Jing Ren, PhD

Associate Professor, Department of Electrical, Computer and Software Engineering, Faculty of Engineering and Applied Science at University of Ontario Institute of Technology
Oshawa, ON, CA

Developing novel image registration methods for treatment planning to improve surgical outcomes

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Advanced surgical techniques are creating new opportunities for minimally invasive surgeries which reduce trauma to the body and promote earlier patient recovery. Still, these surgeries pose greater challenges for surgeons since the surgical site is not visible. Image registration, the alignment and matching of similar features of multimodality images, is critical to improving patient outcomes.

Organs such as the lungs, liver and kidneys have few notable landmarks for image registration, yet blood vessels are clearly visible using CT and MRI scans, and provide useful features for these schemes. Jing Ren, PhD, Associate Professor in the Department of Electrical, Computer and Software Engineering, Faculty of Engineering and Applied Science, is exploring a vessel-based approach to improve image registration quality, and provide doctors with clearer, more accurate CT and MRI images to advance diagnosis and treatment planning for minimally invasive procedures. Her research will segment the blood vessels from the surrounding structures and tissues; and use extracted vessels to identify major landmarks in the organs for vessel-based image registration.

Dr. Ren has developed novel registration methods which combine feature-based and intensity based registration techniques to achieve fast registration speed. Along those lines, she is also developing fast deformable image registration methods since soft tissues and organs are often deformed in two images acquired at different conditions.

Already making major strides in her field, she has established a method for mapping the haptic rendering to the beating heart. In her lab, Dr. Ren simulated embedding a tumour under the skin of the heart, and using haptic force guidance, she removed it without damaging the heart or critical tissues or organs.

Intrigued by China's early use of televisions and radios, Dr. Ren grew up with a keen interest in repairing circuits and earned her Bachelor of Electrical and Computer Engineering from Shandong University in Jinan, China in 1993, her Master and Doctorate of Electrical Engineering from the University of Western Ontario in 2003 and 2005, respectively. She joined UOIT in July 2006, following a postdoctoral fellowship at Imaging Research Laboratories, Robarts Research Institute in London, Ontario where her interest in medical imaging research was born.

Education/Learning, Electrical Engineering, Information Technology and Services, Research

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Introductory Electronics, Circuit Design, Advanced Control Systems, Advanced Image Processing, Electric Circuits, Intelligent Control Systems, Computer Architecture, Fuzzy Control Systems, Haptics and Virtual Reality, Imaging Processing, Soft Computing, Discrete Mathematics, Robotics

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Professional Engineers Ontario, Institute of Electrical and Electronics Engineers

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Accurate Seed Points Classification Using Invariant Moments & Neural Network
The 28th Canadian Conference on Electrical and Computer Engineering (CCECE)

Adaptive Deformable Image Registration of Inhomogeneous Tissues
SPIE Medical Imaging

Segmentation of the Liver from Abdominal MR Images: a Level-Set Approach
SPIE Medical Imagining

Automatic Surface Reconstruction for Endoscopy-MR Image Fusion in Image Guided Procedures
26th Annual IEEE CCECE

University of Western Ontario
PhD Electrical Engineering

University of Western Ontario
MSc Electrical Engineering

Shandong University
BSc Electrical Engineering

Natural Sciences and Engineering Research Council of Canada (NSERC) University Faculty Award
Awarded $200,000 between 2006 and 2011 to conduct groundbreaking research to improve image registration for minimally invasive procedures.