CS 474/674 Image Processing and Interpretation

Fall 2023 – Dr. George Bebis

Catalog Description: image files, thresholding, histograms, convolution, edge detection, segmentation, frequency domain filtering, morphology, registration, combining images.

Prerequisites: CS 202 with a "C" or better; STAT 352 or STAT 461.

Credit hours: 3.0

Meets: MW 1:00pm – 2:15pm (WPEB 200)

Instructor: Dr. George Bebis

- **Office:** 411 WPEB

- **E-mail:** bebis@unr.edu

- **Office Hours:** Monday/Wednesday 3:45pm – 4:45pm or by appointment

TA: Aminul Huq

- **Office:** 414 WPEB (Computer Vision Lab)

- **E-mail:** aminul.huq@nevada.unr.edu

- **Office Hours:** Tuesday/Thursday 3:30pm – 5:00pm or 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. This course will provide an introduction to the theory and applications of digital image processing. In particular, this course will introduce students to the fundamental techniques and algorithms used for processing and extracting useful information from digital images.

Course Outline (tentative)

- Introduction
- Intensity & Geometric Transformations
- Spatial Filtering & Convolution
- Fourier Transform & Frequency Domain Filtering
- Sampling and Aliasing
- Image Restoration
- Image Compression
- Short-Time Fourier Transform
- Multi-resolution Representations & Wavelets (if time permits)

Student learning Outcomes (ABET)

- **(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.

Grading will be based on **quizzes**, **exams**, and **programming assignments**. Graduate students will also need to **present** a paper.

- There will be 7 quizzes during the semester which will be announced at least one class period in advance. The **lowest** quiz grade will be dropped.

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

- There will be 4 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 **15 minutes** long and presented in a professional manner

(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's web page.

- Quizzes and exams will be closed books, closed notes. If you are unable to take a quiz or exam at the designated date and time, you must inform me in advance. Quizzes and exams **cannot** be made up unless there is an extreme emergency.

- Programming assignments need to be submitted on **Canvas**.

- 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 on 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 all lectures and be on time. Students who miss a class and/or are late for a class may experience an impact on their grade by missing course activities. If you miss a lecture, **you are responsible** for all material covered or assigned.

- 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. If this happens, all students will be notified in advance of implementation of the new and/or modified policy.

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. The University Academic Standards Policy defines academic dishonesty, and mandates specific sanctions

for violations. See the University Academic Standards policy: UAM 6,502.

Disability Services

Any student with a disability needing academic adjustments or accommodations is requested to speak with the Disability Resource Center (Pennington Student Achievement Center, Suite 230) 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 be 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

COVID-19 Training Policies

Students must complete and follow all guidelines as stated in the Student COVID-19 Training modules, or any other trainings or directives provided by the University.

COVID-19 Face Coverings

In response to COVID-19, and in alignment with State of Nevada Governor Executive Orders, Roadmap to Recovery for Nevada plans, Nevada System of Higher Education directives, the University of Nevada President directives, and local, state, and national health official guidelines face coverings are required at all times while on campus, except when alone in a private office. This includes the classroom, laboratory, studio, creative space, or any type of in-person instructional activity, and public spaces.

A "face covering" is defined as a "covering that fully covers a person's nose and mouth, including without limitation, cloth face mask, surgical mask, towels, scarves, and bandanas" (State of Nevada Emergency Directive 024).

Students that cannot wear a face covering due to a medical condition or disability, or who are unable to remove a mask without assistance may seek accommodation through the Disability Resource Center.

COVID-19 Social Distancing

Face coverings are not a substitute for social distancing. Students shall observe current social distancing guidelines where possible in accordance with the Phase we are in while in the classroom, laboratory, studio, creative space (hereafter referred to as instructional space) setting and in public spaces. Students should avoid congregating around instructional space entrances before or after class sessions. If the instructional space has designated entrance and exit doors students are required to use them. Students should exit the instructional space immediately after the end of instruction to help ensure social distancing and allow for the persons attending the next scheduled class session to enter.

COVID-19 Disinfecting Your Learning Space

Disinfecting supplies are provided for you to disinfect your learning space. You may also use your own disinfecting supplies.

COVID-19, COVID-19 Like Symptoms, and Contact with Someone Testing Positive for COVID-19

Students must conduct daily health checks in accordance with CDC guidelines. Students testing positive for COVID 19, exhibiting COVID 19 symptoms or who have been in direct contact with someone testing positive for COVID 19 will not be allowed to attend in-person instructional activities and must leave the venue immediately. Students should contact the Student Health Center or their health care provider to receive care and who can provide the latest direction on quarantine and self-isolation. Contact your instructor immediately to make instructional and learning arrangements.

Failure to Comply with Policy (including as outlined in this Syllabus) or Directives of a University Employee

In accordance with section 6,502 of the University Administrative Manual, a student may receive academic and disciplinary sanctions for failure to comply with policy, including this syllabus, for failure to comply with the directions of a University Official, for disruptive behavior in the classroom, or any other prohibited action. "Disruptive behavior" is defined in part as behavior, including but not limited to failure to follow course, laboratory or safety rules, or endangering the health of others. A student may be dropped from class at any time for misconduct or disruptive behavior in the classroom upon recommendation of the instructor and with approval of the college dean. A student may also receive disciplinary sanctions through the Office of Student Conduct for misconduct or disruptive behavior, including endangering the health of others, in the classroom. The student shall not receive a refund for course fees or tuition.

Quizzes: 20%

Midterm Exam: 20%

Final Exam: 20%

Prog. Assign: 40%

Presentation: 10% (grad students only)

A	>=90
B	[80-90)
C	[70-80)
D	[60-70)
F	<60

Important dates

9/4/2023 – Labor Day (no class)
10/16 & 10/18 – ISVC'23 (no class)
10/25/2023 – Midterm exam
11/1/2023 – Final day to drop classes and receive a "W"
12/13/2023 – Prep Day
12/18/2023 - Final exam (12:45pm – 2:45pm)