Tutorial Title: Use of 3D ultrasound in image-guided surgery and therapy

Responsible organizer:

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Tutorial Speakers:

Dònal Downey
Richard Prager
Frank Lindseth
Bob Galloway
David Gobbi
Aaron Fenster

Tutorial Audience:

The audience that will benefit from this tutorial includes both investigators from academia and developers from industry. The tutorial will cover issues related to the emerging use of 3D ultrasound ranging from clinical implications and needs to practical implementation and used of this new technology. Thus, trainees, scientists and technology developers, both with and without experience in this field will benefit from the tutorial as they will gain an appreciation on the factors that are driving this new technology as well as gain insight into the technical innovative implementations.

No special prerequisites are needed to gain an appreciation of the use and directions in the use of 3D ultrasound in image-guided surgery and therapy

Tutorial Description:

Minimally invasive techniques are rapidly replacing traditional practices because they result in improved benefits for patients, health care providers, payers, employers and hospitals. While 2D imaging has been used to guide interventional procedures for many decades, the use of 3D imaging of the anatomy has the potential to provide more accurate and less variable interventional guidance and monitoring options. Although 3D MRI, CT and angiography are important

modalities, the development of 3D ultrasound imaging techniques that are capable of acquiring B-mode, color Doppler and power Doppler images, has allowed the development of image-guided therapy and surgery approaches that promise to be more accurate and less variable. The use of 3D ultrasound has the potential to provide inexpensive and near real-time views of the anatomy and pathology enabling minimally invasive interventional procedures. In this tutorial, six speakers will be invited to discuss the principles and advantages of 3D ultrasound imaging in image guided surgery and therapy, review some of the implementations techniques, and present applications such as neuro-surgery, cardiac surgery, liver surgery, prostate therapy and breast biopsy

Provisional schedule:
(30 min presentation, 10 min discussion)

1. Dònal Downey: Clinical perspective on the need for 3D ultrasound in image –guided surgery and therapy
2. Richard Prager: Freehand 3D ultrasound for tumour bed localization to improve breast radiotherapy planning.
3. Frank Lindseth: Multimodal visualization, navigation accuracy and image quality in interventions guided by 3D ultrasound

COFFEE

4. David Gobbi: Technical issues in the use of 3D ultrasound in neurosurgery
5. Bob Galloway: (To follow)
6. Aaron Fenster: Use of 3D ultrasound in planning and guiding prostate therapies

Short CV of the speakers:

Dònal Downey: Dònal Downey MB, BCh, FRCP is the Director of Diagnostic Ultrasound at the London Health Sciences Centre in London, Canada, an Associate Professor in the Department of Diagnostic Radiology and Nuclear Medicine at the University of Western Ontario, and an Associate Scientist at the Robarts Research Institute. He has for many years been active as a clinical partner with Dr Fenster in the development of 3-D ultrasound, and continues an active research program in the utilization of 3D US technology for both Diagnostic and Therapeutic applications.

Richard Prager: Richard Prager, Andrew Gee and Graham Treece lead the Medical Imaging Group in Cambridge University Engineering Department. This group, which was founded in 1992, specializes in the development of freehand 3D ultrasound systems for volume measurement and visualization. Their software system, Stradx, has been freely available on the web since 1997.

Frank Lindseth: Frank Lindseth was born in Bergen, Norway in 1969. He received his Ph. D. degree in computer science from the Norwegian University of Science and Technology in 2003 with a doctoral theses entitled "Ultrasound Guided Surgery: Multimodal visualization and Navigation Accuracy". He also has a M.S. degree in mathematics and a B.S. degree in information and communication technology. He has been a researcher at SINTEF Unimed, Ultrasound, Norway, since 1996. The Ultrasound department is part of Center of Competence - 3D Ultrasound in Surgery, a research collaboration between SINTEF Unimed, St. Olav's University Hospital and the Norwegian University of Science and Technology, all located in Trondheim, Norway.

His research interests lie in the field of ultrasound-based image-guided minimally invasive surgery, including navigation and tracking technology, multimodal visualization and registration, medical image analysis and segmentation, navigation accuracy, probe calibration and 3D ultrasound reconstruction.

Robert L. Galloway, Jr. is a Professor of Biomedical Engineering, Neurologic Surgery and Surgery at Vanderbilt University. Dr. Galloway earned the BSE from Duke University in 1977, the ME from UVa in 1979 and the Ph.D. from Duke in 1983, all in Biomedical Engineering. He teaches courses in Medical Instrumentation, Medical Imaging and a new course in Therapeutic Bioengineering. He also serves as the Director of the Center for Technology-Guided Therapy at Vanderbilt.

David Gobbi: David Gobbi holds a PhD in Medical Biophysics from the University of Western Ontario, where he performed research on the application of freehand 3D ultrasound to imaging of the brain during surgery at the Robarts Research Institute. David has contributed several fundamental improvements to the popular VTK open visualization package and has co-founded a company, Atamai Inc., which both provides software development services and maintains an open repository of visualization
Software.

Aaron Fenster: Aaron Fenster is the Director of the Imaging Research Laboratories of The John P. Robarts Research Institute in London, Canada. This laboratory has about 190 individuals pursuing research in diagnostic radiological imaging, including CT, MRI, fMRI, ultrasound and digital x-ray imaging. Fenster is also a professor in the Departments of Radiology, Biomedical Engineering, Medical Biophysics, Physics, Electrical Engineering and Radiation Oncology of the University of Western Ontario. His present research interest is focused on the development of 3D ultrasound imaging systems for radiology, cardiology and for image-guided therapy. A number of the systems developed in Dr. Fenster's laboratory (25 patents) have been commercialized and are now being sold worldwide. He numerous awards including a Canada Research Chair and is the

founding scientist of 2 companies formed based on his research (Life Imaging Systems Inc. and Enhanced Vision Systems Inc.).