CS 474/674 Image Processing and Interpretation

Fall 2011 – Dr. George Bebis

Catalog Description: Image files, thresholding, histogram transformation, spectra, connectedness, edges, filtering, detection and recognition of objects, optical character recognition.

Prerequisites: CS202 and MATH/STAT 352. If you do not meet the prerequisite requirements for this course, you should see me immediately. *Credit hours:* 3.0

Meets: TR 4:00-5:15 PM (SEM 257)

Instructor: Dr.George Bebis

Office: 235 SEM

Phone: 784-6463

E-mail: bebis@cse.unr.edu

Course Webpage: http://www.cse.unr.edu/~bebis/CS474

Office Hours: TR 2:20 pm - 3:50 pm or by appointment

Required Text:

Digital Image Processing by R. Gonzalez and R. Woods, 3rd edition, Prentice Hall, 2008 (ISBN 9780131687288).

Optional Texts:

Digital Image Processing, by W. Pratt, 3rd edition, John Wiley, 2001.

Image Processing: The Fundamentals, by M. Petrou and P. Bosdogianni, John Wiley, 1999.

Fundamentals of Digital Image Processing, by A.Jain, Prentice Hall, 1989.

Digital Image Processing, by K. Castleman, Prentice Hall, 1996.

Computer Vision and Image Processing: A Practical Approach Using CVIPtools , by S. Umbaugh, Prentice Hall, 1998.

Objectives

Digital image processing is among the fastest growing computer technologies. With increasing computer power, it is now possible to do numerically many tasks that were previously done using analogue techniques. The objective of this course is to provide an introduction to the theory and applications of digital image processing.

Course Outline (tentative)

- Introduction
- Digital Image Fundamentals
- Intensity Transformations and Spatial Filtering
- Filtering in the Frequency Domain
- Image Restoration
- Wavelets and Multi-resolution Processing
- Image Compression
- Morphological Image Processing
- Image Segmentation
- Representation and Description
- Applications

Exams and Assignments

Grading will be based on two exams and 5-6 programming assignments. Details are provided below:

- Homework problems will be assigned on a regular basis but will NOT be collected for grading. Homework solutions will be made available for each assignment.

- There will be 2 exams: a midterm and a final. The material covered in the exams will be drawn from the lectures and the homework.

- There will be 5-6 programming assignments which will be done on an individual basis. For each programming assignment, you are to turn in a brief report which should include a description of the problem, a description of your approach, and your evaluation of the results. Details of the deliverables will be given for each assignment respectively.

Course Policies

- Lecture slides, assignments, and other useful information will be posted on the course web page.

- Graduate students will be required to do extra work.

- Discussion of the programming assignments is allowed and encouraged. However, each student should do his/her own work. **Assignments which are too similar will receive a zero.**

- **No** late programming assignments will be accepted unless there is an extreme emergency. If you are unable to hand in an assignment by the deadline, you must discuss it with me **before** the deadline.

- Both exams will be closed books, closed notes. If you are unable to attend an exam you must inform me in advance. Exams cannot be made up unless there is an extreme emergency.

- No incomplete grades (INC) will be given in this course and a missed exam may be made up only if it was missed due to an extreme emergency.

- Regular attendance is highly recommended. If you miss a class, you are responsible for all material covered or assigned in class.

- You should carefully read the section on Academic Dishonesty found in the UNR Student Handbook (copies of this section are available from http://www.unr.edu/stsv/acdispol.html) Your continued enrollment in this course implies that you have read it, and that you subscribe to the principles stated therein.

Useful Tips

Since the material in this course is highly integrated, a limited understanding of one topic will have a serious effect on the understanding of subsequent topics. You should expect to spend many hours on this course outside the classroom. Do not expect to fully understand the material covered in this class if you do not spend many hours in front of your computer.

Don't get behind in the programming assignments. Probably the main reason for students doing poorly in this course is getting behind in the assignments and never recovering. Design and implement in a top-down, modular fashion. Get something working that has the skeleton structure of what you need and then add features to it. Each time you add a feature, test it and make sure everything is still working. It can be tough to debug big programs if all you know is that the output is wrong and you are not sure anyone module is working. In addition, partial credit will be given for a program which at least partially works while it is very difficult to give credit for a program which may have many features but is not doing anything correctly.

Disability Statement

Any student with a disability needing academic accommodations is requested to

speak with me or contact the Disability Resource Center (Thompson Building, Suite 101), as soon as possible to arrange for appropriate accommodations.

Grading Scheme

Midterm Exam: 30%

Final Exam: 30%

Prog. Assign: 40%

A 90 and above

B 80-89

C 70-79

D 60-69

F<59

Important dates

10/20/2011 – Midterm exam

10/27/2011 – Final Day to Drop Classes

11/24/2011 – Thanksgiving Day (no classes)

12/14/2011 – Prep Day

12/15/2011 - Final exam (5pm – 7pm)

Course Assessment Matrix

CS 474 Image Processing and Interpretation

Program Outcomes	Course Outcomes	Assessment Methods/Metrics	CSE Program Objectives Impacted
1	Students demonstrate a thorough understanding of fundamental concepts in image processing (image filtering, enhancement, restoration, and compression).	Examinations and programming assignments	1, 2
3	Students are familiar with methods used in various image processing applications – e.g., Fourier transform, Wavelets.	Programming assignments.	3
4	Students acquire an understanding of team dynamics by allowing them to work together on certain programming assignments.	Specific programming assignments.	2, 3
5	Students are better prepared to analyze a problem and assess the strengths and weaknesses of different methods and techniques for solving it.	Specific exam questions and specific programming assignments.	1, 4
12	Students are better prepared to apply mathematical concepts, algorithms, and programming concepts to design effective image processing algorithms.	Specific exam questions and programming assignments.	3

Program Outcomes:

Our graduates will have achieved:

1. an ability to apply knowledge of computing, mathematics, science, and engineering.
2. an ability to design and conduct experiments, as well as to analyze and interpret data.
3. an ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs, within realistic constraints specific to the field.
4. an ability to function effectively on multi-disciplinary teams.
5. an ability to analyze a problem, and identify, formulate and use the appropriate computing and engineering requirements for obtaining its solution.
6. an understanding of professional, ethical, legal, security and social issues and responsibilities.
7. an ability to communicate effectively with a range of audiences.
8. the broad education necessary to analyze the local and global impact of computing and engineering solutions on individuals, organizations, and society.
9. a recognition of the need for, and an ability to engage in continuing professional development and life-long learning.
10. a knowledge of contemporary issues.
11. an ability to use current techniques, skills, and tools necessary for computing and engineering practice.
12. an ability to apply mathematical foundations, algorithmic principles, and computer science and engineering theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
13. an ability to apply design and development principles in the construction of software systems or computer systems of varying complexity.

Computer Science & Engineering Program Objectives:

Within 3 to 5 years of graduation our graduates will:

1. be employed as computer science and engineering professionals beyond entry level positions or be making satisfactory progress in graduate programs.
2. have peer-recognized expertise together with the ability to articulate that expertise as computer science and engineering professionals.
3. apply good analytic, design, and implementation skills required to formulate and solve computer science and engineering problems.
4. demonstrate that they can function, communicate, collaborate and continue to learn effectively as ethically and socially responsible computer science or computer engineering professionals.