AbstractID: 4490 Title: Visualization for IGI

Algorithmic methods from computer vision and machine learning are dramatically changing the practice of health care and the exploration of fundamental issues in neuroscience. By coupling knowledge of tissue response, atlases of normal anatomy, and statistical models of shape variation, these methods are used to build detailed, patient-specific reconstructions of neuroanatomical structure from MRI imagery. Such structural models can be automatically augmented with information about function (using fMRI), and about connectivity (using DT-MRI) to create detailed models of a patient's brain. These models are routinely used for surgical planning – how to reach the target tumor with minimal damage to nearby critical structures; and for surgical navigation – guiding the surgeon to the target site rapidly and safely.

By combining with statistical models of population variation, these methods can also be used to investigate basic neuroscience questions – how different are the shapes of subcortical structures between normal subjects and patients with a specific disease (such as schizophrenia or Alzheimer's); how do these shapes change with development in children, or with administration of pharmaceuticals; how do physiological properties differ between populations (such as the local structure of fiber orientation in white matter tracts). These computational methods provide a toolkit for exploring the structure and connectivity of neuroanatomical structures, in normal subjects and in diseased patients.

This lecture will review current methods for image segmentation and shape analysis.

Educational objectives:

1. Understand algorithmic methods for image segmentation by tissue type;
2. Understand methods for analyzing shapes of anatomical structures across populations;
3. Understand the application of reconstructed anatomy for surgical guidance and navigation.