Sabancı University
Faculty of Engineering and Natural Sciences

EE 563 - DIGITAL IMAGE PROCESSING

Spring 2012-2013
Information Sheet

Lecturer : Müjdat Çetin, mcetin@sabanciuniv.edu,
Room: MDBF 1107, Phone: x9594

Textbook : *Digital Image Processing*, Rafael C. Gonzalez and Richard E. Woods
Upper Saddle River, NJ, Pearson Education, 2008. ISBN: 013168728X
(On reserve in the information center.)

Reference texts :1)*Fundamentals of Digital Image Processing*, Anil K. Jain.
Englewood Cliffs, NJ : Prentice Hall, 1989. ISBN: 0133361659
2)*Digital Image Processing*, Kenneth R. Castleman
Englewood Cliffs, N.J. : Prentice Hall, 1996. ISBN: 0132114674
3)*Digital Image Processing*, Bernd Jähne
Berlin ; New York : Springer, 2002. ISBN: 3540677542
4)*Multidimensional Signal, Image, and Video Processing and Coding*, John W. Woods
Elsevier, 2006. ISBN: 0120885166
5)*Image Processing: Analysis and Machine Vision*, Milan Sonka, Vaclav Hlavac, Roger Boyle
Thomson-Engineering; 2nd edition, 1998. ISBN: 053495393X

Lecture hours : Thursday, 9:40-12:30, FASS 1102
(Session 1: 9:40-10:55, Session 2: 11:15-12:30)

Office hours : TBD

Course Objectives : This is an entry-level graduate course whose objective is to provide: (1) a unified picture of the fundamental problems in imaging science, (2) basic understanding of the existing theory and techniques to solve these problems, (3) practical experience in implementing such solutions, and (4) vision and creativity to solve open scientific and technical problems in image processing. The course will not focus on a particular modality but will consider applications including computed tomography, magnetic resonance imaging, radar imaging, astronomical imaging, ultrasound imaging, as well as imaging in the visible band.

Prerequisites : Signals and systems, linear algebra, basic probability, programming in MATLAB

Grading Policy : Homeworks 30%
Midterm 30%
Project 40%
[Note that your level of participation in the course may also affect your grade, particularly if your preliminary grade falls near a borderline.]

Homeworks
There will be roughly biweekly homework assignments, which will include some implementation exercises in MATLAB as well. In evaluating each of your homeworks, I will try to determine which of the following four categories it falls into: 1) Little evidence of any original thought or work, 2) Some attempt, but with significant gaps, 3) Good effort, but with some deficiencies in understanding, 4) Solid effort, demonstrating good understanding. It is OK to have some collaboration on the homeworks with your classmates. However you must write your solutions independently, and all participants must be involved in all aspects of the joint work (hence you cannot just work on part of the homework or part of a problem in the homework and copy your friend's solution for another part). In addition, at the top of your homework you must write the name of the people you have collaborated with, and specify which problems you have collaborated on. We also encourage discussion with the instructor about the homeworks during office hours. We will not accept any late homeworks (except for the most compelling reasons), because we believe that the habit of late submissions can make it difficult for the students to keep up with the course and cause them to fall behind.

Project
Each student needs to complete a research project. If you are already involved in thesis work, I would ideally like this project effort not to be completely disconnected from your own work, but rather to be something that could be useful for your thesis as well. However, that might not be possible for everyone, and that's OK too. I would like you to propose a topic for your project, but if you cannot decide on a topic yourself, I would be happy to help you identify one. I will send out some guidelines on choosing project topics later. You need to submit (through SUCourse) a **one-page project proposal by March 18**. (Note that if you do not have a topic in mind you need to contact me earlier, so that we can work towards identifying a topic by the proposal deadline.) I will give you feedback on the proposal, in which I may accept the proposal as is, or suggest major or minor revisions. You also need to prepare and submit a **two-page progress report by April 29** (text should fit in two pages, but you can add as many images as you want on additional pages). Every student will give a **20-minute presentation** of the project at the end of the semester, and also prepare a **written final report** (no page limits). You need to submit the final report electronically (through SUCourse). The due date of the final report will be announced later. You also need to submit electronic copies of your presentation material. In lieu of a report, you may choose to write a conference paper based on your project work to be submitted to a national or international conference (if you are thinking about doing that, please talk to me as early as possible). Your project grade will be composed of the following components:
Originality and creativity 20%; Technical quality 25%; Clarity of written report 25%;
Clarity of presentation 20%; Progress report 10%

Midterm
The midterm will consist of a take-home part (70%) and an in-class part (30%).

SUCourse
We intend to use SUCourse to distribute problem sets and their solutions, and as a communication medium among all of us. If you have any problems accessing the course material on SUCourse, please let us (or IT) know as soon as possible so we can have such problems fixed.

Topics and (Rough) Schedule:

- Introduction (Modalities and application areas, Electromagnetic spectrum, Fundamental tasks: acquisition, processing, interpretation) (*Portions of Chapters 1&2*) (Lecture 1) [**Feb. 14**]
- Review and 2-D Mathematical Preliminaries (*Portions of Chapters 2&4*) (Lectures 2-3) [**Feb. 21,28**]
- Modeling, Representation, and Description of Images (*Portions of Chapters 4& 11*) (Lecture 4) [**March 7**]
- Image Enhancement (*Portions of Chapters 3&4*) (Lectures 5-6) [**March 14,21**]
- PROJECT PROPOSALS DUE [**March 18**]
- Image Restoration and Reconstruction (*Portions of Chapter 5*) (Lectures 7-8) [**March 28; April 11**]
- SEMESTER BREAK [**April 1-7**]. No lecture on **April 4**.
- Image Segmentation (*Portions of Chapter 10*) (Lectures 9-10) [**April 18; May 2**]
- No lecture on **April 25**. I will be away for a conference
- PROJECT PROGRESS REPORTS DUE [**April 29**]
- Image Compression (*Portions of Chapter 8*) (Lecture 11) [**May 9**]
- Pattern Recognition and Scene Interpretation (*Portions of Chapter 12*) (Lectures 12-13) [**May 16,23**]
- MIDTERM [**May 23-24**]
- PROJECT PRESENTATIONS [**end of May or beginning of June**]
- PROJECT REPORTS DUE [**beginning of June**]