MEDVIZ FROM VISION TO DECISION

SEMINAR FRIDAY 12.12.2014

PLACE: MedViz Facilities., Møllendalsbakken 7, 5th floor

TIME : 12:00-13:30

SPEAKERS/TITLE

Bernhard Kainz
Title: Fast volumetric super-resolution reconstruction of organs from moving subjects

Torfinn Taxt (MR) and Radovan Jirik (ultrasound)
Title: New perfusion analysis algorithms for MR and ultrasound

Ivan Viola
Title: Deriving Anatomical Context from 4D Ultrasound

Robert Bjerknes: Christmas Greetings from Vice Dean of Research at The Faculty of Medicine and Dentistry

ABSTRACT

Kainz

Abstract: Magnetic Resonance Imaging (MRI) is a primary tool for clinical investigation of the brain and fetal organs. High resolution imaging with volumetric coverage using stacks of slices or true three dimensional (3D) methods is widely available and provides rich data for image analysis. However such detailed volumetric data generally takes everal minutes to acquire and requires the subject to remain still or move only small distances during acquisition. Fetal organ imaging introduces a number of additional challenges. Maternal breathing may move the fetus and the fetus itself can and does spontaneously move during imaging. These movements are unpredictable and may be large, particularly involving substantial head and body rotations. Motion correction methods have revolutionized MRI of the fetus by reconstructing a high-resolution 3D volume of fetal organs from such motion corrupted stacks of 2D slices. Such reconstructions are valuable for both clinical and research applications. However, reconstruction is computationally expensive and can only be performed off line. Information about the accuracy of the scan and potential uncertainties is unknown or not considered in the clinical practice. In this talk I will discuss the fundamentals of fetal MRI reconstruction and it's parallelization and hardware acceleration for a future on-line application during the scan. Furthermore, I am looking forward to a discussion about potential application of novel visualization techniques to communicate varying uncertainties of the reconstruction to examining radiologists and scientists.

Taxt and Jirik

Good estimates of the microvascular functional (perfusion) parameters in normal and pathological tissues is based on
a) good estimates of the local arterial input functions (aifs),
b) adequate tissue residual function models (trfs) and
c) tissue contrast signals with reasonable signal to noise ratios.
This talk will present some recent developments to obtain reliable aif estimates in MR and ultrasound using blind deconvolution methods. A presentation of pharmacokinetic trf models for leaky capillaries will also be given.

Viola

Real-time three-dimensional (also known as 4D) ultrasound imaging using matrix array probes has the potential to create large-volume information of entire organs such as the liver without external tracking hardware. This information can in turn be placed into the context of a CT or MRI scan of the same patient. However for such an approach many image processing challenges need to be overcome and sources of error addressed, including reconstruction drift, anatomical deformations, varying appearance of anatomy, and imaging artifacts. In this work, we present a fully automatic system including robust image-based ultrasound tracking, a novel learning-based global initialization of the anatomical context, and joint mono- and multi-modal registration. In an evaluation on 4D US sequences and MRI scans of eight volunteers we achieve automatic reconstruction and registration without any user interaction, assess the registration errors based on physician-defined landmarks, and demonstrate realtime tracking of free-breathing sequences.