ECE-533 Digital Image Processing
Spring 2008

Goal:

To learn and practice key methods in modern digital image processing.

Catalog course description:

Fundamentals of 2D signals and systems. Introduction to multidimensional signal processing. Applications in digital image processing. Image formation, representation and display. Linear and nonlinear operators in multiple dimensions. Orthogonal transforms representation and display. Image analysis, enhancement, restoration and coding. Students will carry out image processing projects.

Prerequisites:

Knowledge in elementary linear systems, transforms, and probability and stochastic processes.

Instructor:

Professor Majeed M. Hayat,
Office: ECE Building, Room 323B; Tel: 277-0297;
E-mail: hayat@ece.unm.edu; Web: www.ece.unm.edu/faculty/hayat/main.htm

Classroom & time

Building: ECE; Room: 210; TR: 11:00–12:15

Office hours

M: 11:00–12:00 & W: 2:00–3:00.

Textbook and web utility:

Digital Image Processing, R. C. Gonzalez & R. E. Woods, 3rd Edition, 2008, Prentice Hall, required. (Available at the UNM Bookstore.)

Students are expected to visit the course website (which can be linked to from Prof. Hayat's website, see above for the url address) frequently for announcements, handouts, assignments, and solutions.

Key topics:

1. Introductory and motivating examples and demonstrations.
2. Signals and systems in two-dimensions.
3. Practicing image acquisition, formation and display.
4. Image sampling and quantization with application to focal-pane arrays.
5. Transforms in two-dimensions.
6. Some examples of visual perception.

7. Methods for image enhancement: point processing, spatial processing, histogram equalization, frequency domain methods.
8. Methods for image restoration: noise models (spatial vs. temporal noise models), deterministic filtering, statistical approaches, Wiener filtering, constrained least-mean-square approach.
9. Sub-sampling and interpolation schemes.
10. Methods for motion estimation and compensation (image stabilization).
11. Principles of resolution enhancement (microscanning).
12. Fundamentals of color.
13. Image segmentation.
14. Image compression: lossy and lossless, the JPEG standard.
15. Introduction to wavelets and multiresolution analysis (time permitting).
16. Image representation using principal components (time permitting).

Computer usage:

Assignments require the use of Matlab including the signal-processing and image-processing toolboxes.

Course requirements

- 40% Homework assignments & projects.
- 25% One in-class midterm examination.
- 35% Final examination.

Tentative grading policy

90 or above: A
75–89: B
60–74: C
59 or below: F

References

Each chapter of the text has an excellent list of relevant references.

Additional reading materials (notes and journal articles) will be distributed during the course; students are required to study these.

Academic honesty

All students are expected to demonstrate personal integrity. Although discussions and interaction among students regarding homework assignments are strongly encouraged, each student *must show his/her individual effort*. Exchange of information during in-class or take-home examinations as well as copying homework/project solutions from each other is strictly prohibited. Students exhibiting any form of academic dishonesty will be subjected to penalties in accordance with UNM policies.