

NEWS RELEASE

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NTU Singapore scientists develop computer programme that uses data from wearable technology to detect depression

A team of scientists from **Nanyang Technological University, Singapore (NTU Singapore)** has developed a predictive computer programme that could be used to detect individuals who are at increased risk of depression.

In trials using data from groups of depressed and healthy participants, the programme achieved an accuracy of 80 per cent in detecting those individuals with a high risk of depression and those with no risk.

Powered by machine learning, the programme, named the Ycogni model, screens for the risk of depression by analysing an individual's physical activity, sleep patterns, and circadian rhythms derived from data from wearable devices that measure his or her steps, heart rate, energy expenditure, and sleep data.

Depression affects 264 million people globally¹, and is undiagnosed and untreated in half of all cases, according to the World Health Organisation. In Singapore, the COVID-19 pandemic has led to increased concerns over mental well-being. A new study² by Singapore's Institute of Mental Health pointed to a likely increase in mental health issues, including depression related to the pandemic.

Activity trackers are estimated to be worn by nearly a billion people³, up from 722 million in 2019.

To develop the Ycogni model, the scientists conducted a study involving 290 working adults in Singapore. Participants wore Fitbit Charge 2 devices for 14 consecutive days and completed two health surveys, which screened for depressive symptoms, at the start and end of the study.

¹ World Health Organisation. Depression: a fact sheet (2021).

² Institute of Mental Health, Singapore. Novel Coronavirus, Population Well-being and Resilience: A Cross-Sectional Study (2021).

³ Statista. Wearables - statistics & facts (2021).

The average age of the participants was 33 years old, with the sample closely mirroring the ethnic population of Singapore. Participants were instructed to wear trackers all the time and to remove them only when taking a shower or when the device needs charging.

Professor Josip Car, Director, Centre for Population Health Sciences at NTU's Lee Kong Chian School of Medicine (LKCMedicine), who co-led the study, said: "Our study successfully showed that we could harness sensor data from wearables to aid in detecting the risk of developing depression in individuals. By tapping on our machine learning programme, as well as the increasing popularity of wearable devices, it could one day be used for timely and unobtrusive depression screening."

Associate Professor Georgios Christopoulos, from NTU's Nanyang Business School, who co-led the study, said: "This is a study that, we hope, can set up the basis for using wearable technology to help individuals, researchers mental health practitioners and policy makers to improve mental well-being. But on a more generic and futuristic application, we believe that such signals could be integrated with Smart Buildings or even Smart Cities initiatives: imagine a hospital or a military unit that could use these signals to identify people-at-risk."

The results of the study were published in the peer-reviewed academic journal ***JMIR mHealth and uHealth*** in November.

Vital signs linked to depressive symptoms

Besides being able to accurately determine if individuals had a higher risk of contracting depression, the researchers successfully associated certain patterns in the participants behaviours to depressive symptoms, which include feelings of helplessness and hopelessness, loss of interest in daily activities, and changes in appetite or weight.

From analysing their findings, the scientists found that those who had more varied heart rates between 2 am to 4 am, and between 4 am to 6 am, tended to be prone to more severe depressive symptoms. This observation confirms findings from previous studies, which had stated that changes in heart rate during sleep might be a valid physiological marker of depression.

The study also associated less regular sleeping patterns, such as varying waking times and bedtimes, to a higher tendency to have depressive symptoms.

The scientists explained that although weekday rhythms are mainly determined by work routine, the ability to follow this routine better differentiates between

depressed and healthy individuals, where healthy people demonstrated a greater regularity in the timings when they woke up and went to sleep.

Prof Car added: “We look forward to expanding on our research to include other vital signs in the detection of depression risk, such as skin temperature. Fine-tuning our programme could help in facilitating early, unobtrusive, continuous, and cost-effective detection of depression in the general population.”

Assoc Prof Christopoulos added: “Our team will also be working on expanding to other types of psychological status, such as mental fatigue, which seems to be an alarming problem nowadays. Wearables can also be part of feedback system that could support therapists to better evaluate the psychological status of their patients – for instance improvements in sleep quality.”

Over the next year, the team hopes to explore the impact of smartphone usage on depressive symptoms and risk of developing depression by enriching their model with data on smartphone usage. This includes how long and frequent individuals use their mobile phones, as well as their reliance on social media.

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Notes to Editor:

The NTU research paper titled “[Digital Biomarkers for Depression Screening With Wearable Devices: Cross-sectional Study With Machine Learning Modeling](#)” is published in *JMIR mHealth and uHealth* on 25 Oct 2021. DOI 10.2196/24872

About Nanyang Technological University, Singapore

A research-intensive public university, Nanyang Technological University, Singapore (NTU Singapore) has 33,000 undergraduate and postgraduate students in the Engineering, Business, Science, Humanities, Arts, & Social Sciences, and Graduate colleges. It also has a medical school, the Lee Kong Chian School of Medicine, established jointly with Imperial College London.

NTU is also home to world-class autonomous institutes – the National Institute of Education, S Rajaratnam School of International Studies, Earth Observatory of Singapore, and Singapore Centre for Environmental Life Sciences Engineering – and various leading research centres such as the Nanyang Environment & Water Research Institute (NEWRI) and Energy Research Institute @ NTU (ERI@N).

Ranked amongst the world’s top universities by QS, NTU has also been named the world’s top young university for the past seven years. The University’s main campus is frequently listed among the Top 15 most beautiful university campuses

in the world and has 57 Green Mark-certified (equivalent to LEED-certified) buildings, of which 95% are certified Green Mark Platinum. Apart from its main campus, NTU also has a campus in Novena, Singapore's healthcare district.

Under the NTU Smart Campus vision, the University harnesses the power of digital technology and tech-enabled solutions to support better learning and living experiences, the discovery of new knowledge, and the sustainability of resources.

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