Bioengineering 508: Physical Aspects of Medical Imaging

(http://courses.washington.edu/bioen508)

Instructors:

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Text: Fundamentals of Medical Imaging, by Paul Suetens, $110.00 Publisher: Cambridge University Press; ISBN: 0521803624

Labs: Optional demonstrations of actual imaging devices will be arranged outside of regular class hours, to include MRI, X-ray CT, nuclear medicine, and ultrasound.

Grading: 40% course project, 20% home work assignments (4), 20% Exam 1, 20% Exam 2

Meeting Times and Locations: Wednesdays, 6:30-9:50 p.m., Sept. 27-Dec. 6, 2006
Bellevue at 2445 140th Ave. NE, in the Overlake area.

Lectures: 6:30 - 7:30 Lecture 1
7:40 - 8:40 Lecture 2
8:50 - 9:50 Lecture 3

Schedule:

Date	Subjects to be covered	Chapter	Instructor
Sep 27	Introduction to medical imaging and image quality. Mathematical preliminaries. Basic Image display and image processing	1,2,3	Alessio
Oct 4	X-ray physics. Projection radiography - part 1 Projection radiography - part 2	4	Schmitz
Oct 11	Computed Tomography Principles. X-ray CT - part 1 X-ray CT - part 2	5	Kinahan
Oct 18	Radiation physics. Nuclear medicine detectors Nuclear medicine systems	8	MacDonald
Oct 25	Tomographic nuclear systems SPECT Tomographic nuclear systems PET Hybrid imaging systems (PET/CT)	8	Kinahan
Nov 1	EXAM 1: Guest lecture		TBA
Nov 8	Ultrasound physics. Ultrasound imaging - part 1 Ultrasound imaging - part 2	7	Kinahan
Nov 15	MRI physics MRI Imaging - part 1 MRI Imaging - part 2	6	Kinahan
Nov 22	No Lecture - Thanksgiving break		
Nov 29	EXAM 2: Image quality Image-guided intervention	 9 10	Kinahan
Dec 6	ORAL PRESENTATION OF PROJECTS		Class members

Labs: Demonstrations of actual imaging devices will be arranged outside of regular class hours, to include MRI, X-ray CT, nuclear medicine, and ultrasound.

Lecture Notes: All powerpoint slides and homework solutions will be available at http://courses.washington.edu/bioen508/

BIOEN 508 Physical Aspects of Medical Imaging, Autumn Quarter 2006

Course Project

Work in groups. I will assign groups if you like.

Investigate a specific problem involving medical imaging and present your conclusions in a written report and 15 minute oral presentation (on Dec 8th). The investigation should have the following three components: 1) it should target a specific organ, disease, and/or other condition, 2) it should specify one or more of the imaging modalities discussed in class, and 3) it should define the objective behind the use of medical imaging. Examples of each of these components are:

Organ / Disease	Modality	Objective
Brain tumor	x-ray	Detection / diagnosis
Lung cancer, breast cancer, etc.	CT	Progression
Coronary artery disease	Nuclear medicine	Registration
Stroke	Ultrasound	Image guided surgery
Joint injuries	MRI	Segmentation

Your report should address these questions:

1. What is the problem being investigated and why is it important?
2. Why is the chosen modality or modalities the best choice to address the problem? This should be an argument based on the technical benefits (e.g. resolution, SNR, speed, etc.) of your choice as compared to other options.
3. How is the problem currently addressed using this modality? What image processing is required? Cite appropriate references from the literature.
4. What could be done to better address this problem in the future? What about the peripheral or support equipment? That is, if you were asked to improve the methodology, what avenues would you pursue first?

Some examples are:

Brain tumor / MRI / Progression – The goal is to measure changes in tumor size (progression) over time. This can be used to assess the response of the tumor to treatment. MRI provides good soft tissue definition necessary to identify tumor boundaries.

Liver disease / CT and ultrasound / Registration – The goal is to align the CT and ultrasound images (registration) so they can be displayed in a combined image. This can be useful in minimally invasive surgery where the ultrasound is used in real time to guide the surgeon and the CT provides high definition images of the anatomy.

Deadlines:

Nov 1:	Outline due	30% of mark for project
Nov 29:	Final report due	50% of mark for project
Dec 6:	Class presentation	20% of mark for project