Medical Image Analysis

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This course has been designed as a topic-driven learning course. Three topics were chosen, though not necessarily fixed, in this semester, namely, tumor detection on CT/MRI, lesion detection/computer-aided diagnosis on breast sonograms, and liver cirrhosis computer-aided diagnosis on liver sonograms. For each topic, the students will be asked to discuss what works need to be done to accomplish the job. Then, the instructor will first present some background knowledge, followed by student presentations on the related techniques. All students will be teamed up with 2 or 3 students in a group to solve each topic. The performance on each topic will be used as the basis for class grading.

Topics

I.   Tumor detection on CT/MRI
   1. Denoise
   2. Watershed Transform
   3. Canny Edge Detector
   4. Deformable Model for Boundary Extraction
   5. Region Competition and Cell Competition

II.   Lesion detection/computer-aided diagnosis on breast sonograms
   1. Despeckle
   2. Vision Model for Image Segmentation
   3. Cell competition for sonography
   4. Feature extraction: geometrical and regional features
   5. Classification: Logistic regression function, neural network , cross-validation

III. Liver cirrhosis computer-aided diagnosis on liver sonograms
   1. Textural feature extraction: co-occurrence matrix, coarseness, cell-based features.
   2. Liver surface feature extraction
   3. Spleen-based normalization
   4. Clustering and classification

Grading:

Each Topic	25% (3 Topics in total, which amount to 75%)
Paper Presentation	25%

Prerequisites: (recommended but not required)
   Medical Imaging Systems, Signal and System, Image Processing techniques