

HKU BULLETIN



ALL-SEEING AI

Research advances in computer vision

97% cure rate

World's first oral arsenic trioxide for leukaemia treatment

3D breakthrough in archaeology

Using innovative virtual reality techniques in excavations

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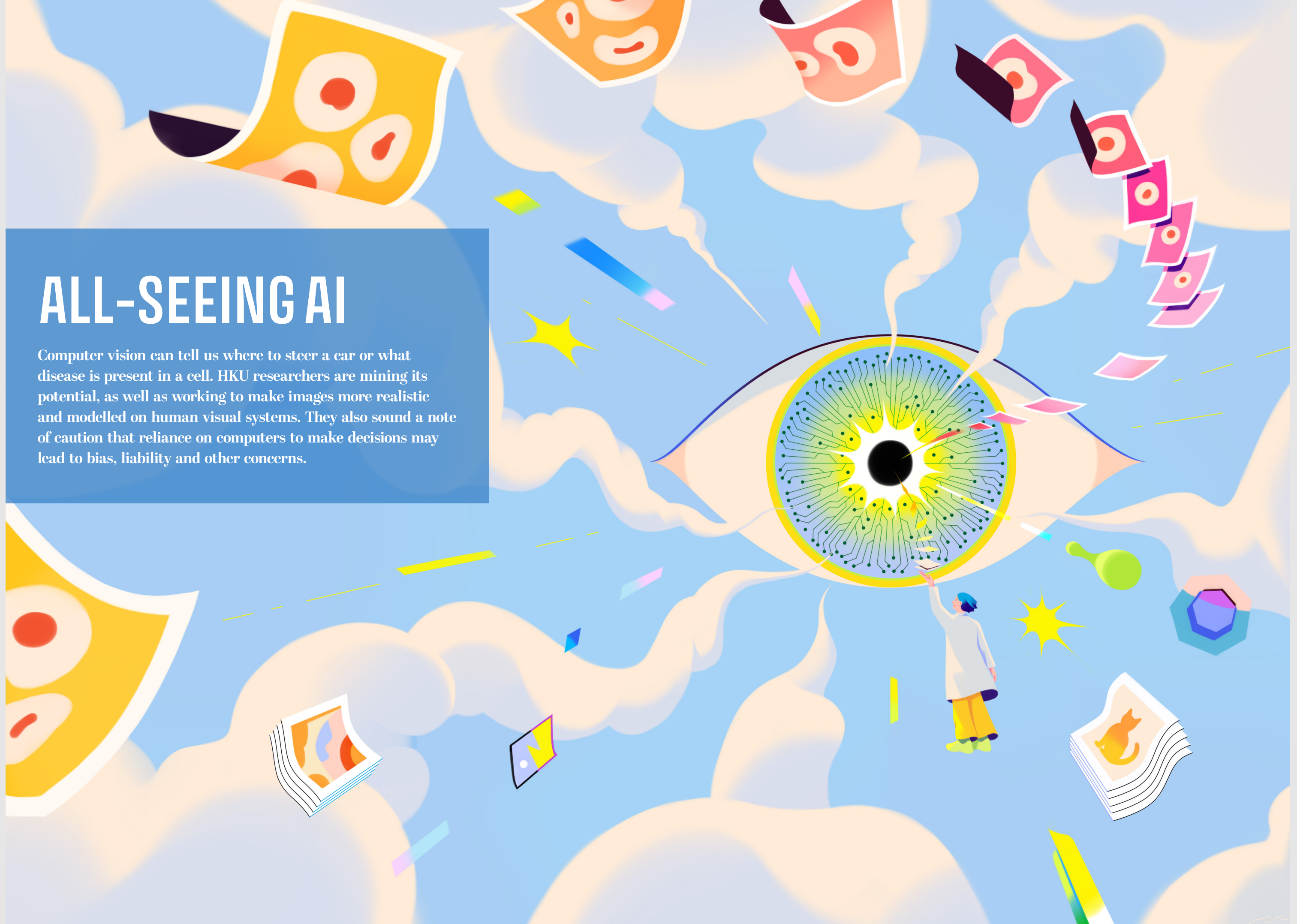
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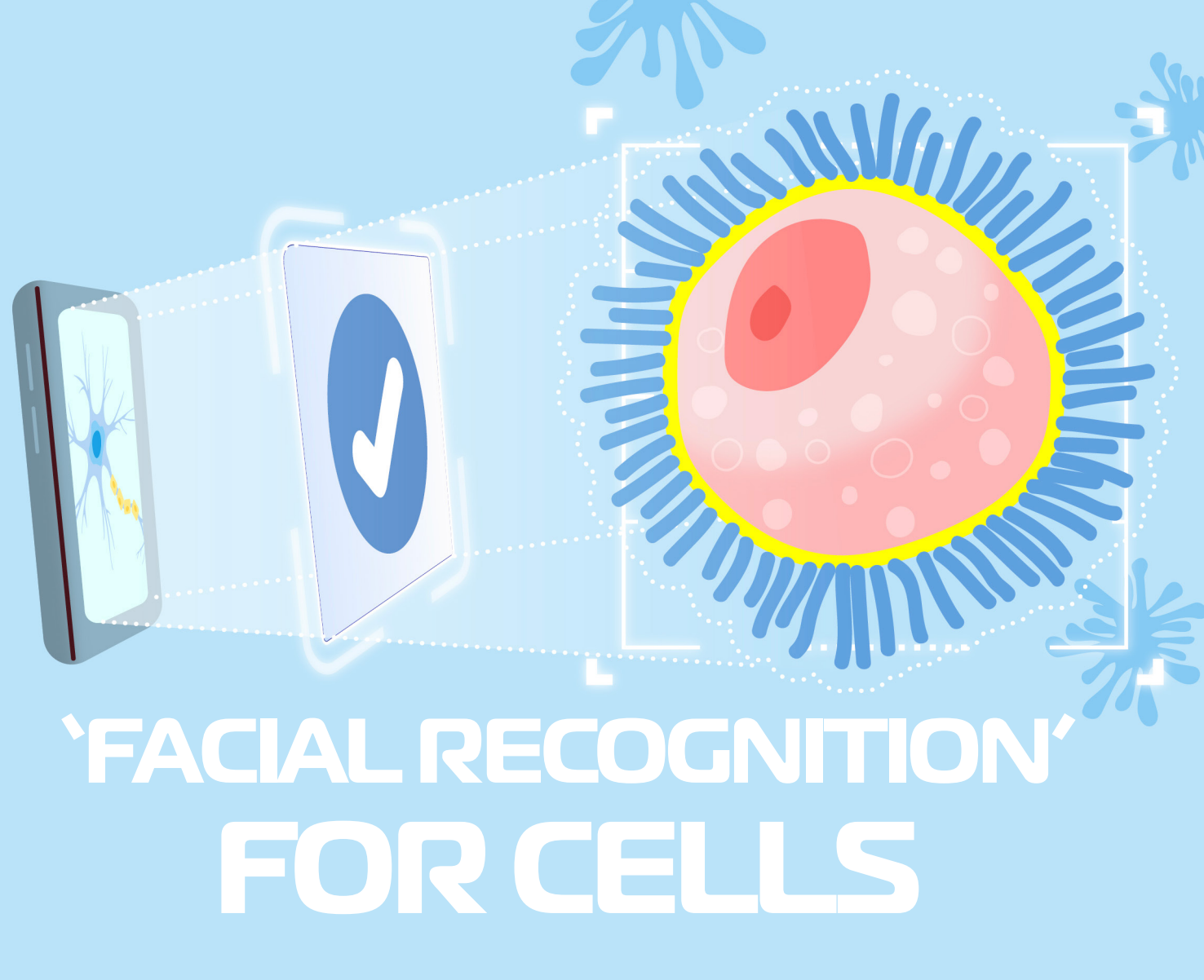
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ALL-SEEING AI

Computer vision can tell us where to steer a car or what disease is present in a cell. HKU researchers are mining its potential, as well as working to make images more realistic and modelled on human visual systems. They also sound a note of caution that reliance on computers to make decisions may lead to bias, liability and other concerns.





Computer vision has an important role to play in medical diagnostics. Building on a decade of work in the field, Professor Kevin Tsia recently deployed an AI-driven, ultra-fast imaging tool to speed up cancer diagnosis and, in a separate project, applied AI to decode the development of zebrafish from images and other data.

Anyone suspected to have cancer wants to know the situation as soon as possible – is the diagnosis confirmed? Is the treatment working? Has it come back? But getting accurate information can be expensive and time-consuming. Labels, or biomarkers, have to be created before samples are screened, to tell the machine what to look for.

But now, a much faster, more cost-effective solution using generative AI has been developed by Professor Kevin Tsia of the Department of Electrical and Electronic Engineering, in collaboration with clinicians from the Li Ka Shing Faculty of Medicine (HKUMed) and Queen Mary Hospital.

Rather than trying to match cells to labels, the Cyto-Morphology Adversarial Distillation (CytoMAD)

takes pictures of the cells and uses AI to determine their shape, mechanical properties and molecular information. Anomalies or abnormalities are flagged for clinicians to investigate.

CytoMAD was tested on about 10 lung cancer patients using both blood samples and tissue samples for clinicians to assess each patient's tumour at the individual cell level and their risk of metastasis. The accuracy was on a par with existing detection methods, but faster and cheaper. Tens of millions of cell images from one patient could be processed in a single day.

“Our technology is very similar to facial recognition technologies that are used to identify individual faces. In our case, we’re focussed on what cells look like,

whether their appearance is normal or not, and whether we can identify any disease,” Professor Tsia said.

“The key advantage is our ultra-high-speed imaging capability. By capturing a huge amount of cell images within a very short period of time, we generate enormous, invaluable data that trains our AI models to pinpoint diseases and abnormalities more effectively and efficiently. Our lab also engineered specialised computing hardware that further accelerates the AI computation of the data we collect.”

Creating ‘cell atlases’

Professor Tsia’s work on imaging has been a decade in development, following foundational work such as capturing the dynamic communication of individual neurons in the brain of a mouse that was awake and imaging blood cells racing through the brain at thousands of images per second – this is the kind of speed that his super-fast imaging technology can operate at.

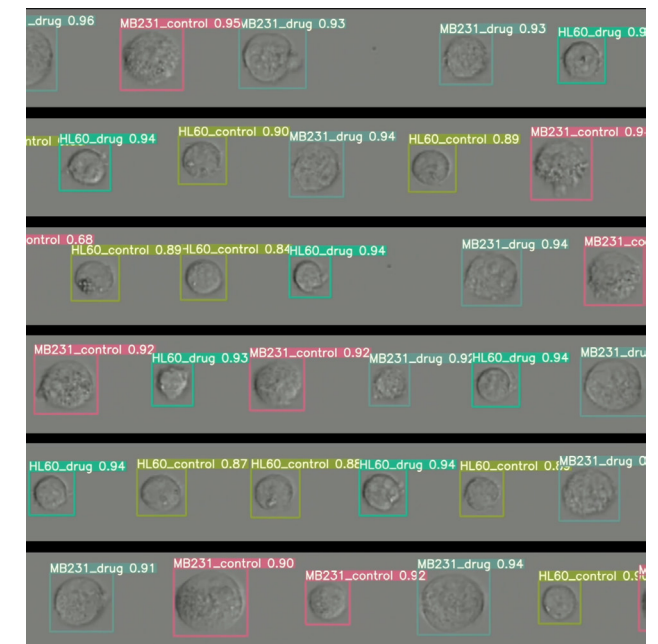
In addition to CytoMAD, he recently also made advances using AI technology to decode the development of zebrafish embryos from a single cell to a complete organism. The zebrafish shares about 70 per cent of its genes with humans so it is of much interest in the scientific community.

Professor Tsia and his team, which included biomedical scientists from HKUMed, developed a large-scale computational framework called StaVia that can process genomic, proteomic and other ‘omics’ information from cells, as well as their morphology, to map in detail how cells change and interact over time, which could help explain disease progression. They worked with one of the largest datasets in the world, from the Chan Zuckerberg Biohub, processing millions of cells and creating catalogues for each cell to uncover the zebrafish’s embryonic development.

“Our tool works very well with large-scale cell atlases, maintaining all the intricate details embedded in omics data, to make it easy and intuitive for scientists to understand complex cell behaviours, from fertilisation to the complex formation of organs,” Professor Tsia said.

“We’re focussed on what cells look like, whether their appearance is normal or not, and whether we can identify any disease.”

Professor Kevin Tsia



The Cyto-Morphology Adversarial Distillation uses AI to perform real-time ‘facial recognition’ of various human cell images.

Hurdles to overcome

The focus for StaVia at the moment is on developmental biology, given it is a more defined field than cancer, but they also hope it can be applied to diseases. An important feature of StaVia is its ability to do trajectory prediction, meaning it could be harnessed to predict the course of diseases and ageing over time.

“Our hope is that one day, CytoMAD and StaVia could together be a one-stop solution for imaging and doing computations to better understand human disease,” he said.

There are some hurdles to overcome, though. Although CytoMAD can process one patient’s blood and tumour samples in one day, this is still rather slow for larger scale clinical trials. If hundreds of people are involved, it would take the team hundreds of days to process using their present equipment and processing power, so they are looking for partners in the industry and elsewhere to help them scale up.

Professor Tsia added that the work would not be possible without the involvement of clinicians and biomedical scientists. He is also Programme Director of HKU’s Biomedical Engineering programme and has seen enthusiasm grow for establishing more partnerships.

“I have benefitted from cross-faculty, cross-discipline collaboration and I am keen to promote it on campus. HKU researchers are very open-minded and willing to try new things. I strongly advocate to our students that they should embrace these kinds of opportunities. There is a lot of innovation to be unlocked,” he said.



SMART EYES ON THE STREET

Streets, sidewalks and roads which constitute more than a quarter of the built-up land in most cities, should be designed for people, but urban planning has typically not incorporated human perspectives. With the aid of urban big imagery data and AI, Professor Qiu Waishan is helping to correct this.

Urban planning that fails to account for human perceptions often results in environments that disadvantage vulnerable population groups. For instance, if you stand on a tree-lined urban street at lunchtime on a sunny day, the greenery will be a welcome canopy of shade. But stand at that same

spot at 11pm and the shadowy trees feel altogether more sinister, especially if you are a woman.

Reconciling such discrepancies is a challenge for planners, who typically have access to mainly day-time views from sources such as Google Maps. Professor Qiu

Waishan, Assistant Professor in the Faculty of Architecture, is working to address that and other urban planning issues through computer vision tools that bring human perspectives into consideration.

“People’s perception of urban spaces has been overlooked in terms of how this affects individual decisions and contributes to a city’s economic prosperity. For instance, it can affect whether someone wants to buy a house or rent a workspace there or go out at night. If you want to energise the urban space, then how people perceive that destination is important,” he said.

Until recently, it was nearly impossible to measure and incorporate people’s perspectives and behaviours. Early attempts by researchers involved manually tracking individuals on the street, a time-consuming process that, without supportive technologies, limited observations to narrow areas in single cities.

But about six years ago, when Professor Qiu was a researcher at the Senseable City Lab of the Massachusetts Institute of Technology, he realised that computer vision programs could perform those observations rapidly and across multiple places at once.

Windows, human scale and variety

He set up a website to get baseline data by asking people for feedback on street pictures, such as whether a scene made them feel safe or was aesthetically appealing. That input was used to create labels of street features and establish a training dataset to predict how people might perceive a given city street and how those perceptions might affect behaviour.

The model was then used in real life. For instance, a study on housing purchases and rentals in Shanghai showed that quite apart

“If you want to energise the urban space, then how people perceive that destination is important.”

Professor Qiu Waishan

from the usual external factors of location and accessibility to parks and schools, perceptions of better visual quality as measured by the model coincided with higher housing prices. This effect had not been tested before.

Professor Qiu’s research has also identified factors that provoke positive feelings in a street environment. Transparency of the street’s building façade – essentially how many large windows there are at street level – matters. So does the ‘human scale’ of the street, meaning the ratio of building heights to street width, which is best at a one-to-one ratio. Street complexity is also important, in terms of a variety of trees, signposts, lights, outdoor settings and spots for people to gather.

However, perceptions of visual quality can depend on what a person is doing on that street. A cyclist may prefer lots of trees, while a pedestrian will favour wide sidewalks and places to meet up and socialise.

Professor Qiu’s research also found that while people feel safer when there are others on the street, this is not necessarily correlated with less crime – crimes of opportunity, especially theft, can increase with more people.

Night vision

Moreover, the shadows and coverage provided by trees can affect a sense of personal safety, as the example of women at night illustrates. He is also working to address that issue by applying computer vision and artificial intelligence to predict nighttime urban spaces based on daytime images in his dataset.

“This is ongoing research, so we are still collecting paired day and night street view images, but the results so far are quite amazing. Our aim is to produce a model that can help urban designers and planners around the world to predict their local nighttime environment,” he said.

He is also trying to predict people’s behaviour to inform better planning. Data collected through computer vision can show such things as the kinds of shops that attract more pedestrians and whether special equipment encourages people to exercise. The behavioural data is collected carefully to protect privacy – faces are blurred and the focus is on crowd behaviour, not individuals, he said.

Professor Qiu has also used his model to show how urban visual quality can attract innovators. He compared innovation hubs in London, Boston, Seattle and San Francisco with Shanghai’s Zhangjiang Science City. The other global hubs scored 7.0–7.5 for visual quality, while Shanghai’s uneven and polarised urban development meant some established parts scored 7.5 while others only about 2.0. Along this line, visual consistency is a fourth factor affecting street visual quality, in addition to transparency, human scale and complexity.

“We need to pay attention to homogenising building façades. Every city wants landmarks, but if every building is trying to be the region’s rockstar, it can look very distracting and overwhelming, making people feel anxious,” he added.

COMPUTERS TAKE THE WHEEL

The technology behind embodied AI and autonomous cars has made huge strides in recent times, helped in part by a system devised by HKU Professor Li Hongyang and his collaborators.

Self-driving cars are no longer a vision of the future. They are already operating in some streets. Google's Waymo, which develops self-driving vehicles, is up and running in several US cities and this year started testing in Japan. Goldman Sachs predicted in August 2024 that partially autonomous cars would comprise 10 per cent of new vehicle sales by 2030.

Handing the wheel over to a machine might seem risky, but it has been made feasible thanks to advances in computer vision and the development of new AI-based systems to process visual data, such as that developed by Professor Li Hongyang, Assistant

Professor in the HKU Musketeers Foundation Institute of Data Science and a member of OpenDriveLab.

In 2023, Professor Li and his team unveiled Unified Autonomous Driving (UniAD), which combines different modules, such as image recognition and action planning, into one end-to-end network. Usually, these modules function separately, but when combined, they are much more effective and accurate at processing visual signals.

The research won the best paper award at the prestigious 2023 IEEE/CVF Conference on Computer Vision and Pattern Recognition and its end-to-end

“We are the originators of the technical roadmap for end-to-end pipeline technology, which has provided the industry with a prototype verification to follow up on.”

Professor Li Hongyang

pipeline approach has since been widely adopted by several renowned automakers globally, generating a wide spectrum of customised versions of end-to-end driving solutions in various scenarios.

Adopted by carmakers

“We are the originators of the technical roadmap for end-to-end pipeline technology, which has provided the industry with a prototype verification to follow up on,” Professor Li said.

“Private companies will never say that they have adopted methods developed in academia, but Tesla now uses this kind of technology. So does Waymo and a number of car manufacturers in Mainland China, such as Huawei and Xiaomi.” In fact, he is collaborating with such a manufacturer to test the latest version of UniAD in vehicles using the platform World Engine.

In the traditional approach, there is a multi-step process where the camera takes images that are interpreted based on manually-input rules, the planning module then decides the trajectory of the vehicle, and the execution module takes the appropriate action. With UniAD, this is all integrated into one flow of action by using AI to train the model in recognition and response, and to optimise features, without any explicit design or intermediary.

The team did a detailed comparison between UniAD and conventional systems and found that the relative

gain or improvement in various tasks ranged from 20 per cent to 100 per cent, depending on the task.

Eyes on robotics

Despite that, though, Professor Li said there are still obstacles to the widespread use of autonomous vehicles, in particular regulatory and liability issues. His team and collaborators have therefore been looking at how to apply their know-how in another kind of system – robotics. Autonomous vehicles and robotics are similar in that they both involve movable rigid objects that can embody AI.

“As AI advances and is able to recognise objects, the next step is to physically interact with the environment. Robotics naturally fit in this category, so we are working on topics like humanoids and manipulation, including our new AgiBot World platform, which is a large-scale dataset for robotic manipulation,” he said.

A recent project is training a robotic arm to recognise objects on a table and tidy them up in an organised way, similar to how humans would perform the task, rather than simply grabbing at the objects. This is not yet the humanoid robot that many envision could be a playmate or personal maid, but it is a necessary step towards developing an intelligent robotic system for AGI 2.0 – the next generation of artificial general intelligence.

“Robotics is still at a very early, preliminary stage. Robots can only move something from one place to another from a fixed position. The key challenge is in making robots mobile and able to perform tasks like a human would. You have to train them with a large amount of data that is very diverse and challenging, and it may be 5 or 10 years away before we can do this. But there are a lot of researchers and start-ups working on it,” he said.

That includes Professor Li and his team, who hope that their approach of using computer vision and an end-to-end pipeline will yield new discoveries in the field.



Picture of a robot performing a household task from OpenDriveLab's AgiBot World, an open-source platform to advance humanoid robot training and development.





MODELLING HUMAN VISION

Professor Andrew Luo's work is deepening understanding about how the human brain processes and understands images, which has implications for the development of machine vision.

In every waking moment, our eyes take in an enormous amount of information from our environment – people, places, things, animals, events. But how does our brain identify and organise these images, and single out the important ones?

That question is of interest to both neuroscientists, who want to better understand the workings of the brain, and computer scientists, who want to apply that to computer vision. Professor Andrew Luo, Assistant Professor in the HKU Musketeers Foundation Institute of Data Science and Department of Psychology, comes from both backgrounds and he has produced insights that enrich our knowledge about visual processing.

"I study a region of the brain called the visual cortex, which processes

everything we see. To study this in the past, you would have had to recruit graduate students and do a lot of experiments to show images to human subjects and record their brain activity. But now, we can do data-driven studies using tools like generative image diffusion models and large language models in a way that is accelerating scientific discovery," he said.

His own work uses functional magnetic resonance imaging (fMRI) to record the brain as it responds to thousands of random images. This is then fed into computer tools, such as image diffusion models and large language models, to identify semantic trends and understand which kinds of images activate which areas of the brain.

Survival needs

A key finding is that the organisation of the visual cortex corresponds to human evolutionary needs, with one component responding to bodies and faces, another to place areas and physical scenes, and a third component to food.

"To survive, a person needs to recognise friends and family, they need to know where they need to go, and they need to find food. This is an exciting observation because it finds that the visual cortex is strongly ecologically driven by these survival needs," he said.

The results have enabled him to stimulate brain activity in specific ways by generating images with different attributes. They have also enabled him to develop computer tools based around the brain's image processing.

One tool he developed, called BrainDIVE (Brain Diffusion for Visual Exploration), creates images predicted to activate specific regions of the brain, having been trained on a dataset of natural images paired with fMRI recordings.

"Semantically self-supervised models are more robust to visual dissimilarity in the world because of how they classify objects. They can learn more flexible representations, potentially in a more similar way to humans."

Professor Andrew Luo

This bypasses the need to hand-craft visual stimuli. Another tool, BrainSCUBA (Semantic Captioning Using Brain Alignments), generates natural language captions for images, which can in turn be used to generate new images. Finally, a tool called BrainSAIL (Semantic Attribution and Image Localization) allows for the disentanglement of complex natural images.

The combination of image and language builds on findings from the past decade that show vision models are best able to predict

the areas of the brain activated by certain images when they are 'self-supervised' and left to their own devices. For example, such models are better at distinguishing between images of a dog and a cat if they can figure it out themselves rather than be told what to look for in a dog and a cat.

More robust

They are also better at semantic coherence, meaning they can understand when objects are related even if their individual components seem a little off. For instance, the red colour of pepperoni on pizza could lead models based on visual similarity, without the semantics component, to conclude the pizza was uncooked.

"Semantically self-supervised models are more robust to visual dissimilarity in the world because of how they classify objects," Professor Luo said. "They can learn more flexible representations, potentially in a more similar way to humans."

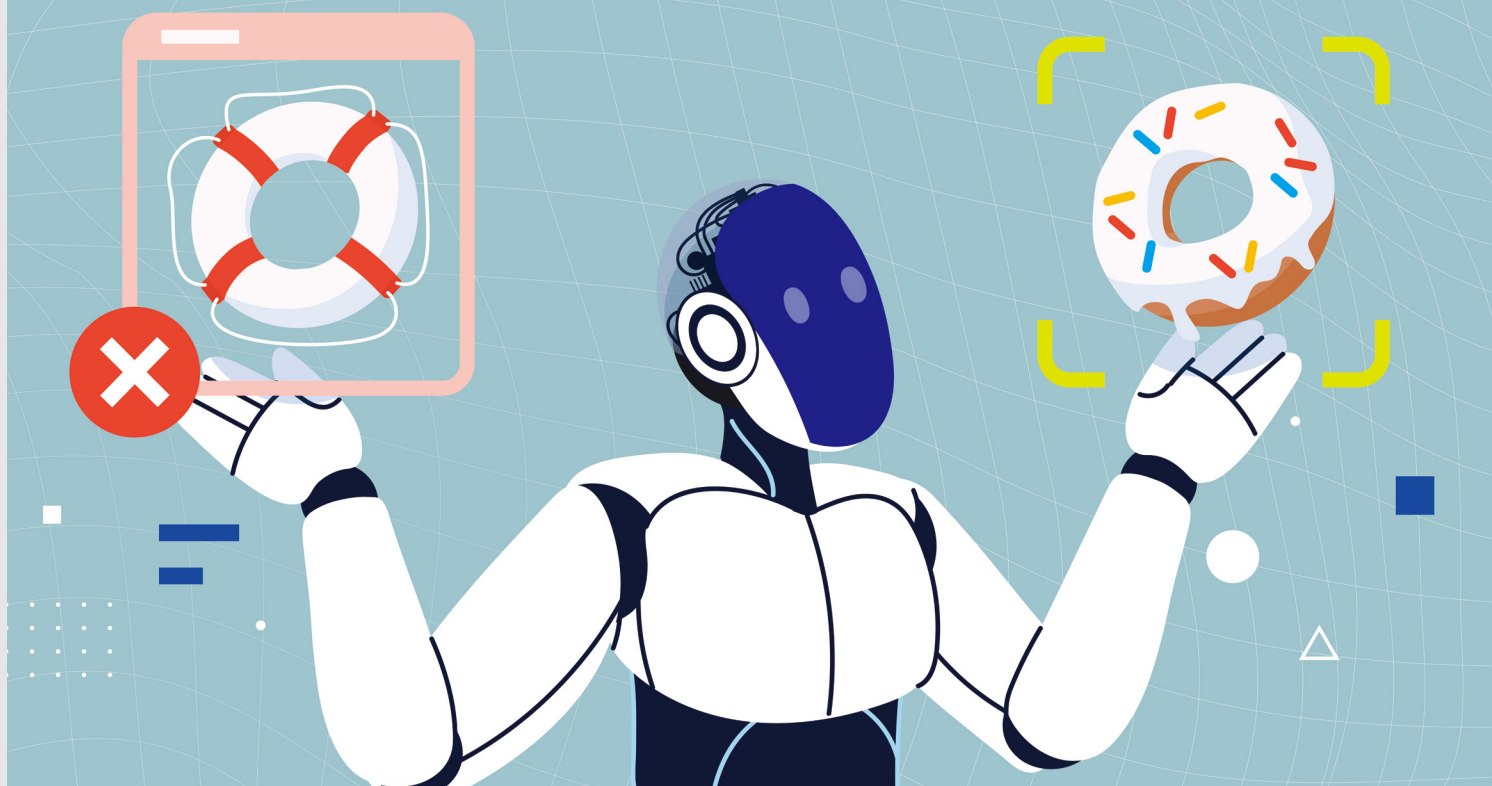
Vision is not the only input that could generate such outcomes. Professor Luo has also been trying to integrate sound into generative models to improve their representations. But vision is still his key focus, given it is the most dominant of the human senses. He hopes to explore the hierarchy of perception and apply his findings to the brain-computer interface.

"I came to HKU in last September and it's a great place because there are a lot of people doing cross-disciplinary work in data science or machine learning combined with another field.

"Going forward, I hope to develop better tools to understand the human brain and to use the human brain to interact with, for example, brain-controlled robotics. I also want to leverage insights from human cognition and psychology to design better models," he said.

PERFECTING THE IMAGE

HKU's Visual AI Lab is developing models to comprehend images from the real world and create new visual content in 2D, 3D and 4D in a more accurate, efficient, accessible and cheaper way than current commercial models.



The AI program Midjourney can generate all kinds of images, but it famously struggles with the human hand. Fingers may be missing or added, fingernails absent, and unnatural poses struck. The problem, says Professor Han Kai, Assistant Professor in the School of Computing and Data Science and Director of the Visual AI Lab, is in the programming.

A massive amount of data is fed into AI-powered image generators to train their billions of parameters, but the

processes by which they produce content remain a black box – not only to outsiders but, it would seem, to the model developers themselves.

“When existing commercial models were initially trained, these problems weren’t considered, or the right parameters were not injected into them in terms of following geometric, physics and other basic laws,” he said.

Professor Han and his team are working to address that. “In our

Lab, we are trying to build models that can actually understand and reconstruct our open world. We want to have a principled understanding of how our models work so they are not just making a random guess.”

His work covers four overlapping areas: understanding and creating images of things, even if the model has never seen them before; creating 3D content; advancing the use of generative AI in image creation; and developing the capacities of existing foundational models.

Open-world training

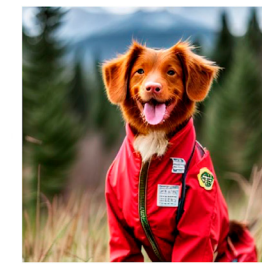
In the first area, Professor Han and his team have developed open-world learning techniques in which the model independently discovers and correctly applies new concepts to identify categories of objects that it has not seen before. For instance, if trained on dog and cat images, it can separate birds as their own distinct category.

This is unlike the closed-world training of most other models, which only recognise objects in categories they have trained on. These models also struggle with streams of images and with varying representations, for instance, failing to understand that paintings or emojis of cats are still cat images.

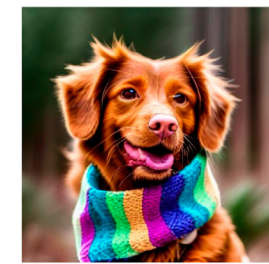
In open-world learning, the model still learns from pre-labelled data but then transfers that knowledge to newly encountered data. In the example of cats and dogs, it knows they have four legs, so it recognises that two-legged birds may be their own category.

“The worst scenario is when a model has very high confidence in its predictions because if it encounters something outside its learning, it may confidently misclassify it.”

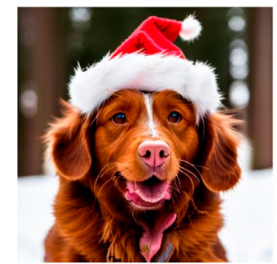
Professor Han Kai



A S* in a firefighter outfit



A S* wearing a rainbow scarf



A S* wearing a Santa hat

The text-to-image generation model developed by Professor Han and his team is capable of learning a visual concept from a set of images, encoding it as a visual token ‘S’, and then regenerating it in diverse, previously unseen scenarios.*

The model is also being trained to admit when it cannot recognise an image outside its training distribution. This is called open set recognition, a subset of open-world learning, and it is important for averting the mislabelling of images – imagine an autonomous vehicle that receives mislabelled information about roadworks or people on the street. Even slight distortions of images can mess with the predictions of an over-confident model.

“The worst scenario is when a model has very high confidence in its predictions because if it encounters something outside its learning, it may confidently misclassify it,” Professor Han said. Better to make conservative predictions than wrong ones.

Open source aims

His second area of investigation is in reconstructing objects and scenes in 3D or 4D from text and single images. This is tricky work and closely related to his third area of study, generative AI in image creation. While some private firms already provide text-to-3D content generation, such as Common Sense Machines, universities and other users have to pay to use them and users often need special expertise. Professor Han is therefore trying a different approach.

His aim is to produce high-quality images on a limited budget and

make this open source for anyone to use with minimal training. For instance, users could extract an object from one image and place it in a different environment simply by typing in some text. The model could find application in things like animation, gaming, education and even creating one’s own avatar to upload to TikTok, although that is still some way in the future.

Professor Han is also working with existing models – his fourth area of focus – to see if they can perform tasks other than those they were designed for, such as matching images to text. He and his team have been testing the capabilities of various models and found Google Gemini 1.5 Pro, GPT 4.0 and Claude’s Sonnet all performed ‘reasonably well’, but still had improvements they could make.

Another ongoing study has set up different AI models to play games against each other, such as chess and Pong, in order to see if their decision-making processes can be discerned.

Professor Han said his Lab’s findings could ultimately have applications in autonomous driving, drug discovery, medical image analysis, surveillance, as well as gaming and entertainment – anything that relies on images. “We are trying to figure out what the key problems are and develop solutions. There are still a lot of problems to address in this space,” he said.

THE CHALLENGES WITH COMPUTER VISION

Allowing computers to identify, use and store visual images such as people's faces, travel routes and medical scans, and to make decisions based on that, raises legal and ethical concerns. Professor Boris Babic explains.

The power of computers to 'see' - to recognise visual patterns - is being tapped for all sorts of purposes, from enabling autonomous vehicles, to providing fast and comprehensive analysis of medical image results, to recognising faces. But there are inherent traps that can undermine trust in the technology.

Bias and discrimination, liability issues, and corporate surveillance are all areas where computer vision has raised red flags, says Professor Boris Babic, joint

Associate Professor at the HKU Musketeers Foundation Institute of Data Science, Department of Philosophy, and Faculty of Law. And while some of these issues have been widely acknowledged, others are not receiving sufficient attention.

Much of the focus in popular and academic literature has been on the bias problem. For instance, computer vision reportedly has difficulty distinguishing between faces of black people and between men and women.

The problem is likely down to the training data used, but there are real-world consequences.

"One obvious issue is that if we apply computer vision systems to public policy and criminal procedure - basically any sensitive decision-making context that requires allocating scarce resources or imposing costs like criminal punishment - then there is going to be a concern about making sure the systems are performing roughly equally among all relevant subgroups," he said.

However, this may be a bigger problem in societies with a history of racial segregation, such as the US, since discrimination and bias may already be embedded in the data used to train computer vision systems there.

Corporate surveillance concerns

A wider issue is liability, particularly in the case of autonomous vehicles. While manufacturers could be held accountable, what happens when an accident is triggered through shared data? Think in terms of something like the digital navigator Amap in China, which is used by the automaker BYD, or an equivalent in other countries.

"If every company is developing its own AI system and its own data, and everything is closed to others, maybe it's easy to determine liability. But how do you re-conceive responsibility when you have multiple subsystems contributing to a decision in a way that's going to make it increasingly hard to decipher which part of the decision belongs to which subsystem?" Professor Babic said.

Some car companies have started experimenting with insurance coverage for autonomous cars, but the question probably will not be settled until there are compelling test cases in court.

"If we apply computer vision systems to public policy and criminal procedure, then there is going to be a concern about making sure the systems are performing roughly equally among all relevant subgroups."

Professor Boris Babic

In any case, the collection of data by companies raises the problem of corporate surveillance. Carmakers and many other companies, such as phone manufacturers and online browsers, collect user data ostensibly for functionality. But what those companies can then do with the data is not really addressed by privacy protection laws, he said. For example, should insurance companies be prevented from using a driver's recorded driving speed to set their insurance premiums? If yes, what assurance can there be that the data is not shared with adjusters in the company?

"I think corporate surveillance and espionage get way too little attention. Most of the attention is on government or police surveillance, which is low-hanging fruit because their cameras are often conspicuous and you can visit government contract websites to see what they are ordering.

"Whereas with corporate data, we have no idea how their models are updated or what happens with a lot of this data, or how it's combined with other data sources. If you have a self-driving car with radar and imaging systems, they can track your every movement, but it's not clear where the data is going," he said.

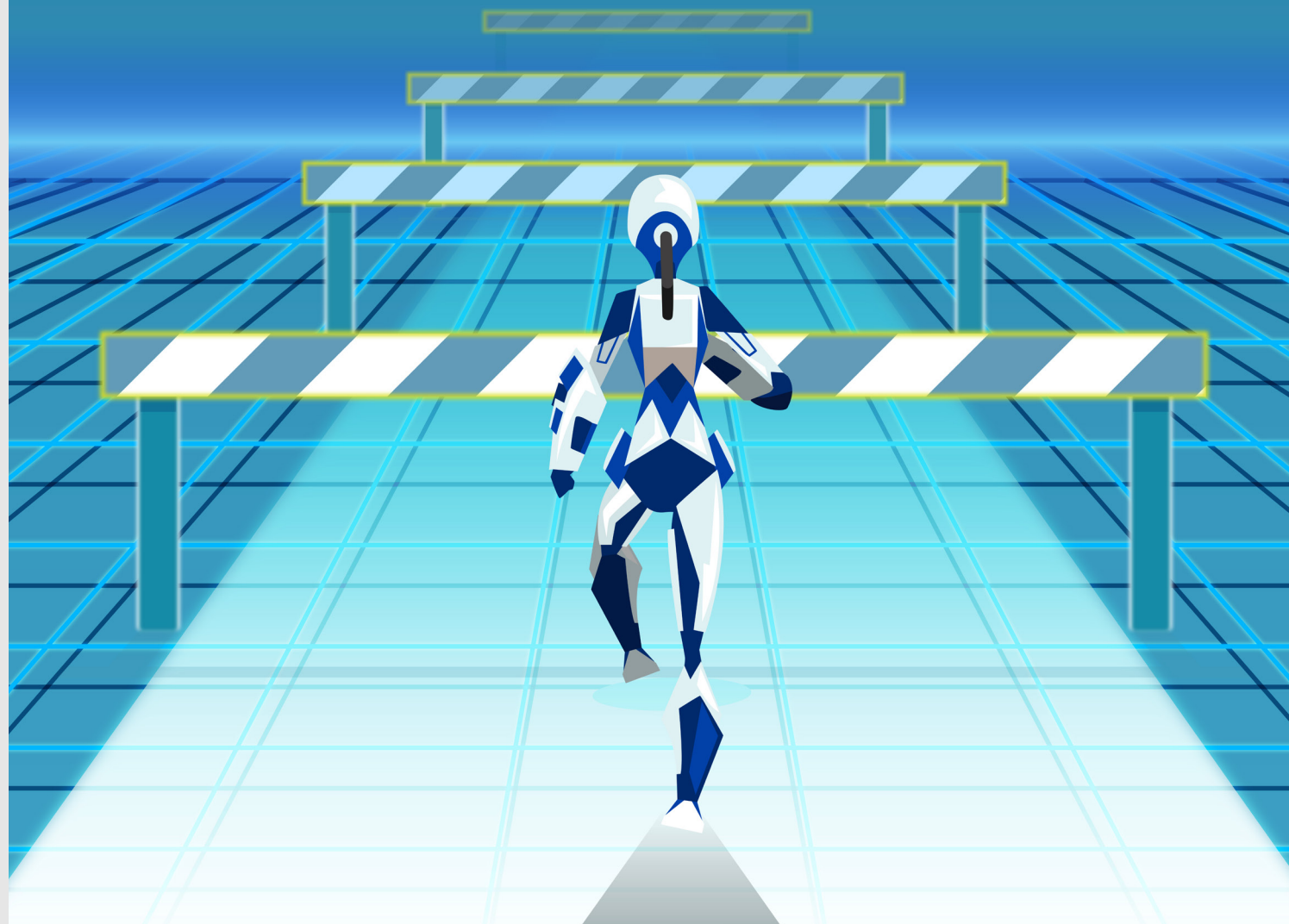
Explainability might not improve things

Other worrying examples of corporate use are medical scans and other health data, which, if accessed by insurers, could affect a person's premiums.

New laws or legal approaches might potentially address liability and surveillance. But when it comes to bias and fairness, the response has been driven by engineers: open the black box of AI and try to fix the problem there. Intriguingly, Professor Babic is not in favour of this approach.

"Computer vision is a paradigm example of a black box system because it is high-dimensional and the features are not intuitive. There has been a large area of research on how to make these systems explainable or transparent, but I think we should accept they are doing something quite different from how our own brains process and recognise images. Rather than attempt to make them understandable to us, we should instead focus on their performance. Because explainability does not necessarily make performance better," he said.

Accepting that the technology operates differently from humans could also help sharpen focus and resources on the important issues of liability, whether decisions are autonomous or informed by human judgement, and how the data is used. "We should be looking at what it is doing and whether it is improving decision-making in society for whatever context we're appropriating it for," he added.





HKU Med



IN THE BLOOD

A remarkable new treatment for leukaemia, invented and developed at HKU, is chemo-free and has a 97 per cent success rate, offering new hope and less treatment trauma for patients.

Scientists at HKUMed have invented a groundbreaking regimen – an oral formulation of arsenic trioxide (oral-ATO, or ARSENOL®) – for the treatment of acute promyelocytic leukaemia (APL), a blood cancer which has a high fatality rate. They have been developing the treatment over the past 25 years, and it is the first prescription medication invented and manufactured in Hong Kong to obtain European, US and Japanese patents and US Food and Drug Administration (FDA) approval.

There are three parts to the treatment – oral-ATO, all-trans retinoic acid (ATRA) and ascorbic acid (AAA) – the first is

a solution and the second two are in pill form. Significantly, it is a chemotherapy-free regimen, meaning far less discomfort for patients, and it can be administered on an outpatient basis with no need for hospitalisation.

Lead investigator Professor Harry Gill, Clinical Associate Professor in the School of Clinical Medicine of HKUMed, said: “The ‘AAA’ regimen is a game-changer – highly effective and safe for all risk categories of APL patients. Oral-ATO is used first to treat patients with APL and then becomes the maintenance treatment for patients in first complete remission, resulting in a 97 per cent five-year leukaemia-

free survival (LFS) rate and a 97 per cent overall survival (OS) rate.

“A five-year survival rate refers to the proportion of patients surviving at five years following the diagnosis of APL. That essentially means these patients are cured. Before oral-ATO was available, the treatment was with ATRA and chemotherapy alone and survivals were between 60-70 per cent at five years taking into account early deaths that occurred during the initial phase of treatment.”

Less trauma

The all-important chemo-free aspect makes the treatment less

“It has been a remarkable achievement with the oral formulation of arsenic trioxide that has led to improvement in patients’ survivals and quality of life.”

Professor Harry Gill

traumatic for patients. “Since 2018 we have been using a completely chemotherapy-free regimen,” said Professor Gill. Conventionally, APL is treated with ATRA and chemotherapy or with the intravenous formulation of ATO that carries higher risks of treatment-related side effects and impairments to quality of life.

“Not only is this treatment less harsh but patients are not exposed to risk of infections such as toxicity or damage to the heart, liver or kidney. Nausea, vomiting, hair loss – all of these impairments to quality of life can be avoided or minimised. Side effects are usually very mild – grade one and grade two in medical terms, such as mild headache, possibly mild gastric discomfort.”

Professor Gill has worked on the treatment since 2007 with the inventors of its initial formulation Professor Cyrus Kumana and Professor Kwong Yok-lam, and initially conducted pre-clinical and phase I studies. Next came the clinical development with phase II studies, and the establishment of Good Manufacturing Practice-grade oral-ATO and obtaining

the European Medicines Agency (EMA) and US FDA designations through clinical research in APL.

“During our first study between 2002-2017, we treated patients who had relapsed APL. At that time, such patients would require a bone marrow transplant, which involved chemotherapy, discomfort and potential complications. This treatment obviated the need for a transplant in relapsed APL. The findings of this study were published in 2018.”

Remission maintenance

Subsequently, the HKUMed research team started to use oral-ATO as the maintenance treatment for APL patients in first complete remission. The findings from this were published in 2020. The next step was the incorporation of oral-ATO into frontline treatment for newly diagnosed APL patients, achieving 100 per cent LFS and OS at five years. The findings were published in 2019. Since 2018, the chemotherapy-free oral-AAA regimen has been fully implemented and initial findings were presented at the American Society of Hematology annual meeting in December 2023.

Oral-ATO (ARSENOL®) is now available in Hong Kong, Macau, Singapore and Malaysia as part of clinical trial or

routine clinical use for APL. It has obtained orphan drug designation from both the US FDA and the EMA, as well as the Investigational New Drug designation from the US FDA.

As a result of these designations, oral-ATO will be used in Europe and North America as part of phase III international studies in 2025. Additionally, an investigator-led phase III study will be conducted in the UK in collaboration with the University of Cardiff. The team’s aim is to complete the phase III clinical studies in APL and also continue researching its efficacy for other diseases.

“We are testing on other malignancies,” said Professor Gill, “and have seen efficacies for mantle cell lymphoma, NPM1-mutated AML, and TP53-mutated AML – but so far, we have not published it as we are applying for patents. We have done pre-clinical work for autoimmune disorders such as systemic lupus erythematosus and rheumatoid arthritis showing positive findings.”

Summing up, Professor Gill said: “It has been a remarkable achievement with oral-ATO that has led to improvement in patients’ survivals and quality of life. Translating research into improvements in patient care is our ultimate aim.”



Professor Harry Gill (right) and Professor Kwong Yok-lam (centre) introducing oral-ATO to the press.

ONLINE, IN TOUCH

A comprehensive international study undertaken by a team from HKUMed and including longitudinal studies on elderly people, found that internet use among adults over 50 years old is consistently associated with better mental health outcomes.

These positive associations were observed in more than 87,000 people across 23 countries and, representing a wide variety of cultural and economic contexts,” said Professor Zhang Qingpeng, from the Department of Pharmacology and Pharmacy and HKU Musketeers Foundation Institute of Data Science. “We found that elderly people who engage online report higher life satisfaction and better self-reported health, as well as fewer depressive symptoms.

“One of the key implications is that the internet can be a valuable tool which offers older people opportunities for social connection, access to services, and engagement with resources that might otherwise

be difficult to obtain. Our study also suggests that promoting internet access and digital literacy among older populations could be a cost-effective strategy for improving mental health, particularly in regions where traditional mental health services are less accessible.”

Previous research on the topic has tended to focus on specific regions with mixed findings. This study is one of the first to provide robust evidence on the relationship between internet use and mental health among older adults across a wide range of countries.

The data came from six large, publicly available ageing cohorts, from high- or middle-income countries,

including the US, England, Europe and Israel, China, Mexico and Brazil. Each cohort follows a similar longitudinal design involving nationally representative samples of middle-aged and older adults and contains detailed information on physical and mental health, socioeconomic factors, and lifestyle behaviours.

By combining data from these multiple international studies, the researchers were able to analyse the relationship between internet use and mental health in a large sample of individuals across diverse countries and contexts. “These datasets are available to researchers through public access or specific research collaborations, ensuring transparency and reproducibility in our study,” said Professor Zhang.

Regular usage

The researchers categorised internet use based on frequency into several levels: ‘never’, ‘less than weekly’, ‘weekly’ and ‘daily’. “The regularity of internet use seems to enhance the potential benefits, as it provides continuous access to social connections, information, and services that can support mental well-being,” he said. “Specifically, individuals who used the internet more frequently – especially those who used it daily – reported better mental health outcomes.”

Based on the findings, the team believe that tailored interventions leveraging internet connectivity hold the potential to improve mental health among middle-aged and older populations. Such interventions would need to be personalised, taking into account sociodemographic characteristics, health behaviours, physical health and genetic risk.

“For example, using mobile health apps to encourage fitness and monitor wellness may be more beneficial for mental health in older adults without sufficient physical activity, as regular exercise has been shown to reduce depressive symptoms and improve life satisfaction,” said Professor Zhang. “These apps could provide reminders, track progress, and offer tailored exercise plans to motivate users. Further, telemedicine platforms and online consultations enable seniors to access healthcare remotely, making it easier for them to manage their physical and mental health.”

E-learning opportunities

“For older adults who are already physically active, other types of interventions, such as e-learning programmes or online hobbies, can be used to engage them mentally. These could include online courses that encourage lifelong learning, virtual arts and crafts workshops, or forums where they can explore new interests and passions. Such activities stimulate cognitive engagement, promote creativity, and provide opportunities for social interaction – all of which are important for maintaining mental health in later life.”

“The internet can be a valuable tool which offers older people opportunities for social connection, access to services, and engagement with resources that might otherwise be difficult to obtain.”

Professor Zhang Qingpeng

Online social platforms also allow them to maintain relationships with family, friends and support networks, reducing feelings of loneliness and isolation.

While the team have not yet begun developing related intervention programmes, they view this as a promising avenue for future research. “It is one of the potential directions we may pursue, with the aim of translating our findings into practical solutions that can help improve mental well-being in middle-aged and older adults,” said Professor Zhang.

Depression projection

Professor Zhang’s findings come at the same time as an economic modelling study on depression health – the first of its kind in Hong Kong – has revealed the city will face a significant and ongoing burden of depression from 2023 to 2032. The study, led by Professor Shirley Li Xue from the Department of Medicine and Department of Pharmacology and Pharmacy, estimates that Hong Kong’s average yearly healthcare cost linked to depression to be HK\$2.51 billion, affecting more than 55,000 people. Finding ways to engage people positively is therefore becoming increasingly important for both the improvement of individual mental well-being and the reduction of this economic burden.





LESSONS FROM THE DEEP

Images of ostracods - microscopic crustaceans - from the deep sea. (Courtesy of Jingwen Zhang)

Fossil data has shown that over time deep-sea ecosystems have been affected by temperature changes and food input, raising questions about possible negative effects of intervention measures to mitigate against climate change.

Paleobiologists from HKU's School of Biological Sciences recently completed a study on the sub-Antarctic zone in the Southern Ocean which revealed that temperature changes and food input have played distinct roles in shaping deep-sea ecosystems. The study was published in the journal *Current Biology*.

The research was a collaboration between HKU and Princeton University in the US. Professor Moriaki Yasuhara and Ms Raine Chong from HKU's School of Biological Sciences, the Swire Institute of

Marine Science, and the Institute for Climate and Carbon Neutrality, joined forces with Dr May Huang from Princeton's Department of Geosciences.

"We showed that the Southern Ocean deep-sea ecosystem we see today was established following the Mid-Brunhes Event - an important climatic transition which occurred around 430,000 years ago - and that the abundance of individual species waxed and waned, depending on sediment input from land, as well as dust concentrations," said Professor Yasuhara.

"However, prior to the Brunhes Event, the species present and how they responded to environmental variability were different. The event thus marks a substantial turnover from colder-water to warmer-water species."

This result suggests that if future human-induced climatic warming weakens global deep-water circulation from the Atlantic through the Southern Ocean to the Pacific, a deep-sea biodiversity hotspot in the Southern Ocean may diminish or even vanish.

Extreme environment

Asked about the methodology used for the study, Professor Yasuhara explained that the understanding of long-term history such as climatic impact in a remote and extreme environment is not an easy job. However, one way of getting around this problem is to study fossil organisms, a key tool for understanding the complex biological history of Antarctica and obtaining glimpses of entire ancient ecosystems.

Professor Yasuhara and colleagues leveraged the fossil record of ostracods - microscopic crustaceans whose shells are preserved in abundance, making them ideal for studying deep-sea ecosystems through deep time - that is, dating back tens of millions of years and beyond.

They obtained the fossils from sediment cores taken from the Tasman Sea and documented the ecosystem response of these fossilised organisms to the most recent major shift in these astronomical perturbations and their accompanying climatic changes.

"Components of fossil fauna showed substantially similar change - one to deep-water temperature and the other to dust flux changes," said Professor Yasuhara. "This indicates Southern Ocean deep-sea fauna responded both to climatic change and to iron fertilisation in different ways, and this could have important

"Southern Ocean deep-sea fauna responded both to climatic change and to iron fertilisation in different ways, and this could have important implications for ocean-based climatic interventions..."

Professor Moriaki Yasuhara

implications for ocean-based climatic interventions as it is possible that they could have negative impacts on the deep-sea ecosystem itself."

The interventions the team are concerned about are geoengineering technologies, referred to as ocean-based climate intervention, which includes proposals such as the removal of marine carbon dioxide with the aim of reducing future warming by putting and storing carbon or carbon dioxide in deep-sea sediment under the ocean bed, where in theory it will remain stable because of the low-temperature and high-pressure environment.

Professor Yasuhara said: "The intention basically is to enhance the surface primary production, for example through iron fertilisation, in order to increase carbon flux to the deep sea - or to put more organic matters such as crops and macroalgae into the deep sea.

"But our research indicates we should be cautious about taking such actions, especially if we are not very sure about their effectiveness and how long such mitigation will actually work sustainably and/or continuously. For example, if carbon will go back to the atmosphere in just 10 years or even 100 years or so, it won't be worth doing."

Researchers acknowledge that the deep-time development of the Southern Ocean's deep-sea ecosystem remains poorly understood, despite being a key region in global ecological, climatological and oceanographic systems, where deep water forms and biodiversity are unexpectedly high.

Carbon dioxide modulators

The Southern Ocean accounts for as much as 75 per cent and 40 per cent of global ocean heat and carbon uptake, respectively, and its currents are key modulators of global carbon dioxide flux. A breakdown of this current system will have significant negative effects on marine ecosystems from the surface to the deep seafloor.

But, while acknowledging that concerns are growing for how climate change and the rise in ocean temperatures will affect even these, the deepest areas of the oceans, Professor Yasuhara pointed out that it's crucial to have foundational knowledge of the deep-sea ecosystem and biodiversity, particularly if the intention is to alter it.

"Even if the intention is good the outcome might not be," he said. "Before taking any action of this kind, we need to have a fuller picture of what the consequences may be."

The team now plan to conduct high-time resolution research. "We want to ascertain if the results will be similar at, for example, the centennial/millennial time scale. That is the time scale we are worrying about for the future," said Professor Yasuhara.



Scientists studied the rosy-faced lovebird, a familiar parrot species, to uncover the genes determining the colour variation between their red and yellow psittacofulvin-containing plumage patches. (Courtesy of Pedro M Araújo)

SEEING RED

The bright plumage of the parrot is one of its most distinctive features, and until recently how their unique red colouring was produced was a mystery. Using cutting-edge technology, biologists have now solved this centuries-old puzzle.

A collaboration between researchers at HKU's School of Biological Sciences and BIOPOLIS' Research Centre in Biodiversity and Genetic Resources (BIOPOLIS-CIBIO) in Portugal have discovered the genetic 'switch' that determines the red colour of a parrot's plumage.

"Parrots are unique in their way they produce colourful plumage," said Professor Simon Sin Yung-wa, co-author of the paper which has been published in *Science*. "Different from all other birds, parrots use a unique polyene pigment, which is called psittacofulvin, to produce the colours from yellow and orange to red."

The genetic basis of parrot pigmentation was only discovered in 2017, when a study on budgerigars found an enzyme for yellow psittacofulvin production. Most other birds need to obtain dietary carotenoids to colour their feathers from red to yellow, but scientists have known for decades that parrots have the ability to endogenously synthesise their unique pigments, psittacofulvins, to colour their feathers.

"However, until our study, we still did not know the underlying molecular mechanism - that is, which enzyme(s) or biochemical pathway produces the red pigmentation in parrots," said Professor Sin. They found that only one protein controlled the colour difference in the lorries, aldehyde dehydrogenase 3 family member A2 (ALDH3A2), and the higher the expression level of ALDH3A2, the more red aldehyde

psittacofulvins are converted into the yellow carboxyl form.

The study was undertaken on three different types of birds - the dusky lory (*Pseudeos fuscata*), a parrot species called the rosy-faced lovebird (*Agapornis roseicollis*) and the budgerigar (*Melopsittacus undulatus*). The methodology utilised was a combination of chemical analyses, genomic and transcriptomic investigations, single-cell analysis, and biochemical assays.

Research methodology

"We first performed chemical analyses to show that red and yellow psittacofulvins are two different forms of the pigment, which are aldehydes and carboxylic acids, respectively," said Professor Sin. "We then conducted a genomic study on the dusky lory. The dusky lory has a naturally occurring red or yellow form, a type of colour polymorphism that is very rare. It serves as a good model to identify the difference in the genomes between the red and yellow dusky lorries. By performing a genetic mapping analysis, we identified a genomic region with the ALDH3A2 gene to be highly associated with the colour polymorphism."

They also performed transcriptomic analysis on the feathers of the rosy-faced lovebird. This parrot species displays both green plumage (that is, plumage containing yellow psittacofulvin) and red plumage patches, and therefore good for studying the genes determining the colour difference between red and yellow psittacofulvin-containing plumage patches to help facilitate the scientists' understanding of the general role of ALDH3A2 in other parrot species.

"We found that the same aldehyde dehydrogenase gene

expressed at a high level in yellow psittacofulvin-containing feathers, where the red psittacofulvins were converted into yellow forms," explained Professor Sin.

The third bird species, the budgerigar, is a common pet parrot that has yellow psittacofulvin-containing plumage almost covering the whole body. "We used it to study how individual cells turn different genes on and off during feather development," he said.

Single-cell RNA sequencing showed that ALDH3A2 is expressed in late-differentiating keratinocytes in growing feather follicles, which are cells important for psittacofulvin metabolism.

Finally, they conducted a biochemical assay in yeast to validate the role of ALDH3A2 in psittacofulvin biosynthesis. They found the action of this protein

is sufficient for the conversion of red pigments into yellow.

Technological advances

The researchers would not have been able to make the new discovery without the latest advances in technology. "New biotechnology assisted us to achieve something that decades ago could only be dreamed of," said Professor Sin.

"Single-cell technology provided unprecedented resolution at individual cell level, making it possible to study what genes are expressed and how they were turned on and off. Also, high-throughput technology allowed us to sequence multiple genomes and transcriptomes within a reasonable budget and timeframe."

This is the first collaboration between CIBIO and the HKU team and it came about after the two labs discovered they were each trying to solve the same mystery.

"In the middle of the study, we somehow learnt about each other's work, and that our data were complementary," said Professor Sin. "We felt we could support each other's work and make the result more comprehensive and compelling. It proved to be a successful collaboration and shows 'if you want to go far, go together.'"

The teams aim to continue seeking new information in this field. "There are still so many unknowns about how different species evolved and developed their plumage colour," he said. "My team and I will keep going on this journey to decipher the mystery behind bird colouration. Through this process, we will also gain more insights into how evolution creates complexity and diversity in the natural world."

"Single-cell technology provided unprecedented resolution at individual cell level, making it possible to study what genes are expressed and how they were turned on and off."

Professor Simon Sin Yung-wa

INTERACTIVE EXCAVATION

Developing 3D technology for archaeological digs improves the accuracy and efficiency of data gathering, and reduces the destructive element.



Professor Peter J Cobb compares the 3D model of a virtual pottery sherd with an adjoining real sherd with the help of a mixed reality headset.

Archaeology investigates the ancient human past based on the things people left behind – from pottery and stone tools to architecture and landscapes. In order to collect information, archaeologists excavate and remove artefacts and structures from a site, so this science is often regarded as ‘destructive’ since no one else can dig the same place again. Although technology has improved the accuracy and efficiency of

how data about the removed remains is preserved, most archaeologists cannot keep pace with the technological changes made by profit-driven industries.

Archaeologists at HKU, however, are not merely keeping up with technology, they are leading the development of innovative new ways to deploy this technology for data collection and use during fieldwork. This begins with the

high-resolution 3D scanning of the excavation and then incorporates the wearing of mixed and augmented reality (MR/AR) headsets by team members who are digging on the site.

With these technologies, the team are pioneering the interactive application of digital 3D scientific data at archaeological sites – allowing the artefacts and spaces to be revisited, with virtual models anchored back in their original places.

“Archaeological excavations happen in the realm of length, width and height; this is our 3D world. It made sense to not only excavate, but also study archaeology in 3D using new technologies,” said PhD candidate Mr Hayk Azizbekyan who is leading this research under the supervision of Professor Peter J Cobb, Assistant Professor in the School of Humanities, Faculty of Arts.

“Our digital 3D models of the excavation contain inherent geospatial information, so we can automatically reposition them at the site using the MR/AR headsets,” explained Professor Cobb. “Augmented reality provides a visual digital overlay on top of our real surroundings, allowing us to see both the digital content and the physical reality. Mixed reality takes this to the next level, enabling users not only to see, but also interact with the digital content in an embodied manner, using hand gestures and voice commands.”

Professor Cobb’s team have been using the new technology for HKU’s fieldwork in Armenia as part of his Ararat Plain Southeast Archaeological Project (APSAP), a collaboration with the Institute of Archaeology and Ethnography, National Academy of Sciences of the Republic of Armenia. APSAP is excavating the 3,500-year-old Vedi Fortress, situated within the Ancient Near East – the area of the world that saw the first agriculture, states, cities and writing.

Big data collection

Asked why this has not been used by other archaeologists before, Mr Azizbekyan said that previously MR/AR technology has simply not been good enough, though recent advancements have provided new opportunities. This work also relies on the team’s cutting-edge efforts at big data collection at the site in Armenia.

“Even though the 3D recording of an entire excavation takes significant time and data storage, this is the most responsible way to conduct comprehensive field research,” said Professor Cobb.

The team’s development of the technology has been a cross-disciplinary exercise. Working closely at the Faculty of Engineering’s Tam Wing Fan Innovation Wing, the archaeologists were able to recruit engineering students to help. They have also partnered with

“Even though the 3D recording of an entire excavation takes significant time and data storage, this is the most responsible way to conduct comprehensive field research.”

Professor Peter J Cobb

Professor Evan Peng from the Department of Electrical and Electronic Engineering, who is an expert in computer vision and displays.

“Some student computer programmers help us develop new headset applications,” said Mr Azizbekyan, who received the University’s Research Postgraduate Student Innovation Award to support his work. “Other students help us overcome the limitations of the existing technology by building our own AR glasses, rather than waiting for the market. Engineering students are interested in experiencing archaeology, and have had a chance to travel to Armenia with us to contribute to our overall goals. We have established a strong collaboration with the Faculty of Engineering that will continue for many years in the future.”

Hands-free digging

Another benefit of MR/AR headsets is the ability for them to replace the smartphones used for basic documentation of excavations, allowing archaeologists to keep their hands free for digging. The team have developed advanced voice controls with AI to take photographs and record a narrative journal about their work.

“We also developed a novel depth-guidance system with the headsets,” said Professor Cobb. “This means that a device shows us how deep to dig, without traditional measuring tools. We plan to experiment with many other new innovative uses as we continue to work towards our future vision for revolutionising how archaeologists use technology to digitally augment their vision in the future.”

This research has received wide international attention since its publication in the *Journal of Computer Applications in Archaeology*. Other archaeologists have reached out to the HKU team with an interest in using the technology. “This gives us added motivation to create a complete working prototype to benefit the whole archaeological community,” said Mr Azizbekyan.

TECHNOLOGY IN THE COURTROOM

How do live broadcasts affect behaviour in the courtroom? What happens when judges use AI? And what can data analytics tell us about the factors that favour litigants in court? Professor John Liu has been investigating.



“There are lots of new technologies available and I think the judiciary should think in an innovative way to accommodate them in their decision-making process to improve efficiency and also fairness.”

Professor John Liu

to improve efficiency and also fairness,” he said. In 2024, he published the book *Can Machine Replace Judges? Artificial Intelligence, Data Science, and Law* that introduces the topic of technologies in the courtroom.

AI factors

Professor Liu is also investigating how AI may affect judicial decision-making. One line of study has found that AI and large language models may reinforce judicial bias.

“You now have a convenient tool and with convenience, you may be less likely to write and think thoroughly. It’s pretty easy to direct the model to write anything you want, which might reduce self-reflection and reinforce decision bias,” he said.

Another study, still underway, looks at public reaction to the involvement of AI in judicial decision-making and whether people can distinguish judgements written by AI or judges and whether that influences their trust in the process.

Nonetheless, Professor Liu believes AI can be beneficial in law through human-AI interactions. “In many scenarios, it is very unlikely for AI to replace human decision-makers. More likely, the human will be in the decision-making role and the AI will be the assistant. The interaction of judges and AI is a good example to explore because first, it is very unlikely machines can replace judges. And second, court proceedings are a high-stakes scenario unlike, say, asking if AI can write a joke.

“I hope my study of this interaction can contribute not only to understanding AI’s application in the judicial field, but also to people’s understanding of human-AI interaction in general,” he said. Professor Liu was recently awarded the University’s 2023-2024 Outstanding Young Researcher Award for his work.

Live broadcasts of court proceedings have become more common around the world, especially since the COVID-19 pandemic. In China, they are also part of an effort to encourage judicial transparency.

But sentiment about such broadcasts is divided. Some fear that judges and lawyers play to the cameras and that decisions will be badly affected. Others fear that all parties involved will be very nervous with livestreaming. In the US, David Souter, former Associate Justice of the Supreme Court, once famously said “the day you see a camera come into our courtroom, it’s going to roll over my dead body.”

Professor John Liu in the Faculty of Law, however, has been sceptical about such risks, which he calls ‘folklore’. Recently, he decided to test the matter in a randomised control trial involving 85 cases in China, including civil, criminal and administrative (suing the government) cases. Some cases were assigned to be broadcast live and all participants in the trials were told of this; the others were not broadcast. The language and

behaviours of everyone involved were analysed using a combination of AI audio recognition tools and manual review.

“What we found out is that some of the folklore is just not true. Judges and lawyers do not play to the cameras or change their behaviour. These repeat players are not influenced or affected in a bad way by live streaming,” he said.

“On the other hand, the parties – the litigants – are somewhat influenced. They appear to be nervous, and they speak at a slow speed and convey less information in trials that are broadcast live.”

Detecting trends

While this may affect litigants’ perceptions of the judicial process – a matter that still needs to be studied more closely – Professor Liu said it demonstrates that judges may be too conservative about the risks of a tool that enhances transparency in the courtroom.

The study ties in with his larger body of work looking at judicial behaviour using data analysis. A major catalyst for this work was the decision by the Supreme People’s Court in China in 2014 to promote transparency in judicial proceedings.

Apart from encouraging all courts in China to broadcast their proceedings, the reform led to the online publication of judicial decisions – about 100 million cases so far. Professor Liu is using data analytics to understand the factors that may influence the decision-making process in these cases. For instance, one of his projects found that clients were more likely to win cases if their lawyer was previously a judge.

He has also noted that the judiciary itself is starting to use data analytics to flag such issues as inconsistencies in criminal sentencing across judges, so they can be addressed.

“There are lots of new technologies available and I think the judiciary should think in an innovative way to accommodate them in their decision-making process

PERSONAL RECORD

Wearable technology that tracks a person's vitals and health indicators is not unusual nowadays, but engineering researchers have taken the tech a big step further for more accurate and complex personal monitoring.



The team have developed an innovative in-sensor computing platform that integrates stretchable organic electrochemical transistors (OECTs) with advanced sensing and edge AI capabilities.

"The key innovation lies in combining sensing, computing and stretchability into a single, compact device," said Professor Zhang Shiming, Assistant Professor in the Department of Electrical and Electronic Engineering, who led the research team. "Unlike traditional wearable devices, this platform processes data locally and in real time, offering faster feedback, enhanced privacy, and reduced reliance on external devices or network connectivity."

'Edge AI' refers to artificial intelligence processing that occurs directly on the device, rather than relying on cloud computing or external servers. "In this wearable platform, edge AI enables real-time data processing, minimising delays, reducing power consumption, and enhancing privacy by limiting the need for data transmission," explained Professor Zhang. "This makes the device efficient, responsive and reliable, especially in scenarios where internet connectivity might be limited or where immediate feedback is required."

The implications are profound: this innovative technology paves the way for personalised, proactive healthcare by enabling continuous, real-time health

monitoring with high precision, even during motion, while also reducing power consumption.

Asked how it differs from an Apple Watch, or similar devices, Professor Zhang explained: "Our wearable platform offers in-sensor computing capabilities through its integration of OECTs, which have higher sensitivity for detecting body signals. It can record real-time electrophysiological data, such as muscle and nerve activity, with much greater accuracy."

Natural movement

Additionally, its stretchable and flexible design allows it to conform to the body's natural movements and soft tissues, avoiding problems like motion artifacts that limit the accuracy of traditional devices. All of this makes it more suitable for long-term, precise health monitoring and applications in fields like AI medicine and human-machine interfacing.

"Stretchability is crucial because it ensures that the device can conform to the body's soft tissues and adapt to natural movements without causing discomfort or losing accuracy," said Professor Zhang. "Traditional electronics, which are made of rigid materials like silicon, create a mechanical mismatch with the body, leading to motion artifacts and unreliable data."

"The stretchable design of this platform was developed as a result of our decade-long research on soft materials, and eliminates these issues enabling seamless integration

"The work is highly significant because of its implications for proactive, personalised medicine and the transition from reactive to active healthcare."

Professor Zhang Shiming

with the skin for stable, accurate and long-term health monitoring, even during physical activities like exercise."

The coin-sized device is highly adaptable and can be worn on various parts of the body, including the wrist or upper arm, depending on the specific health monitoring application. Its flexible design allows it to conform to different body areas, making it versatile for multiple diverse healthcare and activity-tracking needs.

The team have been actively working at the intersection of flexible electronics, electrochemistry, wearable biosensors, and AI-integrated systems for several years.

"We conceptualised the world's first stretchable OECT device and the first hydrogel OECT device," said Professor Zhang. "Previous research efforts also include developing multi-channel printing platforms for scalable sensor fabrication and exploring bioelectronics applications using OECTs. These advancements laid the groundwork for integrating sensing, computing and stretchability into a single hardware platform, as demonstrated in this project."

Healthcare settings

The next step involves refining the platform to enhance scalability and durability, as well as exploring its potential applications in various healthcare settings, such as remote patient monitoring, rehabilitation and early disease detection.

"The team are also seeking collaborations with industry partners and medical institutions to translate this technology into commercial and clinical use," said Professor Zhang. "For example, some well-known wearable companies, such as Shokz (formerly known as AfterShokz), which specialises in headphones, have shown interest in our technology to develop headphones with electroencephalogram detection functionality to support sports and health applications."

The research was published in *Nature Electronics*, and has already garnered significant interest from the academic and healthcare communities.

"Our team are particularly proud of the interdisciplinary nature of the research, which combines flexible electronics, advanced sensors and AI technologies to address critical challenges in healthcare," concluded Professor Zhang.

"We hope this work will push the boundaries of what is possible with wearable technology. The work is highly significant because of its implications for proactive, personalised medicine and the transition from reactive to active healthcare. The scalability of the platform and its potential to improve quality of life through real-time health monitoring means that it has the potential to have a very broad societal impact."



Students got hands-on at a workshop hosted by the Arts Tech Lab in late 2024 where they explored real-time rendering and procedural workflow with game development tools Unreal Engine and Houdini.

ARTS FACULTY LAUNCHES TECH LAB

The potential of AI in arts and the humanities is in its early days, but the Faculty of Arts is at the frontline with the launch of its new Arts Tech Lab to support teaching on digital humanities and entrepreneurship and to promote AI in research.

Large language models (LLMs) are the bedrock for generative artificial intelligence, but most of the focus on them has been from a computing perspective. Yet LLMs have their origins in language, a topic normally related to the arts, not computer science.

Linguists and literature experts all play a role in the development

of LLMs, from informing how language is constructed to discerning meaning. Moreover, arts and humanities research can also reap major benefits from using AI.

With this in mind, the Faculty of Arts formally launched its Arts Tech Lab in December 2024 to train students in digital humanities and promote the use of technology in research.

The Lab offers advanced facilities ranging from a 4D scanning room to an immersive extended reality space to a research computer laboratory. It also has space for seminars, training and workshops.

“Our vision is to be a hub and catalyst where like-minded scholars and students can benefit from cutting-edge technology and

equipment and build meaningful networks with people who have special expertise,” said Dean of Arts, Professor David Pomfret, who chairs the Arts Tech Steering Committee and has been the catalyst behind its formation.

The Lab has been in development for more than a year, alongside new teaching programmes focussed on digital humanities to be launched in September 2025.

New degree programmes

A new double degree programme Bachelor of Arts and Bachelor of Engineering in Artificial Intelligence and Data Science will be offered that combines humanities with AI and data science. Students will receive technical training as well as explore philosophical and ethical issues associated with AI usage.

The Bachelor of Arts in Global Creative Industries will train students with an entrepreneurial bent to apply humanities perspectives in fields such as gaming and film (for instance, by drawing on their insights about storytelling) and give them practical advice on setting up and managing their own start-ups. The programme builds on a major currently offered under the School of Modern Languages and Cultures.

These two programmes are clustered with a third, the Bachelor of Arts in Humanities and Digital Technologies, which had its first intake in 2022 and focusses on applying technologies to such subjects as history and English. For instance, LLMs could be used for ‘distant reading’ to discern patterns and trends across everything from a single literary text to an entire genre of literature. Or it could be used in history to map familial connections and relationships across entire dynasties.

The Arts Tech Lab’s co-ordinator, Dr Jenny Kwok, is working with LLMs to discover their potential and limits in understanding literary narratives and nuances as compared with human capabilities. “Computational advances now give us this macroscopic ability in humanities research,” she said.

In addition to promoting learning and research, the Faculty is also keen to help students develop entrepreneurial skills. HKU’s Techno-Entrepreneurship Core has been brought in to provide training and advice. The Faculty also provides seed funding to help both students and researchers launch initiatives.

Some projects are already getting attention. Music Entrepreneurship and Popular Practice is a new initiative led by Professor Rujing Stacy Huang of the Department of Music and industry experts. Professor Giorgio Biancorosso, also of the Department of Music, has a multidisciplinary project on holography and dramaturgy, involving experts in music, philosophy, engineering, mathematics and architecture.

“Our vision is to be a hub and catalyst where like-minded scholars and students can benefit from cutting-edge technology and equipment and build meaningful networks with people who have special expertise.”

Professor David Pomfret

Meeting place

The Arts Tech Lab’s hardware is an important enabling factor in this work, but Professor Pomfret said they also want it to be a space for bringing people together. Three new programmes have been launched to achieve that. One is the Transformations: Lecture Series, which invites top humanities experts from both academia and industry to share their latest findings and experiences in using technology in research.

Second is InnoArts, which offers hands-on workshops and training sessions, including accredited ones, for both students and teachers. For instance, in January 2025, a scholar from the National University of Singapore taught students how to fine-tune a large language model – a skill in demand globally. Students received a digital certificate to verify their participation.

Third is AI+Teaching, which provides training and workshops for teachers on the pedagogy and practical application of the latest technologies in teaching and learning.

The Lab also hosted the inaugural conference of the Hong Kong Association for Digital Humanities, attended by more than 50 scholars from around the world. People from other disciplines and jurisdictions are also welcome to use the lab space and engage with the Faculty’s students and scholars.

“We are here to support humanities scholars and students who want to advance their visions with technology. Yes, there are other AI initiatives on campus and beyond, but we distinguish ourselves from them because humanities remains at the core of the Lab and also the Faculty of Arts,” Professor Pomfret said.



A poster exhibition was held in April 2025 where projects from the new AI literacy course were showcased.

AI FOR ALL

The new School of Computing and Data Science will deliver mandatory programmes on AI to all undergraduate students, while also reshaping existing discipline-based programmes to make them more fit for purpose.

People are bombarded everyday with information about and created by AI technology. Some of it may be true, some misleading, some deliberately wrong. But it can be difficult to separate facts from the noise. With that in mind, the University is launching a mandatory course on AI literacy to ensure students are equipped with some fundamental knowledge about the technology, both its capabilities and limitations.

“AI education or literacy is becoming as important to communication skills as learning Chinese and English. In future, it will be unavoidable that students will need to know how to communicate and understand intelligent machines,” said Professor Ma Yi, Director of the new School of Computing and Data Science that has designed the mandatory course, to be fully launched in September 2025.

The course will include components such as the history and fundamental concepts and principles behind AI, ethical uses such as intellectual property protection with AI and the use of AI for homework and research, and the capabilities and limits of things like AI-based robotic technologies.

“We want students to understand what AI can do from an objective and scientific perspective, rather than reading social media or technical reports from companies, which can be severely biased to their advantage, because our students will be leaders in society in the future,” Professor Ma said.

In addition to the AI literacy course, the School is also helping design a new Area of Inquiry in the Common Core, which will offer 20-30 courses related to AI from which all undergraduate students will need to take at least one

“AI education or literacy is becoming as important to communication skills as learning Chinese and English.”

Professor Ma Yi

course. These courses are multidisciplinary, involving other Faculties such as Law, Arts and Social Sciences, and they will delve deeper into specific issues faced in these fields.

Breaking down silos

While HKU-wide programmes are a big part of the School’s remit, they are not the only priority. The School also brings computer science and statistics programmes under one roof in light of technological advances. Previously, computer science was in the Faculty of Engineering and statistics in the Faculty of Science.

“The power of computing and the power of data really have transformed both disciplines,” Professor Ma said. “The traditional programmes have shown signs of inadequacy, and some things are even obsolete and haven’t changed in years.”

For instance, statistics students typically have strong mathematical and analytical training but lack a foundation in practical computational tools and technologies – these are things they usually have to learn on the job. Computer science students have the practical know-how but lack deep analytic training, which is becoming more important as machines take over more computational tasks.

“These two fields were siloed before, but intellectually, they belong together. We want the boundaries to start to disappear because there will be a need in future for truly cross-disciplinary talent,” he said.

The integration runs much deeper than simply housing the two programmes together under one umbrella. The existing curricula in both fields have been substantially reformed. For instance, some statistics courses have been merged and others upgraded to professional degrees, with higher requirements. Computer science programmes have also been streamlined and upgraded with a higher component of AI.

International trend

These changes follow the international trend at institutions such as the Massachusetts Institute of Technology and

University of California, Berkeley, which are similarly revamping computer and data science offerings and with whom the School has been collaborating.

“Everybody realises that it is necessary to do a substantial redesign and reform in these areas. It rarely happens in universities that there is this kind of top-down, enforced reform, but we need to do more than just re-organise courses,” Professor Ma said.

New cross-faculty programmes are also being introduced through double degrees with the Faculties of Social Sciences, Arts and Law. There is also an ‘x plus AI’ stream in which top students can earn a Master’s degree alongside their disciplinary major, within five years or less.

Postgraduate studies are also being reformed to meet the high demand from the industry for new talent. The School is strengthening its research postgraduate programme with more course requirements and exams, in step with the rest of the University. The aim is to produce graduates who are globally competitive.

The School also has a team of academics who are strong in research, many of them from the HKU Musketeers Foundation Institute of Data Science, which Professor Ma also leads. They have started to collaborate with cities in Mainland China, for instance, a new AI research lab was established in 2024 in Shanghai with local government support.

Overall, though, the School’s main focus is on academic programmes. “What we are doing here is important for the future to make sure our graduates are prepared for the new era of AI technology and the digital revolution. This is also important in helping Hong Kong maintain its position as a place for excellence in higher education,” he said.



The School of Computing and Data Science organised exclusive workshops to introduce its new undergraduate programmes to prospective students. In these workshops, students were invited to engage with the School’s professors and visit the Tam Wing Fan Innovation Wing.



The 360-degree virtual reality videos require no special equipment to view, making them accessible like regular online videos. However, they can also be paired with a headset to offer students a more immersive clinical experience.

LIVE ACTION LEARNING

Nursing students are being immersed in hospital scenarios with the aid of a 360-degree virtual reality camera and AI simulations. Dr John Fung Tai-chun – recipient of the University’s teaching and innovation awards – has developed these tools and taken them to other disciplines.

Immersing students in clinical environments is always a challenge. Pandemic restrictions, large class sizes and other obstacles make it difficult to provide sufficient real-life exposure. But with the aid of technology – and a well-constructed debriefing process – HKU nursing students are participating in virtual clinical learning that is meaningful and enriching.

Dr John Fung Tai-chun, Senior Lecturer from the School of Nursing, led the project to develop a 360 virtual reality (VR) technology, that can be used with or without a headset or goggles and is operated simply with the click of a mouse. He collaborated with the Faculty of Dentistry on the technology and worked on its application with the Centre for Applied English Studies and the School of Chinese.

The aim was to create an environment where nursing students were exposed to a multi-patient simulation scenario in which a number of activities were happening at once, similar to a hospital setting.

Students were first trained to use 360 VR through their mandatory English and Chinese language classes,

where they observed group conversations by actors and zoomed in to study certain interactions in detail.

In nursing classes, students applied this learning to simulated hospital scenes based on assessed topics in clinical skills and healthcare education. Through 360 VR, they observed busy scenes, discerned irregularities and other events, and time-stamped their responses. Crucially, they underwent a de-briefing process to describe the event, unpack their feelings, and consider how to apply their learning in practice.

Competence and confidence rise

Dr Fung conducted a randomised control trial of 360 VR plus the debriefing and found that students’ clinical competence, satisfaction and self-confidence all improved. Student research assistants, who were recruited to be actors in the hospital videos, also helped in the debriefing and acted as near-peer or peer teachers.

“We have broken the physical barrier of needing goggles by putting VR in a learning management system by making

“This technology goes beyond being just a digital tool. It signifies a philosophical shift towards immersive, boundary-less learning environments.”

Dr John Fung Tai-chun

it so that anyone can also use it online,” he said. “This technology goes beyond being just a digital tool. It signifies a philosophical shift towards immersive, boundary-less learning environments that can not only address educational gaps but enhance the overall learning experience.”

The technology is applicable in other disciplines and scenarios. Dr Fung has seven projects underway using 360 VR to train students in such things as endoscopic procedures and health assessment and to enable international exchanges. He also sees future potential for its use in the humanities, such as recreating historical events or exploring cultural landmarks.

Dr Fung is also pushing the technology further by using AI-generated virtual actors. He has attained a patent for ‘Apparatus and method for diagnosis prioritizing and debriefing’ in generative AI patient simulation, which provides greater flexibility for creating learning scenarios. The results are promising, with improved clinical and cultural competencies observed in students using generative AI patients.

Dr Fung’s dedication to innovation in teaching has earned him several awards, including the University’s Outstanding Teaching Award in 2023, and Teaching Innovation Award (Team) in both 2020 and 2023 as the team leader. He is also a finalist of the 2024 UGC Teaching Award.

Seeing through others’ eyes

Professor Joseph YK Chan, a medical engineer and Associate Professor of the Department of Ophthalmology, wants people to understand what the world looks like when one’s eyes are afflicted by different conditions, such as age-related macular degeneration (AMD), retinal detachment and cataracts. He has therefore developed augmented reality technology that can be used interactively through one’s phone to create a realistic, accessible and impactful experience for users.

The technology involves an app that is paired with special eye goggles that have a slot for mobile phones. The phone acts as a controller to activate different eye conditions and give a first-person perspective. For instance, users wearing the goggles might experience a dark spot in the middle of their vision as seen with AMD, or the blurry vision of astigmatism.

“I think it’s important for people to understand what these different eye diseases look like and how they progress,” said Professor Chan, who was motivated after

seeing his grandfather suffer from AMD, leaving him homebound because he did not have sufficient vision to go out by himself.

He has used the technology to raise awareness among more than 4,100 elderly, caregivers of visually impaired people, and primary, secondary and tertiary education students, asking them to perform tasks that further reinforce the experience. For instance, they copy line patterns while wearing the goggles, with results that may be blurry, wavy

or otherwise distorted depending on the eye condition involved.

The technology has particular pertinence for Secondary Five educators because it dovetails with biology lessons about the five senses and the drive to promote empathy. The headsets are affordable – about HK\$70-80 each – and gifted to participating schools. Professor Chan has received funding support from the government’s Innovation and Technology Fund for Better Living and HKU’s Teaching Development Grant.



Secondary students learning about the visual symptoms and progression of important vision-threatening diseases with the eye goggles.



READING BETWEEN THE LINES

A 15-year study by an educational neuroscience research team from HKU brings in new understanding of how bilingual children comprehend what they read.

The team led by Professor Shelley Tong Xiuli from the Faculty of Education have published an original theory that bridges language skills and reading comprehension, and developed an innovative programme to help Chinese-English bilingual children with reading difficulties.

"We embarked on this research because reading comprehension is a foundational learning skill for bilingual children," said Professor Tong. "It is even more crucial in our current information/AI age because children are constantly exposed to large amounts of information every day.

"Solid reading comprehension and critical literacy skills enable children to navigate our data-saturated culture efficiently and differentiate false rhetoric from evidence-based information. Without a deep-level understanding of text, children will be less likely to think deeply."

The team's research began in 2011 and included three longitudinal studies involving high levels of community engagement with school-age children and their parents. With no available standardised means for determining levels of reading comprehension, Professor Tong's team created Chinese and English comprehension tests that used both cutting-off

scores and regression approaches to identify children with reading comprehension problems.

"We spent 15 years researching bilingual reading comprehension," Professor Tong explained. "Our work has formulated an original theory - the prosodic catalysing hypothesis (PCH) - which is the first to explicitly recognise that reading comprehension involves both perceptual and production processes that require active interaction between children and texts. PCH is simple and elegant, and is going to influence the direction of reading comprehension intervention."

She emphasised that reading comprehension is important because most learning relies on the comprehension or understanding of the meaning of the text. According to previous studies, approximately 10 per cent of school-age children experience reading comprehension difficulties.

"We refer to them as 'poor comprehenders'," said Professor Tong. "These children can read each word aloud, but they cannot fully comprehend the meaning of the connected text. In Hong Kong, poor comprehenders have not been officially recognised nor clinically identified. My work shows why it is necessary to identify these children at an early age, and provide timely intervention."

PCH has profound theoretical, clinical and educational implications. Previously, almost all reading and reading comprehension theories were developed based on alphabetic languages. Until now, research on Chinese children's reading comprehension development and difficulty has largely focussed on replicating or adopting existing theories.

Optimising instruction

"This previous work is informative and incremental, but not innovative," said Professor Tong, adding that her team's work has a wide-ranging impact. "At the pedagogical level, PCH has implications on how to optimise the instruction for supporting reading comprehension in two distinct languages, that is, Chinese and English.

"Specifically, my work demonstrates that prosodic reading - reading aloud the text with rising and falling voice, and with shorter and longer pauses within and between sentences - can enhance reading comprehension, especially for second language English. Prosodic or expressive reading is fun and entertaining. Children act out the characters by using appropriate pitch and pauses for correct semantic and syntactic emphasis. This requires them to chunk connected texts into smaller syntactic units."

This process directs their attention to morphological and syntactic cues, enabling them to apply what they have learnt from speech comprehension to

"Without a deep-level understanding of text, children will be less likely to think deeply."

Professor Shelley Tong Xiuli

reading comprehension. Thus, prosodic reading acts as a 'catalyst' for expediting the connection between spoken language and text reading, facilitating children's transition from word-by-word reading to reading in meaningful phrases and sentences.

The research team also developed innovative assessment techniques and remedial interfaces based on their extensive research. They are currently validating these materials with children of different ages with diverse neurodevelopmental conditions, including autism and dyslexia.

International aspect

Professor Tong's contributions to the field of bilingual reading have been internationally recognised. She is an associate editor of *Scientific Studies of Reading*, the flagship journal of the Society for the Scientific Study of Reading, and is also a founding member of UNESCO's Global Alliance on the Science of Learning for Education.

"I feel privileged to work with leading scientists and educational practitioners to promote foundational learning abilities, including reading, maths and social-emotional skills, at the global level," she said. In 2024, she was invited to contribute a chapter titled 'AI to the rescue: Helping children at risk for dyslexia surmount educational barriers' to UNESCO's 'Insights from the science of learning for education' compendium.

In Hong Kong, the research team are leveraging AI for intelligent diagnosis and remediation of children with dyslexia or autism. Recently, they developed Intelligent Dyslexic Interface Design, a patented integrated strengths-deficit-based assessment and intervention for bi/multilingual children at risk for developmental dyslexia.

"Our aim remains the same," said Professor Tong. "We promote early identification, prevention and intervention for children struggling with text reading comprehension. Timely remediation is key. We are at the forefront of using AI technology to create intelligent tools for ameliorating reading comprehension difficulties experienced by bilingual children in Hong Kong and beyond."



HKU COMMUNITY PHARMACY OPENS SHOP

The University has done groundbreaking work to help establish pharmacy services in Hong Kong that are based in the community rather than hospitals, to carry out such things as medication management and health counselling. Now, it is opening its own pharmacy.

When Professor Ian Wong Chi-kei arrived at HKU from the UK in 2011 to head the Department of Pharmacology and Pharmacy, he was struck by one thing: training was focussed almost entirely on public hospitals. This was very unlike places like the UK, Canada and Australia where pharmacists in the community help patients manage their medications and contraindications, address difficulties

such as swallowing tablets, offer vaccinations and give advice on minor ailments, chronic diseases and over-the-counter drugs. “These other places had moved into community care but somehow in Hong Kong, everything was based around the hospital. Patients had to go to the hospital to get their medicine. I thought something had to be done about that because a lot of that medicine

could actually be dispensed in the community,” he said. His initial response was to work with local NGOs to help them set up community pharmacies in Wah Fu and Kwai Chung, which were thrust into the spotlight during the COVID-19 pandemic. At the time, people could not get medications or even simple over-the-counter remedies from hospitals. The community

“We are using our expertise and innovation to develop new services so other pharmacies can follow and patients can benefit.”

Professor Ian Wong Chi-kei

pharmacists became a resource to provide medicines and information, such as the fact that paracetamol is the same as Panadol and can provide similar pain relief.

In the wake of that experience, the Jockey Club approached Professor Wong and his team to help with a project that significantly expanded on his NGO-run model. The Jockey Club PHARM+ Community Medication Service Network Project has, since 2024, established six additional NGO-run community pharmacies in multiple districts in Hong Kong, using protocols and advice from Professor Wong and his team. The government has also voiced support for community pharmacies through its new policy to expand primary healthcare services and appointed Professor Wong to its Primary Healthcare Committee.

Real-world exposure

“Everything we had done before was somewhat academic, but with the pandemic and the government’s primary healthcare policy, suddenly we were in the right place and time to do the right things,” he said.

Professor Wong’s vision extended beyond being a supporter, though. He wanted to establish a community pharmacy at HKU itself to support teaching and research. A mock pharmacy had already been established, but this only offered students the chance to practise with empty boxes of medicines, with their teachers and others acting as patients. While students did spend short, limited times in real pharmacies, that depended on those pharmacies being able to accommodate such placements (not always possible). Professor Wong wanted to give students greater real-world exposure.

The opportunity to do this coincided with the requisitioning of the mock pharmacy’s location for other purposes. Professor Wong proposed to ramp things up and establish a real pharmacy within the Faculty of Medicine itself, and he received strong support.

The HKUMed Community Pharmacy, the first of its kind in Hong Kong, opened last November and is staffed by trained pharmacists, with pharmacy students learning alongside them under the supervision of HKU staff. Students from

all years will spend time there and their responsibilities will increase as they reach senior years. Apart from dispensing, they will be exposed to the sensitive questions that pharmacists might deal with, such as embarrassing side effects or the benefits of lifestyle drugs such as Viagra.

“Our students need to learn how to handle those things. Initially, they will see how qualified pharmacists do this. Later, when they are senior and experienced enough, we will be able to get them to do some of the counselling themselves,” he said. “Our professors can now focus on supervising students rather than pretending to be patients and simulating discussions.”

Taking the lead

Students in other healthcare programmes, including MBBS, nursing and Chinese medicine, can also observe in the pharmacy as part of HKUMed’s promotion of interprofessional education.

The HKUMed Community Pharmacy will also support research, such as clinical trials looking at the cost and clinical outcomes when pharmacists, versus hospitals, manage drugs for patients with specific needs, such as epilepsy or allergies. It is hoped community pharmacies will be found to be a cost-effective alternative option to public hospitals.

Professor Wong, who stepped down as Head of the Department in 2024 and is focussing on initiatives such as the HKUMed Community Pharmacy, said they are also developing public education programmes with pharmaceutical organisations to raise people’s awareness of the services that pharmacies can provide.

“Our role is not about providing a service for the sake of providing a service. We are using our expertise and innovation to develop new services so other pharmacies can follow and patients can benefit,” he said. “As trainers of the next generation of leaders, we need to be a leader ourselves.”



Pharmacy students receive on-site training at the HKUMed Community Pharmacy alongside practising pharmacists.

SAFETY FIRST

A groundbreaking programme is using AI and 3D architectural drawings to improve fire safety in older buildings by providing owners and firefighting services with better knowledge of potential fire risks.

The project, which is a collaboration between the Faculty of Architecture's MetaBIM Research Lab and the Home Affairs Department (HAD), was born out of a tragedy in March 2022, when fire swept through a subdivided tenement in Mong Kok district, killing one woman.

"My team and I asked: How can firefighters systematically inspect risks if even building blueprints are missing?" said Dr Landson Li of the MetaBIM Research Lab. Their solution was to undertake 3D scanning and Building Information Modelling (BIM) for buildings, thereby replacing missing fire safety data.

Describing the collaboration with the HAD as 'a collision of pain points and innovation', Dr Li said: "HAD needed solutions for missing fire safety data in old buildings, while our business is BIM and our team had already developed wearable mobile scanning technology."

During a demonstration, the team scanned an entire floor in 10 minutes. "When the 3D model revealed an illegal rooftop structure, an HAD officer said, 'This is how building management should work in the 21st century'," said Dr Li. "This is one of our successful direct collaborations, and it builds on years of trust in technology between HKU and the government in BIM standardisation."

Gamifying diagnostics

The pilot programme developed by MetaBIM gamifies fire safety diagnostics in three parts. First, they capture the data by scanning the building. "Scanning stairwells feels like mapping a VR game - details like wires hidden in wall cracks are recorded," said Dr Li.

Next is AI analysis, when their system flags information such as misplaced fire extinguishers (and highlights them in red) and guides users to the nearest valid extinguishers

via green arrows. Finally, there is a collaborative simulation, which enables fire departments to place virtual fire sources in the model to test evacuation times.

"For example, the AI detected a security gate blocking 70 per cent of an escape route. It instantly generated a retrofit plan - a task that traditionally would have required multiple site visits and discussions," said Dr Li.

Captured data is turned into a 3D BIM model, then owners can scan a QR code to revisit the building and compare pre/post-renovation states. Smart modelling enables the team to include point clouds with fire safety metadata, such as having a water pipe showing its installation year and maintenance history. And immersive reviewing technology enables firefighters to use VR headsets to walk through virtual buildings, thereby taking the guesswork out of what a fire would look like in dark stairwells.

Silent killers

"What we are specifically looking for in the older buildings are silent killers," said Dr Li. "For example structural traps such as illegal rooftop structures which have shrunk escape routes. These appear as 'heat maps' or red zones in models. We're also looking for potential time bombs: our AI compares annual scans to spot risks like a load-bearing wall crack widening by 0.2mm yearly - invisible to the eye but catastrophic in a fire."

The technology also enables users to simulate likely scenarios should a building catch fire. "In one case, for example, all fire extinguishers in a building were on the ground floor," said Dr Li. "We did a simulation which showed it would take residents 2 minutes 15 seconds to retrieve extinguishers from the fifth floor - far exceeding the golden rescue window.

"We recommended adding extinguishers on every floor and provided three retrofit plans costing under HK\$5,000. The system even auto-generates construction drawings compliant with the Buildings Department's guidelines."

"AI detected a security gate blocking 70 per cent of an escape route. It instantly generated a retrofit plan - a task that traditionally would have required multiple site visits and discussions."

Dr Landson Li



A wearable mobile device is used to conduct 3D scanning inside a building.

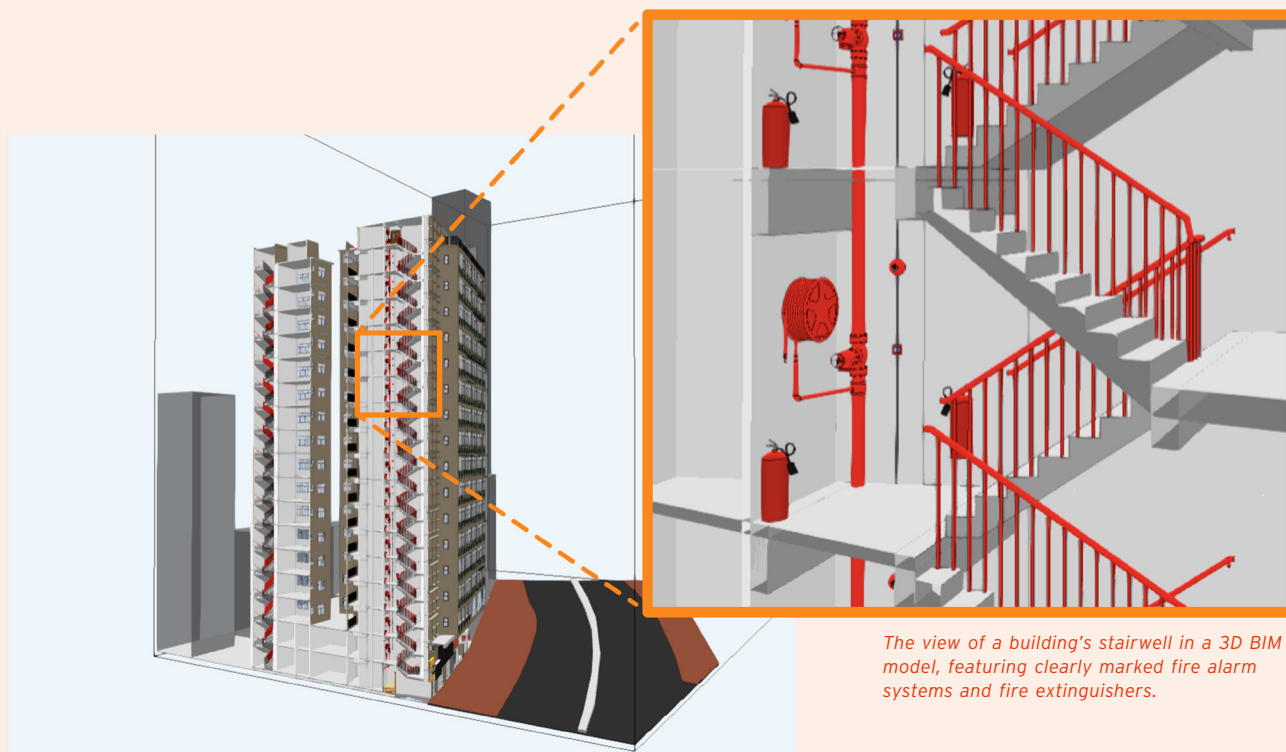
The technology has great potential for other uses in other fields such as: public health, where it could be used for identifying poorly ventilated subdivided units to prevent disease outbreaks; cultural preservation, through creating digital archives of soon-to-be-demolished buildings for the metaverse; and 'insurtech', for developing dynamic fire insurance premiums based on building risk scores.

Smart community

"We are open to sharing our experiences with other applications to build a better smart community," said Dr Li, who feels that programmes such as this are another big step towards creating 'smart cities'.

He describes a heartfelt moment in one of the scanned building projects: "After seeing clutter blocking her doorway flagged as a risk in the model, 78-year-old Mrs Lee organised neighbours to clear it. She told me, 'The computer showed me that those boxes I stepped over every day really were blocking a lifeline'. Her words really made me think: technology shouldn't be cold data - it must make safety tangible."

For the next step, Dr Li and the MetaBIM Research Lab team would like to connect more with people and real living environments via technology. "We are proud to provide services that can tackle key items and improve our quality of life," he said. "We will do more on this through our BIM and AI technology - turning all physical buildings into digital assets managed by cutting-edge AI technology to ensure the city environment really fits human needs."



The view of a building's stairwell in a 3D BIM model, featuring clearly marked fire alarm systems and fire extinguishers.

A MASTER OF MATERIALITY

Architect Professor Chang Yung Ho has held positions at the Massachusetts Institute of Technology (MIT) and Harvard University and received multiple awards for his work, which celebrates materials as much as artistry. He is the new Dean of Architecture.

Architecture is a discipline of both art and construction, but sometimes, the latter can get lost in debates about meaning and aesthetics. Not so with Professor Chang Yung Ho, who has won a slew of international awards and held such positions as Founding Head of the Graduate Center of Architecture at Peking University, Head of the Department of Architecture at MIT, Chair Professor at the Harvard Graduate School of Design, and Founding Partner and Principal Architect of Atelier Feichang Jianzhu.

Professor Chang comes from architecture royalty – his father Zhang Kaiji was one of the most important architects in China of his generation – and he has applied his skills to designing not only buildings but everything from an Alessi tray to a re-imagined *qipao*. Although his original ambition was to be an oil painter, he has no regrets that his poor painting skills forced him down a different path.

“Architects are ultimately not artists, we’re better than artists. We also solve real problems,” he said.

As the new Dean of Architecture, he wants students to solve modern problems with technology. But first, he has a message for them: engage with the materials you work with, touch and hold them, so you can understand how to use them to create beautiful buildings. He offers a telling example of what that means.

Stones in the sky

When Professor Chang was at Peking University, he came across a piece of stone, about one metre long and 30 centimetres square, with fine carvings etched into it, suggesting it was historically significant. He decided to install it in the courtyard by his centre, but when he and three students tried to move it, it would not budge. Two more students were brought in with the same result.

“Finally, there were eight of us and we could barely move the stone. If you never lift a stone like this, you won’t know its weight. You won’t know how to appreciate Notre Dame Cathedral in Paris, which has delicate stone vaulted ceilings that look weightless but are actually very heavy. The masons and artisans were brilliant, they not only used their hands, they used their minds to imagine how to put these stones into the sky.

“Using hands and head together is important for architects because we want to embrace the material, then intervene in this tangible reality,” he said.

HKU’s Faculty of Architecture is one of the few schools to emphasise a material approach to architecture, which attracted Professor Chang to the Deanship. But he is also interested in how cultural and artistic heritage can be incorporated into modern architecture, given the need to accommodate mechanical ventilation and

heating and cooling facilities – something the architects of Notre Dame and the Pantheon did not have to worry about when building their magnificent, vaulted ceilings.

The task is challenging but not impossible. He points to Hong Kong International Airport, which maintains an open, airy feeling like that of the Pantheon because the mechanical duct work has been placed between the arrival and departure floors. The roof itself is thin, contributing to the feeling of space.

“Not many architects are tackling this problem. Usually, they let the mechanical engineers decide and then things get put in all the wrong places, really destroying the space,” he said.

‘One dragon’ approach

Professor Chang hopes that his Faculty can start to come up with holistic solutions to the problem of integration within the building industry. Today, most projects start with the land, then the building is designed, then it is built. What, he asks, if that process were to start with something else – a carbon reduction target, say, or even a doorknob?

“It’s a very strange challenge because advanced technologies are everywhere, but the building industry operates on a primitive level. I want to see whether, with the help of digital technology or artificial intelligence, we can fully integrate the cycle from investment and programming to planning, design, construction and management – a ‘one dragon’ project as we’d say in Chinese.”

This will take time. In the more immediate term, his attention is on celebrations for the 75th anniversary of architecture at HKU starting in September, which will include a series of talks titled ‘Beyond Architecture’. The plan is to introduce students to architects who have pursued careers in a variety of fields, such as policymaking, theatre and finance, and encourage them to see architecture as something that opens doors in many directions.

“Architecture can help students develop a better idea not only about working but living. My wife [architect Lu Lijia] and I, we appreciate the small things in life because we studied architecture. Architecture is about culture and if you study it, it will benefit your whole life.”

“Architects are ultimately not artists, we’re better than artists. We also solve real problems.”

Professor Chang Yung Ho



Tourists, which Professor Han described as 'short-term migrants', also have an impact on the perceptions of China.

CHINESE IMPACTS IN SOUTHEAST ASIA

The actions of individual Chinese citizens – be they tourists, businessmen or migrants – are affecting regional perceptions of the country well beyond the Chinese government's own actions and narrative.

China's economic rise this century has coincided with its people venturing out to spend their money or find new economic opportunities, often to positive effect but sometimes with less favourable outcomes. Take, for instance, Manila. Chinese-owned casino firms operating there have snapped up real estate for investment or to house their workers coming over from China. This has priced out local industries and forced many ordinary Filipinos to move out of the city centre.

Or take the example of durian farming in Thailand. The fruit is in such high demand in China that many farmers have converted their land to the crop, rather than grow local produce in demand. Durian has also become very expensive for local Thai consumers.

These effects – not to mention the impact of Chinese criminal gangs and tourists – are documented in a book by Professor Han Enze of the Department of Politics and Public Administration called *The Ripple Effect: China's Complex Presence in Southeast Asia*. He uses media analyses, surveys and other information to assess perceptions of China in Southeast Asia.

"Conventional literature on China's influence or relations with Southeast Asia has overwhelmingly focussed on the actions of the state, while ignoring lots of things happening at the societal level," he said. Yet the bad behaviour of

a few Chinese citizens could in fact affect the state's efforts to promote China's image and culture abroad.

Centres at the border

One of the most problematic examples is scamming. In Myanmar, along the Thai border, Chinese entities have set up scamming centres targeted at Chinese people. They need fluent Chinese speakers to do this work, so they lure people from Mainland China, Hong Kong or Taiwan on false pretences, then force them to work through threats and abuse. Thousands have been tricked this way. Bad publicity in the wake of the snaring of Chinese actor Wang Xing and of Hong Kong citizens has led to a recent crackdown in Myanmar, but the news also adds fuel to anti-China sentiments.

"Thai media now focusses a lot on Chinese criminals working at the border. This will affect how ordinary people perceive China because they often associate those Chinese criminals with China in general," Professor Han said.

Migrants, in the broadest sense, also have an impact on perceptions of China. Professor Han includes tourists in this group, as 'short-term migrants'. While tourism income is welcome, host countries such as Thailand have seen operators from China set up shop to provide Chinese-language tours and other support, diminishing local economic benefits. Poor behaviour by tourists, such as speaking loudly and not respecting rules for photography, is also a concern.

"Perhaps like the 'ugly Americans' travelling in Europe during the post-World War II years, Chinese tourists have faced similar pejoratives in Southeast Asia because of the way they flaunt newly gained wealth, while having a strong sense of entitlement and lack of respect for local customs," he said. The Chinese government has taken note, publishing a guide on being civilised while abroad and setting up a blacklist of tourists who publicly misbehave.

Complex influence

The region cannot turn its back on the giant of China, though, given its huge economy and population and its geographic dominance. But Professor Han believes the government's own actions in areas such as the South China Sea may not be as impactful as the body of literature about it suggests.

"My argument essentially is that public perceptions of China in Southeast Asia, while they may be affected by state actions, are probably more likely affected by those non-state actors," he said. "Ordinary people will not understand what authoritarianism means in their daily lives, but they will encounter investors who come to buy their land and push up property prices, or tourists who swarm into the area."

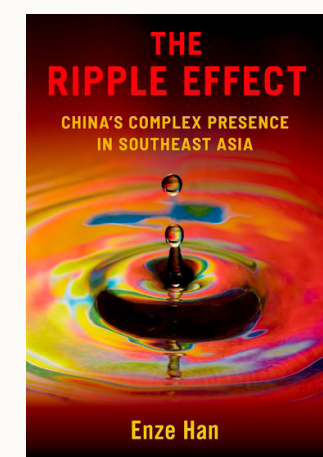
"My argument essentially is that public perceptions of China in Southeast Asia, while they may be affected by state actions, are probably more likely affected by those non-state actors."

Professor Han Enze

The impact can vary from country to country. For instance, Chinese living in Indonesia, who have been targeted in periodic violent anti-Chinese riots, are careful to avoid perceptions of collusion with China or disloyalty to Indonesia. During the COVID-19 pandemic, they were very generous in donating to charities to help local people.

But overall, the picture is of a giant that looms over its neighbours, politically, economically and culturally, similar to the United States over Canada and Mexico.

"I want to show the complexity of this influence. It cannot be easily simplified to say that everything is directed by the state. There is a ripple effect and people need to get used to it. The rise of China will have lots of ripples and Southeast Asia is at the frontline," Professor Han said.



The Ripple Effect: China's Complex Presence in Southeast Asia

Author: Enze Han
Publisher: Oxford University Press
Year of Publication: 2024

Unique Perspective

The book *Unruly Comparison: Queerness, Hong Kong, and the Sinophone* posits that Hong Kong's mixed cultural history of British colonialism, global capitalism, transnational migration and as a Special Administrative Region of China has rendered it a site of queer worldliness.

After the Sino-British Joint Declaration of 1984, many filmmakers and writers in Hong Kong and elsewhere speculated on the possibility of a resulting identity crisis. Professor Alvin K Wong, Assistant Professor in the Department of Comparative Literature, says that *Unruly Comparison* is a response to this preoccupation with identity and looks at how filmmakers visualise Hong Kong as a queer time and place mediated by multiple power relations.

"Queer culture is always already unruly and transnational in Hong Kong and we see that in the movies of the time," he said. "I'm interested in a more global perspective. Sometimes the transnational aspect of Hong Kong takes us to spaces beyond - it's what I term queer transnationalism in a minor key."

The book - which is subtitled *Queerness, Hong Kong, and the Sinophone* - spans 25 years and makes comparisons between films, novels and visual artworks of the post-1997 period.

For example, Professor Wong examines Wong Bik-wan's feminist novel *Portraits of Martyred Women* (1999) which imagines the possibility of feminist solidarity and lesbian intimacy during 1940-70s Hong Kong, alongside director Jacob Cheung's *Intimates* (1997), a film of lesbian eros and regionalism. He then brings in Ma Ka-fai's queer novel *Once Upon a Time in Hong Kong* (2016), which presents a story of colonial complicity and interracial desire in the affair between a Scottish officer and a local mafia boss during the Second Sino-Japanese War.

"World War II is a time period often only associated with the Japanese invasion, British defeat and then victory. Putting the two novels together is a way of imagining queer desire in Hong Kong modernity," said Professor Wong.

"My book demonstrates that queer Hong Kong culture exemplifies unruliness that

"Queerness in Hong Kong cinema precisely points to modes of disorientation and transnational mobility that deviate from the geopolitics of British colonial legacy and China-centrism."

Professor Alvin K Wong

exceeds the political forces and epistemological limits of British colonialism, China-centrism and global capitalism."

Global intimacies

The second chapter explores Hong Kong cinema as a rich site for queer Sinophone theory, positioning the city as a geographic locale through the visual mapping of global intimacies and connections. "Queerness in Hong Kong cinema precisely points to modes of disorientation and transnational mobility that deviate from the geopolitics of British colonial legacy and China-centrism," said Professor Wong.

"This chapter examines queer non-relationality to Chineseness in independent filmmaker Scud's two films, *Permanent Residence* (2009) and *Amphetamine* (2010), which links Hong Kong with Guangzhou in China, Thailand and the Israeli occupation of Palestinian lands, and maps queer desire across Australia and Hong Kong, respectively."

He also offers a critical legal analysis of transgender rights in Hong Kong, and makes a comparison between the film *Tracey* (2018) directed by Jun Li by mapping the condition of being transgender through multiple queer temporalities and transnational spaces, and then contrasts it with Maisy Suen's film, *A Woman Is a Woman* (2018), which narrates the struggle of a married transwoman named Sung Chi-yu and the life of a feminine high school boy, Chiu Ling-fung. The chapter concludes with an analysis of a series of photo exhibitions of transgender subjects, entitled *Transcendence*, that were inspired by Suen's film and organised by Mimi Wong.

Rich cinematic domain

"Hong Kong cinema is a rich domain for negotiating and portraying legal disputes about transgender rights," said Professor Wong. "While Hong Kong is a global 'world' city, it doesn't have some basic LGBTQ rights legislation. It's interesting that some companies that want to appear as queer- and diversity-friendly introduce queer liberal aspects

themselves - for example, by offering medical insurance for gay partners - but it's not the law."

In another chapter, Professor Wong puts the focus on domestic helpers, specifically queer desire among migrant domestic helpers. "We see them gathering on Sundays and among them are butch-femme lesbian couples and we know such gay groups as Filguys Association Hong Kong exist. So, this chapter is a necessary study of queer Filipino women who are 'invisibilised' in Hong Kong and it questions the 'heteronormative assumption' assigned to domestic helpers."

He examines the situation through two documentary films - Susan Chen's *Lesbian Factory* (Taiwan, 2010) and *Sunday Beauty Queen* (2016) by Baby Ruth Villarama, which focusses on Filipino beauty pageants and a butch organiser.

"I very much see my book as making a case for doing more 'unruly' forms of global comparison that move beyond the constant need and pressure for interdisciplinary scholars to justify the geopolitical and cultural importance of a small region (like Hong Kong)," said Professor Wong.

"I suggest that Hong Kong matters to queer theory (and vice versa) beyond its local particularism, postcolonial 'Chinese' differences, and capitalist exceptionality. Alternatively, queer Sinophone studies offer a non-totalising perspective on Hong Kong itself as a site of racial, gender, sexual and cultural incommensurability and intersectionality. In turn, this recognition of Hong Kong's queer worldliness binds it to the rest of the world and engenders unruly modes of comparison."



Unruly Comparison: Queerness, Hong Kong, and the Sinophone

Author: Alvin K Wong
Publisher: Duke University Press
Year of Publication: 2025

Transcendence is a portrait exhibition featuring transgender people living in Hong Kong to showcase their authentic sides and foster meaningful exchanges with the wider community. It made a stop at HKU's Main Library in 2021 as part of its tour. (Courtesy of Mimi Wong)



The University of Hong Kong Bulletin reports on activities, events and research initiated by members of the University. It aims to keep the local and international communities informed of new breakthroughs and achievements in all of our faculties and disciplines.

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