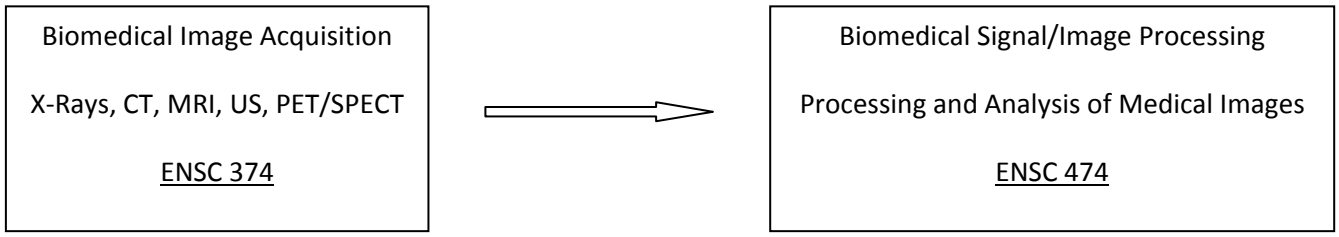
Spring 2008 - ENSC 474-4

Biomedical Signal and Image Processing (http://www.ensc.sfu.ca/courses/course-list/474)

Lecture: Monday 10:30-11:20 WMC 3510, Wednesday 9:30-11:20 WMC 3220

Introduction: This course develops signal processing techniques of wide applicability, presented in the context of processing and analysis of biomedical images. It forms a sequel to the course ENSC 374-4 Introduction to Biomedical Imaging, which covers acquisition of medical images. The subsequent visualization, processing and analysis tools applied to multidimensional signals such as 2D/3D medical images are covered in this course.



List of Topics:

1. Digital 3D Image representation and file formats – sampling and quantization, interpolation, storage formats, concepts in digital connectivity.

2. Introduction to software and libraries for Interacting with, and visualization of, medical images and scalar, vector and tensor fields - Paraview, Amira, ITK, VTK, BrainWorks etc..

3. Filtering, Noise removal and Image Enhancement techniques – Spatial domain filtering via convolution masks, Fourier domain filtering via design of frequency domain filters, image enhancement, restoration and constrained filtering, morphological filters.

4. Segmentation of Medical images – overview of the main concepts in segmentation via region growing, clustering, Level set methods, deformable curves/surfaces. Introduction to brain MR image segmentation using Freesurfer.

5. Registration of Medical images – landmark and image registration using low dimensional and high dimensional transformations. Applications to registration of brain and heart MR images.

6. Representing images/anatomical shapes - Fourier descriptors, statistical/shape moments, principal components.

Prerequisite: ENSC 380-4 Linear Systems and either ENSC 327-4 Communication Systems or ENSC 328-1 Random Processes in Engineering. Note that these prerequisites can be substituted with equivalent prior courses/background with approval from the instructor/department.

Course Text: The textbook for this course is Digital Image Processing, Third Edition by Rafael Gonzalez and Richard Woods. Notes will also be provided for topics that are not covered in the book, or, which may need additional reading material. The second edition of the DIP book can also be used.

Supplementary Reference books:

1. Fundamentals of Digital Image Processing by Anil Jain, Prentice Hall, ISBN 0133361659.
2. Digital Image Processing by Kenneth Castleman, Prentice Hall, ISBN 0132114674.
3. Handbook of Medical Imaging: Processing and Analysis (Biomedical Engineering), Academic Press, ISBN 0120777908.

Grading Policy:

35% Final, 25%Midterm, 30% Homework, 10% Final Project.

Assignments are to be electronically submitted on WebCT. Normally, there will be an assignment every Friday and will be due in one week. The final project is to be completed individually.