# Making smarter, more agile robots

From its Munich headquarters and a branch in Beijing, an international start-up is seeking to **BRIDGE THE GAP BETWEEN AI AND ROBOTICS** to enhance robot intelligence.

Agile Robots AG has designed a force-controlled robot that mimics the movements of a human arm.

**Technological advancements** are enabling robotics to play an increasingly important role in a variety of industries. As robots become smarter and more flexible, they are reshaping conventional manufacturing, and branching out to the health care and service industries.

Committed to connecting artificial intelligence (AI) and robotic technologies, Agile Robots AG was established in 2018 to push the boundaries in robotics. A spin-off of the German Aerospace Center (DLR), this high-tech start-up was founded by Peter Meusel and Zhaopeng Chen, long-term researchers at DLR's Institute of Robotics and Mechatronics.

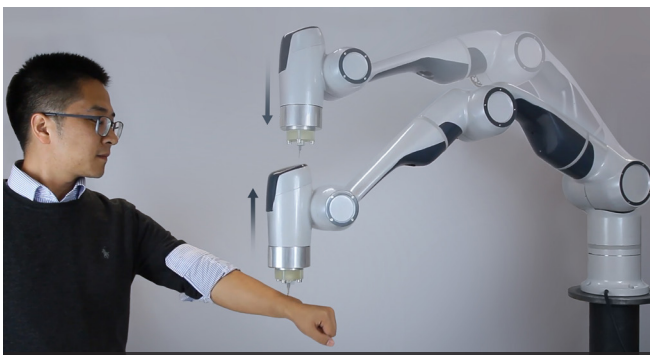
In response to the growth of robotics market in China, the company has set up offices there, and in Germany. "We are keen to combine the precision technologies in Germany, and the experienced robotics market in China to create maximum value for our customers, and contribute to technological advancements," said Chen.

From robotic intelligence based on machine learning and transferring, to vision intelligence and force perception, Agile Robots AG's unique combination of technologies provides intelligent, easy-to-use and affordable robotic solutions to some of the most challenging manufacturing and medical problems.

To enable applications in complex, unpredictable environments, such as operating theatres, researchers at Agile Robots AG have combined integrated mechatronic design and AI technology, with soft robotics and lightweight structures. Their high-performance, lightweight robotic arm is user-friendly, and has ultra-sensitive joint torque sensors to detect and respond to interactions with human users and the environment.

Safety is enhanced by a modular design featuring electronics integrated into the joints, with sensor redundancy to protect against sensor failure, and full-state measurement in joints. Algorithms for collision detection and gravity, and joint friction compensation were developed based on joint torque sensor signals. They support accurately controlled torque and position to ensure necessary safety in surgical use.

For tracking patient body movement and avoiding collision, a robotic vision system was developed, empowered by the cutting-edge AI technique of deep learning. The combination of deep learning and high-resolution 3D sensing enables the robot to learn and adjust to unknown environments, based on vast quantities of data, so that it can accurately recognize objects and react instantly and appropriately.



The robot's sensing and reaction control allows it to detect contact and avoid causing injuries.

While intelligent image processing algorithms lead to safe and precise movement of the robot in unstructured environments, the user-friendly interface and vision technology bolster seamless cooperation between robots and humans.

Hybrid force and vision-based control is enabled by a force feedback technology that allows robots to 'feel' the physical world. Featuring autonomous planning, the robot is also capable of synthesizing and adjusting motion trajectories in real time. Both technologies enhance intelligence and the robot's 'human touch', making it applicable in clinical settings.

More recently, seeing the growing demand for robotics in the diagnosis and treatment of infectious diseases, Agile Robots AG researchers are using their technologies to develop teleoperated robots for collecting pharyngeal swabs for virus testing. This will potentially reduce the risk of exposure for medical staff, and lighten their workload, offering a contributory role for medical robotics in epidemic control. ■

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