



Singapore
General Hospital
SingHealth

AI for Fibroepithelial Lesions

Singapore General Hospital, a member of Singapore Health Services, is the public sector's flagship hospital. Established in 1821, SGH is Singapore's largest acute tertiary hospital and national referral centre offering a comprehensive range of more than 40 clinical specialties on its campus.

Every year, about 1 million Singaporeans benefit from medical care delivered by its 800 specialists. As an academic healthcare institution and the bedrock of medical education, SGH plays a key role in nurturing doctors, nurses and allied health professionals, and is committed to innovative translational and clinical research in her continual strive to provide the best care and outcomes to her patients.



"We are glad to have the opportunity to work with AISG on the project. It has been an eye opening experience for me as I now have better insights of the AI algorithm development process to solve clinical challenges. I can also better appreciate the immense potential AI could bring to augment and enhance the work of pathologists."

Dr Cheng Chee Leong

Senior Consultant, Department of Anatomical Pathology

BACKGROUND

- Breast fibroepithelial lesions (FELs) comprise fibroadenomas (FAs) and the less commonly occurring phyllodes tumours (PTs)
- Diagnosing FELs can be a challenge as PTs mimic FAs clinicoradiologically, and histological evaluation is necessary to distinguish the two lesions. Cellular FA and benign PT share overlapping morphological features, leading to difficulties in discriminating between them, especially in core needle biopsies
- It is crucial that the correct diagnosis is determined, especially on core biopsies, since FAs and PTs have different clinical management, with PTs conventionally requiring surgical removal with clear margins

OUTCOMES

Model produced 87.5% slide-level accuracy on the unseen test set provided by SGH, with accuracies of 80.0% and 95.0% for FA and PT slides respectively

5-10 minutes are required for model inference per slide, compared to 15 minutes for examination by a pathologist

AI solution is accompanied by a visualisation and explanation component to assist users to understand the top discriminative features behind each prediction

Solution has been tested for deployment by SGH's internal IT and analytics group

Having a more objective and rapid detection tool could augment the work of pathologists in accurately diagnosing the lesion in CNBs, with selection of appropriate treatment – this may potentially bring significant cost savings, and reduces the need for surgical management and anxiety in patients

BUSINESS CHALLENGE

How can SGH use AI to improve the speed and accuracy of diagnosing FAs and PTs based on analysing morphological features?

AI SOLUTION DEPLOYED

A novel and bespoke two-stage computer vision model was developed and trained on high-resolution microscope slide images of FA and PT tissue samples.

- First stage of the pipeline creates smaller patches out of a large, gigapixel-scale whole-slide image, applies several preprocessing steps, and uses a convolutional neural network (CNN) to extract discriminative visual features at the patch level
- Second stage of the pipeline uses a recurrent neural network (RNN) to learn the spatial arrangement of the patch-level features within each slide, in order to aggregate them and produce an overall predicted class (FA or PT) for each whole-slide image