Biomedical Signal and Image Processing

4800-420:001, 4800-697:002, or 3450- 489:004.

The University of Akron, Fall Semester, 2008

Course Description and Text. This course concerns biomedical applications of signal and image processing. The textbook for this course is "Signals and Systems Analysis In Biomedical Engineering" by Robert Northrop, CRC press. We will also incorporate cutting edge articles published in the *IEEE Transactions on Biomedical Engineering*, *IEEE Engineering in Medicine and Biology Magazine*, and similar journals into the course. The software for this course is MATLAB, particularly the signal processing toolbox and the image processing toolbox. The website for this course is at *www3.uakron.edu/honors/biosignals.html*

Course instructor. Dr. Dale H. Mugler, Office: Honors Complex 178. Campus phone: (330) 972-5365; fax: (330) 972-5625; e-mail address: dmugler@uakron.edu; Office Hours prior to class (8:30-8:50 a.m.) and by appointment (call ext. 7966). Students are encouraged to contact the professor.

Topics.

Signal and image processing involve filtering, decimating, interpolating, sampling, reconstructing, transforming, convolving, performing statistical functions and many more types of operations, both to continuous signals or images as well as to discretized digital versions of signals or images. This course concentrates on these types of operations with particular regard for biomedical applications.

This course will include signal and image processing as applied to areas such as: basic electrocardiogram (ECG) analysis, the processing of signals from body sensors, motion artifacts in biomedical signals, identification of heart sounds, edge detection in images, finding hidden features in biomedical images, and more.

The course will include a review of Fourier analysis with particular regard for the discrete Fourier transform and its applications. Various methods used to compute the power spectral density will be discussed. Wavelet theory will also be introduced. Image processing methods, such as compression involving discrete cosine transforms, filtering to reduce blurring or artifacts, and jpeg standards will be included.

Assignments, policies, and grading procedures

Tests. There will be two midterm examinations, each worth 100 points. Exams will be given on October 8 and November 5.

Homework. Homework assignments will be given regularly. Due dates will be given and assignments will be given point value according to the difficulty of the assignment. Assignments will involve projects that involve Matlab applications. Points from homework assignments will accumulate in the combined total.

In-class presentations. Each student taking the course for graduate credit should choose a research paper from a current journal, in consultation with the professor. The list of chosen papers will be announced prior to the in-class presentations, and every student should review the paper prior to the presentation. Each graduate student should be the presenter of one cutting edge research paper during the term. The value of the work of the presenter is 25 points. Presenting more than one paper will earn bonus points.

Course project. Those students taking this course for graduate credit should write a term paper about some aspect of signal and image processing. The topic should be chosen and reported to the instructor prior to the second midterm. The value of the term project is 50 points.

Final exam. The final exam (2 hours) will be comprehensive but will emphasize topics covered after the last midterm. It will be worth 150 points. The final exam is during the week of December 8.

Withdrawal. No course withdrawals will be permitted any time past the twelfth week of class.