Paving the way for automated surgeries

A Beijing-based start-up has integrated SURGICAL EXPERIENCE AND DIGITAL AUTOMATION in its orthopaedic robots.

Leveraging its clinical resources and engineering strength, Rossum Robot's research team has designed an automated robotic assistance system specializing in one of the most difficult trauma surgeries, treating pelvic fractures.

"We expect to use digital technologies to 'replicate' clinical experience of surgeons and enable personalized surgery planning," said, Yu Wang, Rossum Robot's founder.

The company is a spin-off from Beihang University. Emerging from a medicine-engineering collaboration between Beihang and Beijing Jishuitan Hospital, the company is committed to offering intelligent medical solutions to health-care organizations, promoting a paradigm shift in medicine via technological innovations.

Pelvic fractures are among the most serious injuries in orthopaedic care, often demanding urgent attention. The first surgical procedure is usually 'reduction', which is reassembling bone fragments to their original alignment. As the pelvis is close to major organs and blood vessels, the risk of uncontrolled bleeding is high, especially when making large incisions.

For closed reduction, where the incision is small, surgeons need to have great expertise, as they may not be able to view bone fragments directly. Any incorrect reduction could affect healing and lead to deformities.

The orthopaedic surgical robot developed by Rossum Robot features a photoelectric tracking and navigation system which enables real-time, in-vivo tracking of the fractured bone structures.

Compared with traditional 2D X-ray images, the real-time 3D tracking can display spatial information more vividly, and use shorter time for intraoperative imaging. It can also reduce information loss caused by image overlaps, further enhancing surgical accuracy and safety.

Incorporating the real-time 3D data, the research team has developed a system for intelligent surgical planning, which automatically provides location data for fracture reduction and screw fixation based on biomechanical, neurovascular, and other anatomical data of individual patients. The underlying technologies, including medical data machine learning and biomechanical analysis, pave the way towards automation by surgical robots.

Furthermore, based on mechanics and location signals, a safety control strategy is set, ensuring operation safety.

Rapid development of robotics technologies is transforming medicine and health care. As integral tools for minimally invasive procedures, robotic systems have the potential to lower costs and improve accessibility of medical resources.

Surgical robots may work like an advanced tool for doctors for now. But an increased level of automation, may redefine the relationship between surgeons and their equipment, forming more of a partnership, Wang predicted.

Wang is also optimistic that the development of intelligent technologies, from big data to artificial intelligence, will take surgical robots to new heights, moving beyond task autonomy, towards full automation.

Closer integration between medicine and engineering will meet new clinical needs, driving the advancement of surgical and robotics technologies. ■

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