CS 474/674 Image Processing and Interpretation

Fall 2018 – 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: MW 1:00pm – 2:15pm (SEM 261)

Instructor: Dr. George Bebis

- **Office:** 235 SEM
- **Phone:** (775) 784-6463
- **E-mail:** bebis@cse.unr.edu
- **Course Webpage:** http://www.cse.unr.edu/~bebis/CS474
- **Office Hours:** MW 10:30am - 12:00pm and by appointment

Assistant (Programming Assignments): Ebrahim Emami

- **Office:** 314 LME
- **E-mail:** ebrahim.emamig@gmail.com
- **Office Hours:** TR 2:00pm - 4:00pm and by appointment

Required Text:

Digital Image Processing by R. Gonzalez and R. Woods, 4th edition, Pearson, 2018.

Optional Texts:

Image Processing, Analysis and Machine Vision, by M. Sonka, V. Hlavac, and R. Boyle, Cengage Learning, 2015.

Image Processing and Analysis, by S. Birchfield, Cengage Learning, 2018.

Digital Image Processing and Analysis, by S. Umbaugh, CRC Press, 2011.

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. This course will provide an introduction to the theory and applications of digital image processing.

Course Outline (tentative)

- Introduction
- Intensity Transformations
- Geometric Transformations
- Spatial Filtering
- Fourier Transform
- Convolution
- Frequency Domain Filtering
- Sampling
- Image Restoration
- Short-Time Fourier Transform
- Multi-resolution Analysis
- Wavelets
- Image Compression
- Applications

Student learning Outcomes

- **(SLO1)** Identify, formulate, analyze, and solve complex computing or engineering problems by applying principles of computing, engineering, science, and mathematics.
- **(SLO2)** Design, implement, and evaluate a computing or engineering solution to meet a given set of requirements, with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- **(SLO5)** Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline, creating a collaborative and inclusive environment, establishing goals, planning tasks, and meeting objectives.

Exams and Assignments

Grading will be based on quizzes, exams, programming assignments, and presentations (graduate students only). Details are provided below:

- Homework will be assigned but it will **NOT** be collected for grading. Solutions will be made available for each homework for students to practice.

- There will be several quizzes during the semester which will be announced at least one class period in advance.

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

- There will be 4-5 programming assignments which should be done in groups of two students.

- Graduate students will be required to present a paper to the rest of the class. Each presentation should be 20 minutes long and professional as if it was presented in a formal conference (i.e., slides/projector).The instructor will provide potential topics for presentation but students are also welcome to propose their own topics (subject to instructor's approval).

Course Policies

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

- 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.**

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

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

- 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.

- Students are expected to attend, and be on time, for every class. This demonstrates professionalism and consideration for your fellow students and your Instructor. Students who miss class and/or are late for class may experience an impact on their grade by missing classroom activities and/or quizzes. If you miss a class, you are responsible for all material covered or assigned in class.

- Students are expected to demonstrate professionalism and courtesy by either silencing or turning off all cell phones and/or other alarm or audible indicator devices.

- The Instructor reserves the right to add to, and/or modify any of the above policies as needed to maintain an appropriate and effective educational atmosphere in the classroom. If this happens, all students will be notified in advance of implementation of the new and/or modified policy.

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.

Academic Dishonesty

Cheating, plagiarism or otherwise obtaining grades under false pretenses constitute academic dishonesty according to the code of this university. Academic dishonesty will not be tolerated and penalties can include filing a final grade of "F"; reducing the student's final course grade one or two full grade points; awarding a failing mark on the coursework in question; or requiring the student to retake or resubmit the coursework. For more details, see the University Academic Standards policy: UAM 6,502

Disability Services

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.

Academic Success Services

Your student fees cover usage of the Math Center (784-443 or www.unr.edu/mathcenter/), Tutoring Center (784-6801 or www.unr.edu/tutoring/), and University Writing Center (784-6030 or http://www.unr.edu/writing_center/). These centers support your classroom learning; it is your responsibility to take advantage of their services. Keep in mind that seeking help outside of class is the sign a responsible and successful student.

Please note that the Math Center is focused on helping students with mathematical and statistical concepts. While mathematics is used extensively in engineering, the Math Center does not have the resources to help students with engineering courses. Engineering students are encouraged to use the Math Center for help in their math classes, and they are welcome to use its computer lab and study area any time –regardless of course. However, Math Center tutors cannot answer questions regarding engineering courses.

Audio and Video Recording

Surreptitious or covert video-taping of class or unauthorized audio recording of class is prohibited by law and by Board of Regents policy. This class may be videotaped or audio recorded only with the written permission of the instructor. In order to accommodate students with disabilities, some students may have been given permission to record class lectures and discussions. Therefore, students should understand that their comments during class may be recorded.

Safe Learning Environment

UNR is committed to providing a safe learning and work environment for all. If you believe you have experienced discrimination, sexual harassment, sexual assault, domestic/dating violence, or stalking, whether on or off campus, or need information related to immigration concerns, please contact the University's Equal Opportunity & Title IX Office at 775-784-1547. Resources and interim measures are available to assist you. For more information, please visit: http://www.unr.edu/equalopportunity-title-ix

Grading Scheme

Quizzes: 10%

Midterm Exam: 25%

Final Exam: 25%

Prog. Assign: 40%

Presentation: 10% (grad students only)

A	90 and above
B	80-89
C	70-79
D	60-69
F	<59

Important dates

9/3/2018 – Labor Day (no class)

10/17/2018 – Midterm exam

11/1/2018 – Final Day to Drop a Class

11/12/2018 – Veterans Day (no class)

12/12/2018 – Prep Day

12/17/2018 - Final exam (9:50am – 11:50am)