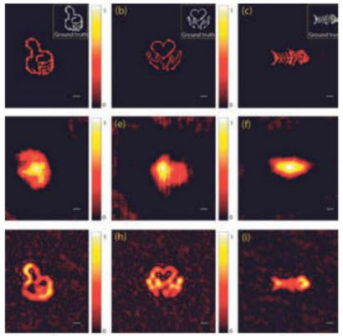
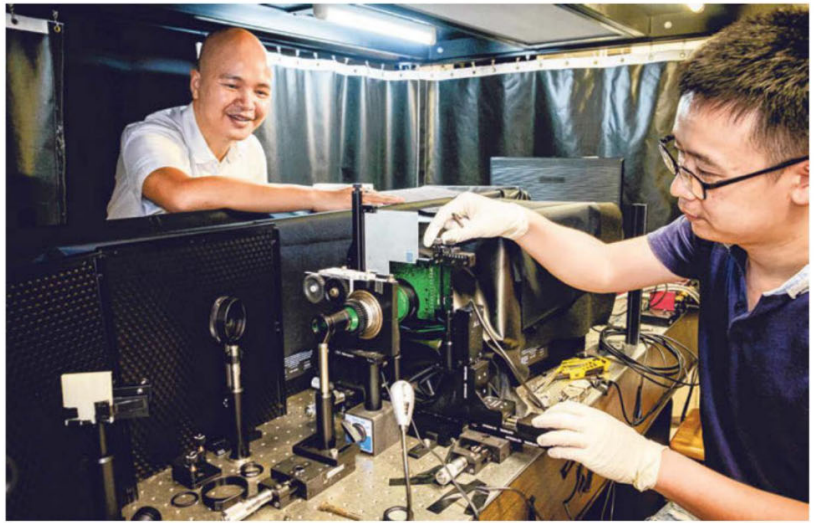
Studying cells under skin without microscope



Above: The top row shows three different images behind egg shell membranes that are reconstructed using the new technique. The second shows images similar to what would have been observed through an optical microscope, while the third shows images similar to what would have been observed through an ultra-high resolution microscope.



Right: NTU's Assistant Professor Steve Cuong Dang (at left) and PhD student Zhu Xiangwen with the prototype of the new non-invasive technique that can reconstruct images of what is behind translucent objects.

PHOTOS: NANYANG TECHNOLOGICAL UNIVERSITY

NTU-led team comes up with technique to reconstruct what lies beneath translucent objects

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In the future, doctors and researchers may not need to use microscopes or extract samples of tissue to study cells or viruses that are near the surface of the skin.

Instead, they may be able to look at high-resolution images of microscopic cells that are reconstructed by an algorithm that analyses the patterns created when the cells being studied scatter light.

A research team, led by Nanyang Technological University, has developed a technique that can reconstruct what lies beneath translucent objects like skin just by taking photos of the objects, without actually having to see behind them.

The team, which also includes researchers from Taiyuan University of Technology in China and Indian Institute of Technology Goa in India, has been working on this project since 2018.

This technique can be used to study objects as small as 100 nanometres (nm) – 1,000 times thinner than a strand of hair – without using ultra-high resolution microscopes.

Called stochastic optical scattering localisation imaging, the technique uses an algorithm, developed by the team, that reconstructs images behind translucent objects.

Photos of the object are taken with a normal digital camera, with a light source behind the object. The light diffusion patterns in the photos are then studied by the algorithm.

The researchers were able to reconstruct images under egg shell membranes, using a laser as a light source.

This is the first time it has been proven possible to reconstruct images of what is behind translucent objects using a non-invasive technique, the team believes.

The team said this technique has promising applications for life sciences, with the possibility of reconstructing images of cells and viruses that lie just beneath the skin in future, among other things.

Assistant Professor Steve Cuong Dang from NTU's School of Electrical and Electronic Engineering, who led the study, told The Straits Times: "We can now not only see through translucent media, but also visualise nanometre-scale objects at unprecedented levels of detail."

This technique is comparable to, or even better than, ultra-high resolution microscopes that are currently used to study objects as small as 100nm.

The team hopes that this technique can be a much more affordable alternative to such microscopes, which cost from hundreds of thousands to millions of dollars.

Another advantage of this technique is its non-invasive nature.

"We can image through skins and cell walls, without killing the cells or making the skin optically transparent," Prof Dang said.

This removes the need for contrast agents, which are typically injected into tissue samples to provide contrast between the objects of interest – cancer cells, for instance – and their background, such as healthy skin tissue.

The team is now exploring other sources of light that are more accessible, affordable and practical, while ensuring that the imaging technology can produce the same level of ultra-high resolution images.

It has filed a patent for this technique, and Prof Dang estimated it would take around three years for it to be commercialised.

He said: "It is our hope that one day, we will be able to take images through the body by light rather than X-ray."

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