ENGR 4350: Applied Deep Learning (CRN26135)
Fall, 2022

Instructor

Name: Lin Zhang
Office: LSC110
Office Hours: Monday 10:00 AM – 12:00 PM *Look for me in LSC013 or LSCA105 if not in office.*
Telephone: 501-450-5904
Email: lzhang12@uca.edu
Webpage: https://uca.edu/physics/facultystaff/lin-zhang-phd/

Class

Time: Monday & Wednesday, 1:00 PM–2:15 PM
Location: Conway Corp Center for Science (CCCS) 105
Course Materials: https://linzhanguca.github.io/applied_deep_learning-2022

All students are expected to comply with the University policy regarding face coverings. UCA's Coronavirus page for students can be found here: https://uca.edu/coronavirus/. Students having any symptom of COVID-19 should stay at home and report to your healthcare provider. Check CDC with the most updated information of COVID-19. https://www.cdc.gov/coronavirus/2019-ncov

Overview

Course Description

This course introduces the foundational concepts of neural networks and deep learning. Students will understand capabilities, challenges and consequences of deep learning. Students will be introduced to practical algorithms and techniques involved in the development of deep learning. This course provides both lectures and labs for students to get a deeper inception and to practice their skills. Students will work independently in each lab, but communications and discussions are highly encouraged. See **Course Contents** section for more details.

Prerequisites

No courses nor skills are required in advance. Though, **MATH1496 Calculus I** can be very helpful. Python programming language is another useful tool.

Textbooks

No textbooks is required. Deep Learning by Ian Goodfellow is a good source to get a better understand on this course though.

Classroom Policy

The instructor and the students are expected to appear in the classroom/lab in every class. If any student cannot show up on time, he/she needs to contact the instructor in advance. The instructor will notify the students with any changes of a class in advance. No food nor drinks are allowed in the classroom/lab.

The Department of Physics and Astronomy provides computers for students to use in the classroom. Students cannot take any classroom belongings out without a permission from the instructor.

Grading

A's are 90-100%, B's are 80-89%, C's are 65-79%, D's are 64-50%, F's are 0-49%. The final grade will be determined by following criteria.

Component	Percentage	Requirement/Format
Attendance	1%	Attend every single class
Labs/Assignments	80%	Jupyter Notebook
Final Project	19%	Code, report & presentation
Total	100%	

Other Policies

The policies and procedures detailed in the UCA 2022-2023 Student handbook are also part of this syllabus. Please refer to the relevant policies as your guidance.
https://uca.edu/student/files/2022/08/STUDENT-HANDBOOK-2022-2023.pdf

If a student discloses an act of sexual harassment, discrimination, assault, or other sexual misconduct to a faculty member (as it relates to "student-on-student" or "employee-on-student"), the faculty member is encouraged to report the act to the Title IX coordinator, deputy coordinator, or employee with the authority to institute corrective measures on behalf of the University. An investigation of a formal complaint of Title IX Sexual Harassment will only be initiated when the Complainant (individual who suffers actual harm from the violation of the Title IX Sexual Harassment Policy) or the Title IX Coordinator signs a complaint. For further information, please visit: https://uca.edu/titleix/. *Disclosure of sexual misconduct by a third party who is not a student and/or employee is also encouraged if the misconduct occurs when the third party is a participant in a university-sponsored program, event, or activity.

Academic Integrity

The University of Central Arkansas affirms its commitment to academic integrity and expects all members of the university community to accept shared responsibility for maintaining academic integrity. Students in this course are subject to the provisions of the university's Academic Integrity Policy, approved by the Board of Trustees as Board Policy No. 709 on February 10, 2010, and published in the Student Handbook. Penalties for academic misconduct in this course may include a failing grade on an assignment, a failing grade in the course, or any other course-related sanction the instructor determines to be appropriate. Continued enrollment in this course affirms a student's acceptance of this university policy.

Building Emergency Plan

An Emergency Procedures Summary (EPS) for the building in which this class is held will be discussed during the first week of this course. EPS and Building Emergency Plan (BEP) documents for most buildings on campus are available at https://uca.edu/go/bep-library. Every student should be familiar with emergency procedures for any campus building in which he/she spends time for classes or other purposes.

Disabilities

The University of Central Arkansas adheres to the requirements of the Americans with Disabilities Act. If you need an accommodation under this Act due to a disability, please contact the Office of Accessibility Resources and Services (OARS), 450-3613.

Course Evaluation

The Student Course Experience Survey is a crucial element in helping faculty achieve excellence in the classroom and the institution in demonstrating that students are gaining knowledge. Students may complete surveys for courses they are taking starting on Monday, November 21st, through the Sunday, December 18th after finals week by logging in to myUCA and clicking on the Course Evaluations task.

Course Contents

Please refer to the following for a tentative course plan. The actual contents will be subject to changes due to the progress of the course. **Note: all assignments due on Monday at 2:15 PM**

Module 1 - Neural Networks

Introduce the basic concepts of neural networks. Students are expected to build a deep neural network from scratch.

- **Lab/Assignment 1:** Python and Numpy basics. **Due date:** Monday, 09/12/2022.

- **Lab/Assignment 2:** Logistic Regression. **Due date:** Monday, 09/19/2022.

- **Lab/Assignment 3:** Neural Network with One Hidden Layer. **Due date:** Monday, 09/26/2022.

- **Lab/Assignment 4:** Deep Neural Network Image Classification. **Due date:** Monday, 10/03/2022.

- **Lab/Assignment 5:** Model Tuning. **Due date:** Monday, 10/10/2022.

- **Lab/Assignment 6:** Python Library for Deep Learning. **Due date:** Monday, 10/17/2022.

Module 2 - Convolutional Neural Networks

Introduce the evolution of computer vision and convolutional neural networks. Students are expected to understand and practice the core modules of the convolutional neural networks.

- **Lab/Assignment 7:** Convolution Model. **Due date:** Monday, 10/24/2022.

- **Lab/Assignment 8:** Object Detection. **Due date:** Monday, 10/31/2022.

- **Lab/Assignment 9:** Image Segmentation. **Due date:** Monday, 11/07/2022.

Module 3 - Deep Reinforcement Learning

Introduce the principles of reinforcement learning and how deep learning boosts its development.

- **Lab/Assignment 10:** Q-Learning. **Due date:** Monday, 11/14/2022.

- **Lab/Assignment 11:** Deep Q-Network. **Due date:** Monday, 11/21/2022.

Final Project - Autonomous Race

Students will use the knowledge they've learned to train an autonomous racing car in simulation. **Due date:** Monday, 12/12/2022.