PHCO 746
2014 Spring Semester

Short title: Computer Vision in Modern Microscopy

Long title: Introduction to Computer Vision Tools for Modern Microscopy

Effective term: Spring (January-March, eight weeks, one hour class meeting per week)
Course units/hours: 1 credit hour
Grading basis: (GRAD – H, P, L, F)
Course Component: lecture

Mons time: 10-11 am
Location: 4007 GMB
Course Coordinator: D. Tsygankov (dtygank@med.unc.edu, room 4078 GMB)
Specific practice assignments will be posted on the Sakai site.

Course Description

This graduate-level course will introduce the basic principles of computer vision as a high-level image analysis tool, with an emphasis on its practical application to live-cell fluorescence microscopy. Important topics and available techniques will be discussed and demonstrated using examples from current biomedical research.

The course is designed as an introduction to computer vision applications for modern microscopy and will not be mathematically or computationally intensive. Students will obtain the very basic knowledge of how to use MATLAB for image analysis, which will provide them with the opportunity to practice with the introduced techniques and expend their toolkit beyond the capabilities of standard software packages as ImageJ.

There are *no* formal prerequisites required for this course and *no* prior experience with MATLAB is expected.

Short Description

This course will introduce computer vision methods for cell biology. Each topic will be motivated with an explanation of a computational challenge, followed by a discussion of available techniques to address the need and practical examples for how to apply the techniques. No prerequisites are required.

Course objectives (learning outcomes):

The objectives of this course are twofold. First, students will learn about the difficulties associated with automated image content recognition. An understanding of imaging issues from the perspective of quantitative image analysis will provide students with a balanced view of modern microscopy studies. Second, the course will cover a broad range of computer vision techniques and provide students with appropriate training to allow them to select and apply methods that are most relevant to their research.

Course Assignments

The course will include take-home assignments designed to provide students with hands-on training using various computer vision tools. The assignments will cover and expand upon material covered in class. Each assignment will contain detailed instructions. No prior experience with computer programming is required.

Assessments

Student evaluation and individual grades will be determined from the take-home assignments and class participation.

Week:

Jan 13. Introduction to Computer Vision

Jan 27. Introduction to live-cell microscopy (issues from the perspective of quantitative analysis)

Feb 03. Digital image and basic processing (enhancement, transformation, filtering, etc.)

Feb 10. MATLAB basics (how to analyze images with MATLAB)

Feb 17. Image analysis, part I (morphological processing, edge detection, feature extraction)

Feb 24. Image analysis, part II (segmentation, shape analysis, image registration)

Mar 03. Automating image analysis (programming within the ImageJ environment)

Mar 10. Advanced CV tools (object recognition, classification, tracking)