DSBA 6165 – Applied Deep Learning

Spring 2022: Course Duration – 14 weeks

Instructor: Minhaj Nur Alam, PhD Email: malam8@uncc.edu Office Hours: TBD	Times: 5:30 pm - 8:15 pm Location: Center City 1001 Virtual Location: Zoom (TBD)

Suggested Course Materials

Recommended: Géron, Aurélion. *Hands-on Machine Learning with Scikit-Learn, Keras, & Tensorflow, 2nd ed.* O'Reilly, 2019.

Recommended: Goodfellow, Ian; Bengio, Yoshua; Courville, Aaron. *Deep Learning*. The MIT Press, 2016.

Recommended: Sutton, Richard; Barto, Andrew. *Reinforcement Learning: An Introduction, 2nd ed*. The MIT Press, 2018.

Course Description

This course will introduce state of the art methods in deep learning while setting a proper context for the growth of deep learning by providing an overview of the broader field of artificial intelligence (AI). Topics will emphasize neural networks and deep learning architectures, but will also include broader AI concepts such as knowledge representation, computer vision, as well as advanced learning methods such as transfer learning and reinforcement learning. Application of the deep learning methods to real world problems such as medical diagnostics, computer vision, natural language processing, and robotics will be examined both in class and in projects.

Course Objectives

- Gaining knowledge of the state of the art deep learning methodologies including knowledge representation, machine learning, computer vision, and robotics.
- Applying deep learning techniques in modern real life scenarios – using python and DL frameworks (tensorflow, keras, pythorch etc.)
- Becoming proficient in DL based problem solving through assignments and prjects (preparing for future research, job interviews).

Instruction method

This course will use a combination of classroom instruction and activities and lab experiments. The first two weeks will be virtual as per Charlotte's guidelines due to covid situation.

Assignments and Grades Determination

Quizzes (10%)	There will be short quizzes on the concepts studied in the previous weeks every one or two weeks.
Midterm Exam (20%)	There will be a mid-term to assess understanding of fundamental concepts and methods.
Final Projects (30%)	The projects will enable you to apply these concepts in a small but realistic application.
Assignments (30%)	You will have homework assignments due for almost every class period.
Class Participation (10%)	Most every week there will be one or more activities for student groups in class. The participation mark will be a combination of individual contribution (attendance / work) and the overall group outcome (summary / conclusion) of the activity.

Final letter grades are assigned as follows:

A = 90% or above
B = 80% or above
C = 70% or above
U = below 70%

Assignment late submission policy:
Your assignments are considered late if they are not completed by the stated due date and time. If your assignment is late, you will usually have seven additional days to complete it for late credit (depending on whether anything contrary has been stated in the syllabus or assignment instructions.) Late credit equals a 20% reduction to the grade you would have received. For example, if you would have received a grade of 90% for completing a particular assignment, you will receive a grade of 70%.

***Syllabus Subject to Change**

The instructor reserves the right to alter this syllabus based on best practices that fit changing circumstances.

Attendance

You are expected to attend (and participate positively in) every class meeting. If you are absent on any particular day, then we will all just assume that you have a very good reason for being absent. If a

pattern of absences develops, we will deal with it individually and appropriately, including setting individualized attendance requirements.

No individual make-up work or extra credit will be set for absences or missed submissions. The lowest grade on in-class assignments may be dropped to allow for absence.

Course Topics

Topic Outlines

Overview of artificial intelligence and machine learning
Neural networks
Applications of Deep learning
Convolutional neural networks and DL frameworks
Applications in computer vision
Application in natural language processing
Recurrent neural networks
Autoencoders and Generative Adversarial Networks (GANs)
Reinforcement learning methods
AI in robotics
Ethical implications of deep learning

University policies

Code of Student Responsibility:
"The *UNC Charlotte Code of Student Responsibility* (the Code) sets forth certain rights and responsibilities in matters of student discipline. The Code defines these responsibilities and guarantees you certain rights that ensure your protection from unjust imposition of disciplinary penalties. You should familiarize yourself with the provisions and procedures of the Code" (Introductory statement from the UNC Charlotte brochure about the Code of Student Responsibility). The entire document may be found at this Internet address: **http://legal.uncc.edu/policies/ps-104.html**

Academic Integrity:
All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Students are expected to submit their own work, either as individuals or contributors to a group assignment. Definitions and examples of plagiarism and other violations are set forth in the Code. The Code is available from the Dean of Students Office or online at: http://www.legal.uncc.edu/policies/ps-105.html.

Faculty may ask students to produce identification at examinations and may require students to demonstrate that graded assignments completed outside of class are their own work.

Course Credit Workload.
This 3-credit course requires 3 hours of classroom or direct faculty instruction and 6 hours of out-of-class student work each week for approximately 15 weeks. Out-of-class work may include but is not limited to: required reading and video viewing, written assignments, and studying for quizzes and exams.

Special Needs: If you have a documented disability and require accommodation in this course, contact Disability Services, Fretwell 230, phone: 687 4355 voice/TDD the first week of the semester. Information about available services may be found at http://legal.uncc.edu/policies/ps-51.html. Accommodations for learning will be arranged by that office and communicated to the Instructor. If you speak English as a second language, please inform the instructor.

Diversity Statement:
UNC Charlotte strives to create an academic climate in which the dignity of all individuals is respected and maintained. Therefore, we celebrate diversity that includes, but is not limited to ability/disability, age, culture, ethnicity, gender, language, race, religion, sexual orientation, and socio-economic status.

All students are required to abide by the UNC Charlotte Sexual Harassment Policy (http://www.legal.uncc.edu/policies/ps-61.html) and the policy on Responsible Use of University Computing and Electronic Communication Resources (http://www.legal.uncc.edu/policies/ps-66.html). Sexual harassment, as defined in the UNC Charlotte Sexual Harassment Policy, is prohibited, even when carried out through computers or other electronic communications systems, including course-based chat rooms or message boards.

Religious Accommodation:
It is the obligation of students to provide faculty with reasonable notice of the dates of religious observances on which they will be absent by submitting a Request for Religious Accommodation Form to their instructor prior to the census date for enrollment for a given semester http://legal.uncc.edu/policies/ps-134.html . The census date for each semester (typically the tenth day of instruction) can be found in UNC Charlotte's Academic Calendar (http://registrar.uncc.edu/calendars/calendar.htm).

Course schedule

Weeks	Topics	Notes
W-1	Overview of artificial intelligence and machine learning	
W-2 Jan 18	• Neural networks • CNN basics • DL frameworks	Assignment 1
W-3 Jan 25	• Frameworks continued • Optimization	Assignment 2
W-4 Feb 1	• Detection • Prediction	Project proposal due next week
W-5 Feb 8	*Project proposal discussion	Assignment 3
W-6 Feb 15	• Segmentation	Assignment 4: Instance segmentation demo
W-7 Feb 22	• Panoptic + Medical Segmentation	
W-8 Mar 1	Application in natural language processing and business analytics	
W-9 Mar 15	• Representation learning • Recurrent neural networks/ LSTM/Transformers	Mid-terms: take home assessment
W-10 Mar 22	• Multi task learning • Reinforcement learning methods	Project progress check in with TA
W-11 Mar 29	Autoencoders and Generative Adversarial Networks (GANs)	Assignment 5
W-12 April 5	Guest lecture 1	Assignment 6
W-13 April 12	Guest lecture 2	Assignment 7
W-14 April 19	AI in robotics	
W-15 April 26	Ethical implications of deep learning	
W-16	Final Presentations	Written reports due

May 3		