CS 474/674 Image Processing and Interpretation

Fall 2024 – 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.

Meets: MW 1:00pm – 2:15pm (WPEB 200)

Instructor: Dr. George Bebis

- **Office:** 411 WPEB
- **E-mail:** bebis@unr.edu
- **Office Hours:** Monday/Wednesday 2:30pm – 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

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

- Introduction
- Intensity & Geometric Transformations
- Spatial Filtering & Convolution

- Fourier Transform
- Frequency Domain Filtering
- Sampling and Aliasing
- Image Restoration
- Image Compression
- 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

- 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 individually.
- 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).

Material Subject to Change

Course material, topics, schedule, assignments, and content are subject to change.

Course Policies

- Lecture slides, assignments, and other useful information will be posted on the course's web page (not on Canvas!).

- 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 must be submitted on **Canvas**. If you have any problems with submitting your work on Canvas, email it to me as close to the deadline as possible.

- 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.

- As per the University Administrative Manual (3,020), students are expected to attend classes in which they are enrolled. 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.

Compliance with University Policies

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.

Generative AI use is NOT allowed for any purpose

For the purposes of this course, any and all uses of generative artificial intelligence (AI)/large language model tools (such as ChatGPT, DALL-E, Gemini, Microsoft Copilot, etc.) will be considered a violation of the UNR Academic Integrity Policy (UAM 6,502), specifically the prohibition against cheating or submitting work that is not your own. This applies to all assessments in the course, including case studies, written assignments, discussions, quizzes, exams, and problem sets.

The following actions are prohibited:

- Submitting any part or all of an assignment statement or test questions as part of a prompt to a large language model AI tool.
- Incorporating any part of an AI-written response into a submitted assignment or assignment component.
- Using AI to summarize or contextualize reading assignments or source materials.
- Submitting your own work for this class to a large language model AI tool for iteration or improvement.

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.

Audio and Video Recording

Student-created Recordings

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.

Instructor-created Recordings

Class sessions may be audio-visually recorded for students in the class to review and for enrolled students who are unable to attend live to view. Students who participate with their camera on or who use a profile image are consenting to have their video or image recorded. If you do not consent to have your profile or video image recorded, keep your camera off and do not use a profile image. Students who un-mute during class and participate orally are consenting to have their voices recorded. If you do not consent to have your voice recorded during class, keep your mute button activated and only communicate by using the "chat" feature, which allows you to type questions and comments live.

Maintaining a Safe Learning Environment

The University of Nevada, Reno 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 the Equal Opportunity and Title IX page.

Campus Closures or Delays

In the event of class cancelations or delays caused by inclement weather conditions, fire/smoke conditions, or other unforeseen emergencies, the safety and well-being of students are the University's top priority. Official notifications will be disseminated through the University website and other official channels with details related to any campus delays or closures. In the event of a campus closure, you will be informed as to whether the class will be offered remotely or if it will be canceled. If the class is cancelled, you will receive information on how to address any missed course content. Students facing significant impacts due to these events are encouraged to communicate with their instructor for potential 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.

Grading

Quizzes: 10%

Midterm Exam: 20%

Final Exam: 20%

Prog. Assign: 50%

Presentation: 10% (grad students only)

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

Important dates

9/2 – Labor Day (no class)

10/21 & 10/23 – ISVC'24 (no class)

10/28 – Midterm exam

10/30 – Final day to drop classes and receive a "W"

12/11 – Prep Day

12/16 - Final exam (12:45pm – 2:45pm)