CS 791 Topics: Mass Detection in Mammograms
Fall 2023

Prerequisites: Background in the following areas would be very useful: image processing, computer vision, pattern recognition, machine learning, and deep learning. Knowledge or desire to quickly learn Jupyter Notebook and Python is required. Familiarity with Keras/Tensorflow or Pytorch would be a plus.

Credit hours: 3.0

Meets: MW 2:30PM - 3:45PM (WPEB 200)

Course Webpage: http://www.cse.unr.edu/~bebis/CS791/Fall2023

Instructors: Drs. George Bebis and Alireza Tavakkoli

Offices: WPEB 411 (Dr. Bebis), WPEB 417 (Dr. Tavakkoli)

E-mails: bebis@unr.edu tavakkol@unr.edu

Office Hours (Non-programming related questions): MW 3:45pm – 4:45pm or by appointment (Dr Bebis)

Assistant: Prithul Sarker

Office: Human-Machine Perception Lab

E-mail: prithulsarker@nevada.unr.edu

Office Hours (Programming related questions): By appointment

Required Text:

We will not use any text in this course; most of the material will be drawn from research papers. You might find helpful the following texts:

- *Pattern Classification*, by Duda, Hart, and Stork, 2nd edition, John Wiley Inter-science, 2001.
- *Machine Learning: A probabilistic Perspective,* by K. Murphy, MIT Press, 2012.
- *Deep Learning,* by Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016. (available online at https://www.deeplearningbook.org/)

- *Introduction to Deep Learning: From Logical Calculus to Artificial Intelligence,* by Sandro Skansi, Springer, 2018 (available on Canvas, under "Pages")

- *Neural Networks and Deep Learning: A Textbook,* by Charu Aggarwal, Springer, 2018 (available on Canvas, under "Pages")

- *Deep Learning With Python (2nd edition),* by Francois Chollet, Manning, 2021 (available on Canvas, under "Pages")

- *Computer Vision: Algorithms and Applications,* by Richard Szeliski, Springer, 2011 (available on Canvas, under "Pages")

Objectives

The course will focus on the problem of mass detection and classification in mammograms and possibly other modalities such as Ultrasound, MRI, CT and PET. The goal is to expose students to some of the main **problems** involved in this research area and to recent **methods** developed by the research community to address these problems. The course is primarily intended for **highly motivated** students who are interested in applying pattern recognition, machine learning and deep learning techniques to a **practical** problem of **tremendous** importance. It will provide opportunities for students to choose a topic for a **MS thesis** or **PhD dissertation** and can lead to a **conference** and/or a **journal publication**.

Course Schedule: will be posted on the course's webpage.

Student Learning Outcome (SLO)

Graduate Students will have: an ability to apply engineering and computer science research and theory to advance the art, science, and practice of the discipline.

Course Requirements

There will be no exams in this course. Grading will be based on paper presentations, class participation, and a semester-long project. Students would be required to work in teams (i.e., two students per team) to complete their paper presentations and project.

Paper Presentations

Each team would be required to present **three** papers to the rest of the class. A list of papers for possible presentation will be posted on the course's webpage. Ideally, each team should choose to present papers related to their project topic. Students who might be interested in presenting a **different** paper (i.e., not in the list to be provided) are encouraged to discuss this with the instructors. Each presentation should be **30 minutes** long (time should be equally divided between team members, i.e., 15 minutes/member).

We plan to have two presentations per class period with 15 minutes left for questions and discussion. The presentation of the material should be **professional** as if it was presented in a formal conference. Teams are required to email their slides to Dr Bebis at bebis@unr.edu by **11am** on the day of their presentation to be posted on the course's webpage.

Class Participation

The students who are responsible for presenting a paper are expected to have a **thorough understanding** of the ideas discussed in the paper. Everyone else should read the paper before class and **contribute** to the class discussion.

Course Project

See "Project Guidelines" and "Project Topics" for details.

Policies

- Lecture/Presentation slides and other useful information will be posted on the course's web page.
- All reports should be submitted on **Canvas**.
- Discussion of your work with others is allowed and encouraged. However, each team should do their own work.
- **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 us **before** the deadline.
- **No incomplete** grades (INC) will be given on this course.
- 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 instructors **reserve** 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 of 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 videotaping 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. 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 training 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 always required 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.

Grading Scheme

Class Participation: **5%**

Presentations: **45%** (15% per presentation)

Project Reports: **50%** (Project Topic Report: 5%, Project Proposal Report: 10%, Interim Report: 15%, Final Report: 20%)

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 – Reserved for final project presentations (3:00pm – 5:00pm)