ECE643 DIGITAL IMAGE PROCESSING (I)
COURSE OUTLINE

Yun Q. Shi

Course description:

Since 1964 the advent of large-scale digital computers and the space program have made digital image processing one of the most rapidly growing fields in electrical engineering. Now image processing has found much more wide applications not only in the space program, but also in the areas such as medicine, biology, industrial automation, astronomy, law enforcement, defense, intelligence. With the progress made in multimedia these days, digital image processing finds more wide applications. It has become an indispensable part of our digital age.

This course is for the first year graduate and senior undergraduate students.

The needed background include: Introductory preparation in mathematical analysis, matrix theory, probability and random process, linear system and computer programming.

The topics to be covered are: 1. Digital image fundamentals: representation, sampling and quantization, image acquisition, basic relationships between pixels, imaging geometry; 2. Image transforms: discrete Fourier transform, discrete cosine transform, Walsh and Hadamard transforms, Hotelling transform; 3. Image enhancement: in spatial domain and in frequency domain, image smoothing and sharpening; 4. Image restoration: degradation models, inverse filter, Wiener filter; 5. Color and pseudo-color image processing; 6. Image segmentation: detection of discontinuities, thresholding, region-oriented segmentation, the use of motion analysis in segmentation.

Prerequisite:

ECE601 or equivalent

Text:

R. C. Gonzalez and E. E. Woods, < Digital Image Processing >, Prentice Hall, 3rd (2007) edition. (The 2nd (2001) edition is doable.)

References:

- A. Rosenfeld and A. C. Kak, < Digital Picture Processing >, Academic Press, 1982
- W. K. Pratt, <Digital Image Processing>, 3rd Edition, John Wiley & Sons, Inc., (2001).
- Y. Q. Shi and H. Sun, <Image and Video Compression>, CRC Press, 1st (1999) or 2nd (2008) edition

Weekly schedule:

- Week 1. Introduction (Chapter 1 and other supplementary material)
- Week 2. Chapter 2. Image Fundamentals
- Week 3 to Week 4. Chapter 3 Image Enhancement in Spatial Domain
- Week 5 to Week 6. Chapter 4 Image Enhancement in Frequency Domain
- Week 7 to Week 9. Chapter 5 Image Restoration
- Week 10 to Week 11. Chapter 6 Color Image Processing
- Week 12. Chapter 10 Image Segmentation
- Week 13 to Week 14. Course project presentation and discussion
- Week 15. Final exam

Computer assignments/Project presentation/Exam schedule:

Five computer assignments will be assigned during the course. The 1st one is due in Week 3.
Course project presentation in Weeks 13 and 14
Final exam Week 15

Course assessment criteria:

- If the fundamentals of digital image processing covered in this course have been understood.
- If the basic problem solving scheme including paper reading and programming has been mastered.

Grading policy:

1. Computer assignments:	40%
2. Course project:	20%
3. Final examination:	40%
4. Some homework will be assigned	0%

Computer assignments and course project can be done via team work (no more than 2 students per team).

Attendance:

Students missing three classes or more without legitimate reasons (as discussed in the class) will not be eligible to join quizzes and final exam.

NJ Honor Code Statement:

NJIT Honor Code will be upheld. Any violations will be brought to the immediate attention of the Dean of Students.

Instructor contact information:

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Office Hours: 4:00 – 5:00 pm (Thu)
4:00 - 5:00 pm (Fri)
Other slots by appointment