

PRESS RELEASE

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AI tool helps scientists to decode brain activity and reconstruct what it sees

Study may be first step towards understanding and early detection of brain diseases in Singapore

Singapore, 13 December 2023—What if what we see, read or experience could be captured by AI, and then rendered as brief video clips to help scientists understand how the brain processes and encodes information?

In the growing landscape of mental health and ageing-related disorders in Singapore and the world, understanding the brain is a key necessity. With the help of AI and decoding data from brain activity, a team of researchers at the Yong Loo Lin School of Medicine, National University of Singapore (NUS Medicine) is able to construct videos that reflect/recall/mirror the images which study subjects were shown. They say this development/technology can potentially be crucial for the early detection of brain diseases, customised treatments, devices, and learning programmes.

The study of brain patterns to figure out how the brain works could entail learning how certain thoughts link to speech and movements. These are beneficial in creating solutions for individuals who suffer from conditions that limit their ability to move or communicate.

Breaking the molds and pushing the boundaries of how AI is used in research, researchers from the Centre for Translational Magnetic Resonance Research at the Yong Loo Lin School of Medicine, National University of Singapore (NUS Medicine), is working on a novel project titled “Mind-Video”, which involves developing an AI model to visualise what individuals see. This model is able to scan and read data obtained from human brains and reconstruct the information as very short video bursts.

The study reconstructs videos that participants are shown, using functional magnetic resonance imaging (fMRI) data, which generates representations from brain activity. This form of data provides a dynamic window into individuals’ thought processes that could revolutionise how we interact with, and interpret the human brain. The study by Associate Professor Helen Zhou from the Centre for Sleep and Cognition in NUS Medicine, and Director, Centre for Translational MR Research at NUS Medicine, Mr Jiaxin Qing, PhD student at Department of Information Engineering, The Chinese University of Hong Kong (CUHK IE), and Ms Chen Zijiao, PhD Student at the Centre for Translational MR Research at NUS Medicine was published in their project page, [Mind-Video](#).

Participants were shown videos of various lengths, ranging from two seconds to a few minutes, on moving objects, animals, humans, and more, while the researchers carried out the scanning via fMRI, a non-invasive procedure which helps to visualise the active parts of the brain when it is engaged in different activities.

Upon collecting the data, an advanced AI model, Stable Diffusion, was used to decode the brain activity and translate the information into reconstructed videos of about two to three seconds long, as viewed by the participants. The team achieved an impressive accuracy rate of 85%.

This is a significant step in bringing forth potentially groundbreaking solutions to treat neuropsychiatric conditions, as well as to help people with conditions that make movement and speech difficult to communicate better. This includes stroke, brain injuries, spinal cord damage, and diseases like Cerebral palsy, ALS and Parkinson's.

This discovery serves as a springboard for the early detection of brain diseases, customized treatments, devices, and learning programmes. For patients, it offers hope for better, more independent lives and effective treatments.

“Our work can help to further our understanding of how the brain processes information with an unprecedented degree of detail, while paving the way for a more advanced communication system via technology and brain stimulation strategies. At the same time, we have plans to develop it further with generalisability and interpretability, to set the foundation for future translational work, including helping those individuals with impaired sensory perception or enhancing human potential,” said A/Prof Zhou.

The team will be presenting their work at the 2023 Conference on Neural Information Processing, which will be held this month, in New Orleans, USA.

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About National University of Singapore (NUS)

The National University of Singapore (NUS) is Singapore's flagship university, which offers a global approach to education, research and entrepreneurship, with a focus on Asian perspectives and expertise. We have 16 colleges, faculties and schools across three campuses in Singapore, with more than 40,000 students from 100 countries enriching our vibrant and diverse campus community. We have also established more than 20 NUS Overseas Colleges entrepreneurial hubs around the world.

Our multidisciplinary and real-world approach to education, research and entrepreneurship enables us to work closely with industry, governments and academia to address crucial and complex issues relevant to Asia and the world. Researchers in our faculties, research centres of excellence, corporate labs and more than 30 university-level research institutes focus on themes that include energy; environmental and urban sustainability; treatment and prevention of diseases; active ageing; advanced materials; risk management and resilience of financial

systems; Asian studies; and Smart Nation capabilities such as artificial intelligence, data science, operations research and cybersecurity.

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About the NUS Yong Loo Lin School of Medicine (NUS Medicine)

The NUS Yong Loo Lin School of Medicine is Singapore's first and largest medical school. Our enduring mission centres on nurturing highly competent, values-driven and inspired healthcare professionals to transform the practice of medicine and improve health around the world.

Through a dynamic and future-oriented five-year curriculum that is inter-disciplinary and inter-professional in nature, our students undergo a holistic learning experience that exposes them to multiple facets of healthcare and prepares them to become visionary leaders and compassionate doctors and nurses of tomorrow. Since the School's founding in 1905, more than 12,000 graduates have passed through our doors.

In our pursuit of health for all, our strategic research programmes focus on innovative, cutting-edge biomedical research with collaborators around the world to deliver high impact solutions to benefit human lives.

The School is the oldest institution of higher learning in the National University of Singapore and a founding institutional member of the National University Health System. It is one of the leading medical schools in Asia and ranks among the best in the world (Times Higher Education World University Rankings 2023 by subject and the Quacquarelli Symonds (QS) World University Rankings by subject 2023).

For more information about NUS Medicine, please visit <https://medicine.nus.edu.sg/>

