Medical Imaging Summer School 2014

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Medical Imaging meets Computer Vision

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Lecture 1 (in joint with Polina Golland): Segmentation in Medical Image Analysis

Syllabus: segmentation, atlases, boundary finding, shape models

We will discuss key approaches to medical image segmentation that have withstood the test of time and have been used across many applications and imaging modalities. We will examine how prior information can be injected into the segmentation process in a form of atlases, shape models or spatial priors. We will also review how local intensity information is incorporated into the segmentation process and integrated with the prior knowledge to produce patient-specific segmentation results.

Lecture 2: Medical Image Reconstruction with Realistic Priors

Syllabus: image reconstruction, MRI, parallel imaging, graph cuts, optimization

Image reconstruction is an exciting and under-explored problem in medical imaging, that involves creating a diagnostic image from the ambiguous data obtained from a sophisticated sensor such as an MRI or CT scanner. Mathematically, the problem is an overdetermined linear inverse system, where the system matrix is typically known but has modality-specific structure. Since the reconstruction problem is ill-posed, solving it requires prior information about how images appear. The most widespread reconstruction algorithms use priors that assume images are globally smooth, since realistic image priors lead to non-convex objective functions. I will describe work by my research group that uses graph cut algorithms to handle these difficult objective functions.