17 August 2023

NUHS LEVERAGES SUPERCOMPUTER TO DRIVE AI IN HEALTHCARE

The Prescience supercomputer, a first in Singapore's healthcare sector, is deployed to train artificial intelligence models that boost delivery of care

SINGAPORE — Healthcare staff at the National University Health System (NUHS) can now use Artificial Intelligence (AI) to estimate the duration of a patient's hospitalisation, much like how hotels have precise information on room occupancy rates. This would allow NUHS to better tailor treatments and allocate hospital resources.

Doctors may also now use locally trained Large Language Models (LLMs) to summarise patients' case notes with just the click of a button, thus freeing up time for more direct patient care.

These initiatives are part of the NUHS AI programme developed using the petabyte-scale edge supercomputing infrastructure named "Prescience" located at the National University Hospital. Fully operational since 31 July 2023, Prescience is Singapore's third national supercomputer and the first in the healthcare sector.

NUHS inked a collaborative agreement with the National Supercomputing Centre (NSCC) Singapore on 3 December 2021 to build this supercomputer dedicated to healthcare and medical research.

Researchers are now able to use medical big data to train AI models using multiple NVIDIA DGX A100 compute nodes that can accommodate the large sizes of LLMs, which was previously not possible with single graphical processing unit (GPU) systems.

Associate Professor Ngiam Kee Yuan, Group Chief Technology Officer, NUHS, said: "Using the Prescience supercomputer, we are now able to train our own large language model for Singapore's healthcare needs. From synthesising precise local medical knowledge to reducing the administrative work of our doctors and nurses, this LLM will bring benefits to both healthcare workers and patients."

Mr Bernard Tan, Director of Strategy, Planning and Engagement at NSCC, said: "The launch of the NUHS supercomputer is timely because of the all-time interest in Generative AI, and especially with the worldwide demand crunch for the computing resources needed to drive such AI-driven technologies. The Prescience supercomputer will significantly benefit Singapore's healthcare research community and enable local healthcare professionals to develop tools that can increase the efficiency of healthcare delivery and accelerate healthcare innovations which ultimately benefit patients here. NSCC will continue to partner with Singapore's

healthcare clusters and government agencies to ensure Singapore's Human Health and Potential domain has the supercomputing capacity and capabilities to be competitive and innovative."

AI tools for healthcare needs

With the supercomputer, NUHS now has its own version of LLMs to boost productivity of healthcare professionals and improve patient care. The NUHS RUSSELL-GPT can summarise patient case notes and write referral letters for doctors in a matter of seconds.

This language model also allows NUHS staff to ask questions, such as those related to medical conditions and clinical practice guidelines, to aid them in their work. Plans are under way to progressively roll out the language model throughout the NUHS cluster.

This model is also used in the Patient Trajectory Prediction AI Model to predict individual patient healthcare journeys through the analysis of all historical data. Research is under way to use this model to predict the severity and trajectory of common conditions, such as urinary tract infections, to help right-site patients.

Another initiative made possible with Prescience is the SMILE AI (Smart Monitoring and Intelligent Learning for Enhancing oral health) project, which entails training two distinct machine learning models – one using 3D dental scans, and the other using X-rays of the upper and lower jaw, in what is known as dental panoramic tomogram.

The 3D teeth charting model generates digital representations of the condition of teeth and their positions in the mouth, replacing manual tooth charting by dentists and facilitating enhanced visualisation. Instead of waiting for up to a day to get a dental cast done, it will take no more than five minutes for dentists to scan a patient's teeth and collect information to initiate treatments.

Dr Peter Yu, Senior Consultant, Department of Prosthodontics, National University Centre for Oral Health, Singapore (NUCOHS), said: "Dental treatments involve three-dimensional appreciation of facial structures, anatomy, reconstruction and a vision of what a patient's teeth could be after treatments. This supercomputer, with its significant graphic capabilities, is particularly suited for this structural approach."

To date, 400 3D dental scans of anonymised patients, from children to adults, have been collected to train the AI model. Another 200 dental panoramic tomograms of anonymised patients, the majority with gum problems, have also been collected.

Dr Wilson Lu, Consultant, Department of Orthodontics, NUCOHS, said the AI tools can help dentists make objective clinical judgements on patients' teeth and gum conditions. He added that the gum disease prediction model also has the potential to be implemented on a population level so that a patient's risk of developing gum disease can be classified into low, medium or high, and interventions recommended before the onset of disease.

Dr Lu said: "We have a vision that the future of dental care will be data-driven and precisely tailored to the individual based on information on health determinants and oral conditions. Dental care will focus on preventing diseases before they happen, and early detection and treatment of diseases when they happen."

Chinese Glossary

National University Health System (NUHS)	国立大学医学组织 (国大医学组织)
National University Centre for Oral Health, Singapore	新加坡国立大学口腔医学中心
National Supercomputing Centre Singapore	新加坡国立超级电脑中心
Associate Professor Ngiam Kee Yuan Group Chief Technology Officer National University Health System Head and Senior Consultant Division of General Surgery (Thyroid & Endocrine Surgery) National University Hospital	严居渊副教授 集团首席技术官 国立大学医学组织 主任兼高级顾问医生 甲状腺与内分泌外科 国立大学医院
Dr Peter Yu Senior Consultant Department of Prosthodontics National University Centre for Oral Health, Singapore	余肇磐 高级顾问医生 口腔修复学科 新加坡国立大学口腔医学中心
Dr Wilson Lu Consultant Department of Orthodontics National University Centre for Oral Health, Singapore	陆威勋 顾问医生 口腔矫正科 新加坡国立大学口腔医学中心
Mr Bernard Tan Director Strategy, Planning and Engagement National Supercomputing Centre Singapore	陈志刚 董事 战略与规划 新加坡国立超级电脑中心

For media enquiries, please contact:

Joan CHEW
Group Communications
National University Health System
Email: joan_chew@nuhs.edu.sg

Eugene LOW
Marketing & Engagement
National Supercomputing Centre Singapore
Email: eugene@nscc.sg

About the National University Health System (NUHS)

The National University Health System (NUHS) aims to transform how illness is prevented and managed by discovering causes of disease, development of more effective treatments through collaborative multidisciplinary research and clinical trials, and creation of better technologies and care delivery systems in partnership with others who share the same values and vision.

Institutions in the NUHS Group include the National University Hospital, Ng Teng Fong General Hospital, Jurong Community Hospital and Alexandra Hospital; three National Specialty Centres - National University Cancer Institute, Singapore (NCIS), National University Heart Centre, Singapore (NUHCS) and National University Centre for Oral Health, Singapore (NUCOHS); the National University Polyclinics (NUP); Jurong Medical Centre; and three NUS health sciences schools – NUS Yong Loo Lin School of Medicine (including the Alice Lee Centre for Nursing Studies), NUS Faculty of Dentistry and NUS Saw Swee Hock School of Public Health.

With member institutions under a common governance structure, NUHS creates synergies for the advancement of health by integrating patient care, health science education and biomedical research.

As a Regional Health System, NUHS works closely with health and social care partners across Singapore to develop and implement programmes that contribute to a healthy and engaged population in the Western part of Singapore.

For more information, please visit www.nuhs.edu.sg.

About the National University Centre for Oral Health, Singapore (NUCOHS)

The National University Centre for Oral Health, Singapore (NUCOHS) is a national specialty centre under the National University Health System (NUHS) that provides a comprehensive spectrum of dental care to manage oral, dental, and jaw-related conditions in patients across their lifespan. NUCOHS is also well-poised to provide oral healthcare to the geriatric population as well as patients with special needs, including those with complex medical conditions.

NUCOHS draws on the expertise of its clinicians and experts in the fields of Endodontics, Oral Maxillofacial Surgery, Orthodontics, Periodontics, Paediatric Dentistry and Prosthodontics, Geriatric Dentistry and Dental Public Health from the National University Hospital's (NUH) University Dental Cluster (UDC) and the National University of Singapore (NUS) Faculty of Dentistry to operate within NUHS under an academic health centre governance model. Its vision is to transform oral health in Singapore, nurture the next generation of oral health professionals, and champion impactful multi-disciplinary research in oral health.

For more information, please visit: www.nucohs.com.sg.

About the National Supercomputing Centre (NSCC) Singapore

The National Supercomputing Centre (NSCC) Singapore was established in 2015 to manage Singapore's national petascale facilities and high-performance computing (HPC) resources. As a National Research Infrastructure funded by the National Research Foundation (NRF), the HPC resources that we provide help support the

research needs of the public and private sectors, including research institutes, institutes of higher learning, government agencies and companies. With the support of our stakeholders, for example, the Agency for Science Technology and Research (A*STAR), Nanyang Technological University (NTU), National University of Singapore (NUS), Singapore University of Technology and Design (SUTD), National Environment Agency (NEA) and Technology Centre for Offshore and Marine, Singapore (TCOMS), NSCC catalyses national research and development initiatives, attracts industrial research collaborations and enhances Singapore's research capabilities. For more information, please visit https://www.nscc.sg/