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NTU Singapore launches research center to transform healthcare and advance biomedical research with data analytics and AI

BY BIOENGINEER — April 22, 2022 in Cancer

Nanyang Technological University, Singapore (NTU Singapore)'s **Lee Kong Chian School of Medicine** has launched a research centre that will leverage data analytics and artificial intelligence (AI) to develop "super algorithms" that predict and personalise treatment in areas such as mental health.

Credit: NTU LKCMedicine

Nanyang Technological University, Singapore (NTU Singapore)'s **Lee Kong Chian School of Medicine** has launched a research centre that will leverage data analytics and artificial intelligence (AI) to develop "super algorithms" that predict and personalise treatment in areas such as mental health.

The **Centre for Biomedical Informatics** will use its expertise and state-of-the-art equipment to identify trends, patterns, and anomalies in data to derive insights that will help researchers and clinicians make better informed decisions, and possibly give rise to new discoveries and the development of powerful diagnostic and treatment methods for diseases.

The work at the Centre is in line with the National AI Strategy under Singapore's Smart Nation initiatives to deepen the use of AI to transform Singapore's economy. One of key area outlined in the strategy is in healthcare, where chronic disease prediction and management could help with faster detection and treatment of such diseases.

NTU LKCMedicine Dean and NTU Senior Vice President (Health & Life Sciences) Professor Joseph Sung said: "The opening of the Centre is very timely; it will not just support LKCMedicine's five flagship research programmes: population health, respiratory medicine and infectious disease, skin diseases and wound repair, neuroscience and mental health as well as nutrition, metabolism and health, but also

research by our partners in NTU and beyond. We need good quality data so that we can make important advancements in science."

Among the Centre's projects is an ongoing collaboration with the Institute of Mental Health (IMH) and the Auckland University of Technology (AUT) to better understand and predict disease progression of mental health conditions in youths using data analytics and AI techniques.

The Centre is also working with IMH to develop algorithms that predict whether patients are at risk of developing psychosis and other mental disorders based on their speech patterns.

NTU Assistant Professor Wilson Goh and Centre Co-director said: "At the Centre for Biomedical Informatics, we are making sense of huge volumes of biological data. We want to work towards achieving the three 'P's in clinical application: prediction, prevention, and personalisation. By building biologically informed models through data analysis and super algorithms, we could create insights that are personalised for the patient. Such models could enable early and accurate detection and prevention of chronic diseases and acute medical emergencies."

NTU Assistant Professor Bernett Lee and Centre Co-director added: "Aside from developing super algorithms and machine learning models, the Centre for Biomedical Informatics also does biomedical data analytics for the scientific community in NTU Singapore to advance biomedical research. To build up biomedical informatics capabilities among medical science researchers in Singapore and the region, the Centre will also organise workshops and courses. Through these efforts, we hope to bridge the gap between medicine and data, devise meaningful and practical ways to confront the complexities in biomedical data head-on, and bring forth a new wave of personalised models and therapies for predictive and preventive disease management."

The Centre will draw upon the expertise of 15 researchers specialising in bio-data science, computer engineering, artificial intelligence, and machine learning.

Developing super algorithms for mental health issues

With more than one in five young adults aged 18 to 29 years old in Singapore found to be of poor mental health[1] according to the latest available population health data, NTU LKCMedicine's Centre for Biomedical Informatics is working with IMH and AUT in New Zealand on a four-year study to develop machine learning methods using a combination of different datasets to enhance the accuracy of early detection or prediction of mental illnesses in at-risk youths.

This collaboration taps into data from IMH's 2009 longitudinal youth-at-risk study that studied 600 youths to identify social, biological, clinical, and cognitive factors involved in the transition to psychosis in at-risk youths.

Applying advanced neural networks (a machine learning technique), the team will analyse and integrate a wide variety of data, including clinical, behavioural, and large-scale molecular data to

understand how seemingly disparate data relate and connect to each other. Such an approach opens doors to new discoveries of new biomarkers and risk factors for the screening of mental health states.

These new discoveries could then be used to develop super algorithms that could one day predict who is at risk of mental disorders, allowing for better clinical intervention via early prognosis and diagnosis of mental health issues in at-risk youth.

The findings could also help in the development of personalised modelling for a better understanding of individual factors that trigger mental illnesses.

Dr Jimmy Lee, an associate professor at NTU LKCMedicine and a Senior Consultant with the Department of Psychosis and Research Division, IMH, who was involved in the 2009 study, said: "Numerous studies have shown that early and timely intervention can improve long-term management and outcome of mental health conditions. By tapping on the expertise of NTU's Centre for Biomedical Informatics and our partners in Auckland, we can now take a deep dive into the data and possibly discover new insights – something that was not possible when we first started our study on at-risk youths. This will potentially help us to map the various clinical attributes of a patient to predict disease progression and tailor personalised therapy."
Aside from mental health, the Centre is also working on projects in the area of cancer treatment. For instance, using statistical, meta-analysis, and machine learning techniques, researchers have devised a way to develop cancer biomarkers – biological molecules that are a sign of disease. They have used this method to produce a breast cancer biomarker associated with prognosis.

Based on this biomarker, the researchers are now developing novel therapeutic strategies to help them discover drugs capable of 'reversing' the biomarker expression patterns in hopes of improving patient outcomes.