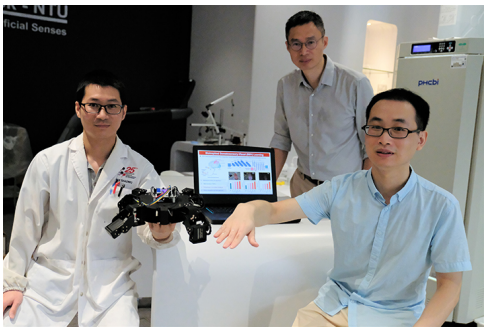
NTU Singapore scientists develop Artificial Intell system for high precision recognition of hand gestures



Scientists from Nanyang Technological University, Singapore (NTU Singapore) have developed an Artificial Intelligence (AI) system that recognises hand gestures by combini electronics with computer vision.

The recognition of human hand gestures by AI systems has been a valuable developmer last decade and has been adopted in high-precision surgical robots, health monitoring e and in gaming systems.

AI gesture recognition systems that were initially visual-only have been improved upon b integrating inputs from wearable sensors, an approach known as 'data fusion'. The wear sensors recreate the skin's sensing ability, one of which is known as 'somatosensory'.

However, gesture recognition precision is still hampered by the low quality of data arrivi wearable sensors, typically due to their bulkiness and poor contact with the user, and th visually blocked objects and poor lighting. Further challenges arise from the integration and sensory data as they represent mismatched datasets that must be processed separ then merged at the end, which is inefficient and leads to slower response times.

To tackle these challenges, the NTU team created a 'bioinspired' data fusion system that like stretchable strain sensors made from single-walled carbon nanotubes, and an AI ap resembles the way that the skin senses and vision are handled together in the brain.

The NTU scientists developed their bio-inspired AI system by combining three neural net approaches in one system: they used a 'convolutional neural network', which is a machir method for early visual processing, a multilayer neural network for early somatosensory information processing, and a 'sparse neural network' to 'fuse' the visual and somatosen information together.

The result is a system that can recognise human gestures more accurately and efficiently existing methods.

Lead author of the study, Professor Chen Xiaodong, from the School of Materials Science Engineering at NTU, said, "Our data fusion architecture has its own unique bioinspired fe which includes a man-made system resembling the somatosensory-visual fusion hierarc brain. We believe such features make our architecture unique to existing approaches."

"Compared to rigid wearable sensors that do not form an intimate enough contact with accurate data collection, our innovation uses stretchable strain sensors that comfortably onto the human skin. This allows for high-quality signal acquisition, which is vital to high

recognition tasks," added Prof Chen, who is also Director of the Innovative Centre for Fle Devices (iFLEX) at NTU.

The team comprising scientists from NTU Singapore and the University of Technology Sy published their ndings in the scienti c journal Nature Electronics in June.

High recognition accuracy even in poor environmental conditions

To capture reliable sensory data from hand gestures, the research team fabricated a tra stretchable strain sensor that adheres to the skin but cannot be seen in camera images.

As a proof of concept, the team tested their bio-inspired AI system using a robot control hand gestures and guided it through a maze.

Results showed that hand gesture recognition powered by the bio-inspired AI system wa guide the robot through the maze with zero errors, compared to six recognition errors m visual-based recognition system.

High accuracy was also maintained when the new AI system was tested under poor cond including noise and unfavourable lighting. The AI system worked effectively in the dark, a recognition accuracy of over 96.7 per cent.

First author of the study, Dr Wang Ming from the School of Materials Science & Engineer Singapore, said, "The secret behind the high accuracy in our architecture lies in the fact t visual and somatosensory information can interact and complement each other at an ea before carrying out complex interpretation. As a result, the system can rationally collect coherent information with less redundant data and less perceptual ambiguity, resulting accuracy".

Providing an independent view, Professor Markus Antonietti, Director of Max Planck Inst Colloids and Interfaces in Germany said, "The ndings from this paper bring us another forward to a smarter and more machine-supported world. Much like the invention of the smartphone which has revolutionised society, this work gives us hope that we could one physically control all of our surrounding world with great reliability and precision throug gesture."

"There are simply endless applications for such a technology in the marketplace to supp future. For example, from a remote robot control over smart workplaces to exoskeleton elderly."

The NTU research team is now looking to build a VR and AR system based on the AI syste developed, for use in areas where high-precision recognition and control are desired, su entertainment technologies and rehabilitation in the home.

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