EE 549

Biomedical Image Analysis

Instructor: Bilge Karaçalı, PhD

Grading: %20 midterm, %20 final, %30 homework, %30 term project

Material: Course handouts, review papers, internet resources

Class locker: http://www.iyte.edu.tr/~bilgekaracali/EE549

Topics and timeline:

1. Overview of histology image data (1 week)
    a. Preparation of histology slides
        i. specimen sources
        ii. cross-sectioning
        iii. immunohistochemical staining
    b. Image acquisition
        i. microscopy basics
        ii. digitization
2. Tissue and region segmentation (2 weeks)
    a. grayscale segmentation
        i. intensity histograms
        ii. parametric thresholding by model fitting
        iii. nonparametric adaptive thresholding
        iv. post processing by morphological filters
    b. color segmentation
        i. RGB, HSV and Lab color spaces
        ii. parametric clustering by model fitting
        iii. nonparametric clustering by *k*-means
3. Detection and morphological characterization of cell nuclei (1 week)
    a. nuclei detection by segmentation
    b. nuclei detection by Hough transform
    c. morphological parameters associated with cell nuclei
4. Abnormality detection (1 week)
    a. Detection of abnormal cell nuclei
    b. Detection of texture abnormalities
        i. texture parameters
        ii. classifier training
5. Overview of radiological sequences (1 week)
    a. Anatomical contrast
        i. MRI
        ii. CT
        iii. Ultrasound
    b. Functional contrast
        i. fMRI
        ii. PET
        iii. SPECT
6. Lesion detection (2 weeks)
    a. Probabilistic lesion models based on image intensity

    b. Non-parametric methods in lesion detection
7. Computational anatomy (3 weeks)
    a. Anatomical atlases
    b. Deformable image registration
    c. Shape representations for morphological analysis
8. Comparative group studies (2 weeks)
    a. Hypothesis-driven analyses
    b. Hypothesis-free analyses
        i. Voxel-based morphometry
        ii. Analyses based on machine-learning
9. Computational anatomy in four dimensions (1 week)
    a. Four-dimensional shape models
    b. Deformable registration in four dimensions
    c. Statistical analysis of four-dimensional shape representations