Moreover, Emma gained numerous opportunities to participate in entrepreneurship competitions, exchange ideas, and build connections among the PolyU startup community, eventually growing

Dress Green into the successful startup it is today.

PolyU is a breeding ground for aspiring entrepreneurs. Through its PolyVentures initiative, the University has trained more than 7,600 entrepreneurs and established over 500 startups over the years.

Excel*x*Impact

is published biannually to showcase PolyU as an innovative world-class university excelling in talent nurturing, cutting-edge research, and knowledge transfer, as well as raising awareness of the University's developments and achievements among local and international communities. For contributions and enquiries, please contact the Communications and Public Affairs Office at paadmin@polyu.edu.hk.

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PolyU ranks

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The Hong Kong Polytechnic University (PolyU) has established itself as a leading global university, a fact reflected in major international rankings that consistently recognise the strength of the University across a range of criteria, including academic reputation, international research network, research impact, internationalisation, employment outcomes, sustainability performance, and others.

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