THE FACE OF SMART TECHNOLOGIES

Jiajia the robot can respond to facial expressions in conversations.

The Chinese robot Jiajia blinked and moved her head in response to questions thrown her way during face-to-face dialogs with media and users in 2016.

Able to respond to facial expressions with her own micro-level movements during conversations in both Chinese and English, Jiajia is the result of integrating technologies for cognitive modelling, semantic understanding, automated reasoning and planning, knowledge acquisition, kinematics and cloud robotics. These technologies have been studied in the Kejia Robotics project by Chen Xiaoping's laboratory at USTC. The award-winning development team has received many international accolades, including first places at the popular RoboCup world championship, and the IJCAI Robotics competition.

The Jiajia project is just one aspect of the computer science and information engineering programmes at USTC, which use high-performance computing to develop intelligent technologies. Another group is working on a 'smart bed' to monitor motion and vital signs at the Laboratory for Intelligent Networking and Knowledge Engineering, led by Li Xiangyang.

His lab is also developing a wireless charging approach to transmit energy over tens of metres to moving battery-less devices. Their battery-free sensor network (BFSN), mainly harvesting energy from ambient environment, is being designed to service the large-scale needs of the Internet of Things (IoT) in smart sensing, communicating and computing.

Li's lab also covers intelligent sensing, IoT security, edge computing, and data privacy and exchange. Zhang Xinming complements this with work on performance optimization for IoT devices, and routing algorithms to enhance the performance of wireless ad hoc networks.

Many others at USTC are also working on cutting-edge computing issues. Tian Ye has modelled the topology and geolocation of the Chinese internet network.

Meanwhile, to address increasing network security challenges, Xiong Yan and Huang Wenchao lead a team that has developed a world-first strategy to automatically verify network protocols for checking design flaws and security weaknesses, reducing the risk of costly technological failures.

Chen Enhong's team develops data-driven intelligent services for a wide range of fields, including context-aware data mining, internet finance and intelligent education. Their Fuzzy Cognitive Diagnosis Framework can precisely analyse students' cognitive knowledge mastery for personalized education solutions. They have also combined hierarchical time series and transformation regression approaches, enabling dynamic tracking and prediction of projects on crowdfunding platforms.

These advances in computer science are backed by the National High Performance Computing Center in Hefei, which was founded in 1995. The first of its kind in China, the centre is a node in China's national grid computing network and promotes the country's high-performance computing industry.

Led by CAS members Chen Guoliang and Shi Zhongci, the centre has been behind projects on weather prediction, bridge mechanics, electric power use, big data real-time analysis and other basic research, leading to more than 20 awards and 1,000-plus journal publications. ■

Straight to the source for artificial intelligence research

The National Engineering Laboratory for Brain-inspired Intelligence Technology and Application was established in 2017 to address the rapid development of artificial intelligence(AI). The only national-level research platform in the field, it aims to establish an innovation system that integrates research, education, and industrial applications.

The laboratory has five research priorities, one of which is natural language processing. Its researchers seek to improve machine translation via research on acoustic modelling, syntax understanding, conversation generation, emotion analyses and knowledge reasoning. Inspired by advances in the understanding of the human visual system, researchers in graphic and video processing want to develop technologies for information presentation and human-machine interaction, covering everything from graphic acquisition and perception to analysis and indexing.

The laboratory also seeks to understand how best to provide a secure and efficient intelligent service framework. On the hardware front, research on high density brain-inspired chips aims to simulate the large-scale asynchronous parallel information processing of the human brain. Using autonomous machine learning and control theory, researchers are also devoted to developing general-purpose, human-like robots capable of decision-making and high-precision movements.