Editorial : Special Issue on Medical Robotics

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Editorial

Special Issue on Medical Robotics

In recent years there has been a significant development in medical robotics from basic research to product development, evaluation, and feasibility studies. While earlier research in medical robotics was targeted towards the development of computer-integrated systems for surgical interventions, over the years it has branched out to cover a wider variety of areas including image-guided therapy, rehabilitation robotics, and cellular-scale manipulation.

The goal of this special issue was to bring together papers in the wide area of medical robotics and share them with the robotics community at large. While clinical work is highly relevant to this area of research, this special issue has focused primarily on papers with a strong methodological component and clinical evaluation was encouraged primarily as a validation tool rather than a major component of the paper. The special issue encouraged submission in a wide range of areas including: robot-assisted procedures, smart instrumented tools for surgery, haptic feedback in medical robotics, rehabilitation robotics, interventional therapy, image-guided procedures, medical imaging for robotic interventions, cell manipulation, cellular-scale interventions, surgical simulation, soft-tissue modeling, and telesurgery.

The Call for Papers attracted a record number of submissions, 51 in total, encompassing most of the areas mentioned above. After a thorough review process including major and minor revisions of several manuscripts, 19 papers were accepted for publication and are published in two parts. These two issues cover several topic areas as discussed below.

Jagadeesan et al. discuss algorithms for robot-assisted catheter insertions with the eventual goal of minimizing radiation exposure for the patient and potentially improve the outcome of the procedure while Trejos et al. discuss the development of a robot-assisted tactile sensing system for tumor localization using a commercially available sensor. Simaan et al. discuss the design and development of a teleoperated system for minimally invasive surgery of the throat while Piccin et al. present their work on the development of a teleoperated needle insertion device with force-feedback capability for percutaneous procedures. Martel et al. present their work in the area of nanorobotics under magnetic resonance imaging (MRI) guidance for interventions in target regions where catheterization is challenging. Lum et al. present their work on the development of RAVEN, a telesurgical system, while Berkelman et al. discuss the development of a compact and modular teleoperated robotic system for laparoscopic surgery.

Venture et al. present their work on *in-vivo* estimation of joint dynamics of the human limbs with applications to diagnosis of neuromuscular disease while Westpahl et al. present their research on robot-assisted long bone fracture reduction. Tavakoli and Howe present their work on the effect of link and joint flexibility of the slave robot on the stiffness of the slave robot in a teleoperated system and its effect on the transparency of teleoperation while Yuen et al. discuss robotic motion compensation for beating heart intracardiac surgery using a one degree-of-freedom motion compensation system. Krupa et al. discuss their work on real-time motion stabilization with B-mode ultrasound using image speckle information and visual servoing. Hu et al. present their work on the design, development, and evaluation of a camera system that is capable of pan, tilt, and zoom with lighting for visualization of organs in minimally invasive surgery.

In the area of rehabilitation robotics, Saglia et al. discuss the development of a high-performance redundantly actuated parallel mechanism for ankle rehabilitation while Ishii et al. present their work on the development and evaluation of an oral rehabilitation robot that provides maxillofacial massage to patients with oral disorders such as temporomandibular joint (TMJ) disorders and dry mouth. Wolf et al. discuss their research on the development of a robotic neural interface for autonomous positioning of extracellular recording electrodes,

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which can be used to develop neuroprosthetic devices as well as carry out neuroscientific research.

In the area of soft-tissue modeling, Ciarletta et al. present their work on the development of the hyperelastic model for anisotropic fiber reinforcements within intestinal walls while Gosline and Hayward present their work on the haptic synthesis of viscoelastic tissue properties using programmable eddy current brakes. Negeotte et al. discuss feasible paths for the needle through the tissue for suturing task to minimize tissue deformation using kinematic analysis and geometric modeling of the stitching task.

Finally, we would like to thank all of the reviewers who helped to review the manuscripts and the revised versions. We would also like to thank Professor John Hollerbach, Editor of *The International Journal of Robotics Research*, and Jennet Batten, Managing Editor of *The International Journal of Robotics Research*, for their support throughout the review process to bring this special issue to the robotics research community.

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