

Biomedical Image Processing

Course Instructor: Wen-Pin Hu

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Office Hour: By appointment

Course description: This course is designed for the students who have basic programming skill and interest in the digital image processing technology. This course will provide introduction to educate students have a broad understanding in image processing technology. In this course, students need to learn the program writing skill with the Matlab language and use Matlab program to carry out image processing assignments. The course will combine examples and exercises in teaching, so that students can learn the theory and application of technology at the same time. Students need to complete several homework assignments and also have to submit the midterm and final reports. In the end of this course, students should learn the basic principles of medical images, the use of Matlab programming language, basic skills of analyzing images and the reconstruction of a 3D object from images.

Pre-requisite:

Graduate students are expected to have basic programming skills, and this course also welcome senior undergraduate students.

Required Textbook:

- [1] Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, "Digital Image Processing Using MATLAB", 2nd Ed., Gatesmark Publishing, 2009. (Required)
- [2] Alasdair McAndrew, "Introduction to Digital Image Processing with MATLAB", Thomson, 2004. (Optional)

Required Equipment: A laptop computer (with wireless internet capability)

Topics and Schedules:

Week	Topic	Hours	Type	Assignments
1	Introduction	3	Lecture	
2	Basic Concepts of Image Processing (1)	3	Lecture	
3	Basic Concepts of Image Processing (2)	3	Lecture & Exercise	
4	Basic introduction to Matlab programming language (1)	3	Lecture	Homework 1
5	Basic introduction to Matlab programming language (2)	3	Lecture & Exercise	
6	Image Enhancement	3	Lecture	Homework 2
7	Image Filtering (1)	3	Lecture	

8	Image Filtering (2)	3	Lecture	
		3		Midterm Project Report
9	Midterm Exam Week		Midterm Exam	
10	Image Segmentation (1)	3	Lecture	
11	Image Segmentation (2)	3	Lecture & Exercise	Homework 3
12	Edge Detection	3	Lecture	
13	Object Contours Detection	3	Lecture & Exercise	
14	image restoration (1)	3	Lecture	
15	image restoration (2)	3	Lecture & Exercise	Homework 4
16	3D Object Reconstruction (1)	3	Lecture	
17	3D Object Reconstruction (2)	3	Lecture	Homework 5
		3		Final Project Report
18	Final Exam Week		Final Exam	

Workload: There will be 5 homework submissions (6% each), 4 exercises (5% each), 2 project reports (25% each for midterm and final report).

For the project reports, students have to process the medical images according to the requirements. Present the results step by step, show the codes and images after processing at the same time. For the midterm and final project reports, the images are obtained from the mammography and the computed tomography screening for lung cancer, respectively. A sample list of works for processing mammographic image are given in the following:

1. To read and show the image, and present the histogram of image
2. Improving the quality of image (denoise, contrast, brightness, filtering etc.)
3. Resizing the image size in half (Matlab function is prohibited to directly use)
4. Presenting the image by using 64 gray colors (Matlab function is prohibited to use)
5. Convert the image to a binary image (Matlab function is prohibited to directly use)
6. Image decomposition using wavelet transform (Matlab function is prohibited to use)

Grading: Evaluation by Score

90~99 (equal to A)

80~89 (equal to B)

70~79 (equal to C)

Below 70 (equal to F)

Late Assignments: All homework assignments must be uploaded to the folder in the e-learning system at the end of the day of submission. Late assignment submissions will be penalized 30%. Besides, late submission for more than 5 days will not be accepted.

Course Policy: Every student need to finish the homework assignments and project by yourself. You can discuss with your classmates, but the codes of programs must be your own. Students also require to participate the exercises in the course.