Leveraging big data and AI in medical diagnosis

A big data and AI-driven approach to medical research is improving the efficiency and accuracy of DIAGNOSING COVID-19 AND OTHER CONDITIONS.

The use of AI in medicine, particularly image-based diagnosis and pathology, has been expanding rapidly. Macau University of Science and Technology (MUST) is dedicated to research in medical AI applications to ease obstacles where medical resources are lacking, and precision medicine is needed.

"For many years, we have adopted an interdisciplinary philosophy to apply AI in medical research. For example, we have developed several imaging-based diagnostic tools described in *Cell* and *Nature Biomedical Engineering*. They have been widely applied in the field," says Kang Zhang, a professor at MUST's Faculty of Medicine.

A persistent challenge in medicine is accurately and rapidly diagnosing patients when assessing a large number of scans or images. It requires a lot of time and effort from highly specialized operatives, and is largely a manual process. Using AI to evaluate images reduces the burden of reviewing images without sacrifices in accuracy.

"It will take a senior radiologist at least 20 minutes to look at a tomography (CT) scan which comprises anywhere from 200 to 400 images," says Zhang. An AI-based CT scan reading takes about only 20 seconds.

"You can teach AI where to look for lesions, and it will remember and improve to the extent that it can exceed senior human experts, while being incredibly fast."

In 2020, Zhang's team developed an AI imaging-assisted diagnosis system for COVID-19 pneumonia and published in *Cell*. Based on the 500,000 copies of CT images that the team studied, the system was able to distinguish COVID-19 from other viral pneumonias within 20 seconds, with an accuracy rate of more than 90%.

In addition, they studied a total of 145,000 chest X-ray scans from 120,000 patients and developed a deep-learning system to assist radiographers in differentiating more swiftly and accurately between COVID-19 pneumonia and common lung diseases, which are normally difficult to pinpoint. The results were published in *Nature Biomedical Engineering* in 2021.

MUST has undertaken a number of similar medical AI projects, including research on key AI technologies for treatment of multi-component tumours, stem-cell ophthalmic diseases, lung diseases, and colorectal cancer.

One such project, led by Naiqi Wu, director of the Macau Institute of System Engineering, is currently studying whether data collected from online card game activities can be used to detect and diagnose mild cognitive impairment (MCI), an unstable transition state from normal ageing to dementia.

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Zhang is sure that with the rapid growth of big data and breakthroughs in key artificial intelligence (AI) technologies, the development of medical AI will drive a wave of change in smart and precision medicine, and the innovation of multidisciplinary cross-field research. ■

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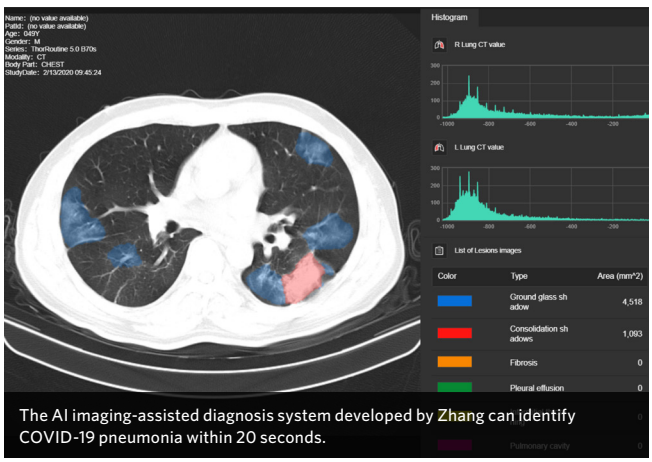
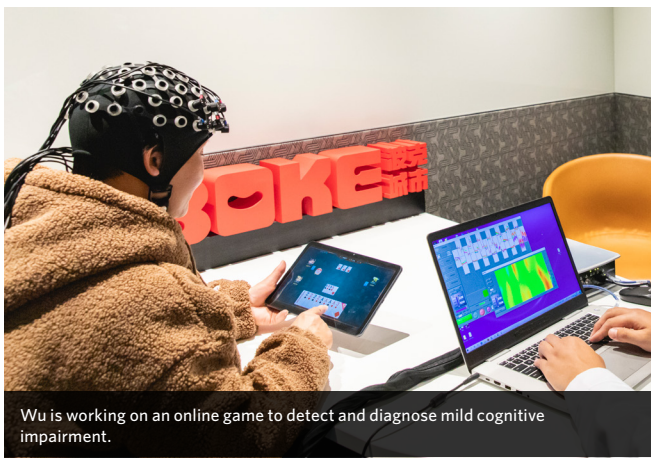


The AI imaging-assisted diagnosis system developed by Zhang can identify COVID-19 pneumonia within 20 seconds.



Wu is working on an online game to detect and diagnose mild cognitive impairment.