GGS 590 – Deep Learning for Geoinformation
Fall 2020 – Tuesday – 7:20 to 8:30
Classroom – Exploratory Hall - 2312

Instructors: Mike Wolf, PhD; Adjunct Professor
Email: mwolf7@masonlive.gmu.edu (best way to reach me)
Office: Exploratory Hall TBD
Office Hours: Tuesday right after class or by appointment

Course Materials (recommended reference text):

- Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems second edition by Aurélien Géron
- Various online deep learning instructional videos
- Various peer reviewed journal articles

Course Description:
This course presents the theory and practice of Deep Learning as it applies to Geoinformation. Deep learning is a class of machine learning algorithms which enables computers to learn from known examples. Deep learning techniques have been used successfully for variety of applications, including automatic speech recognition, image recognition, natural language processing, drug discovery, and recommendation systems. Our focus will be on the application of deep learning to problems involving geoinformation. Peer-reviewed literature in deep learning is explored. The computer lab will be used to enhance the subject materials using the Python programming language and other tools. Having prior experience working with Python is required and a very good statistical background is essential to maximize your learning. We will build from the basics in class but move quickly in order to be able to apply basic deep learning techniques. Class attendance is required in that we will be doing multiple in-class exercises which you will leverage for your class project.

Course Objectives:
This is a graduate course and so it is expected that one has advanced research abilities along with refined writing and programming skills. By attending class lectures, performing background topic research and independent study, students will be able to:

- Understand the fundamentals of deep learning and its application to geoinformation
- Develop the ability to effectively and authoritatively research and present executive summaries of deep learning problems.
- Ability to formulate and solve basic problems using various deep learning methods
- Most importantly, learn how to learn from each other in a collaborative environment.

Planned Schedule:

Date	Topic	Lecture Scope
8/25/2019 Lecture #1	Introduction	Introduction, Classroom Conduct, Syllabus Review and What is Deep Learning?
9/1/2019 Lecture #2	What is Deep Learning? How can we use Deep Learning with geoinformation?	In-class examples Class peer review journal discussion Peer review journal presentation #1
9/8/2019 Lecture #3	Survey of computer hardware and deep learning tools	In-class demonstration using an NVIDIA GPU
9/15/2019 Lecture #4	Mathematics of Deep Learning Part 1	In-class examples and hands-on exercise Peer review journal presentation #2
9/22/2019 Lecture #5	Mathematics of Deep Learning Part 2 Machine Learning Basics	In-class examples and hands-on exercise Regression Assignment Due and presentation
9/29/2019 Lecture #6	Neural Networks: FFN Build a neural network: feed forward	In-class examples and hands-on exercise Peer review journal presentation #3
10/6/2019 Lecture #7	Neural Networks: Example with error analysis	In-class examples and hands-on exercise
10/13/2019	NO CLASS	
10/20/2019 Lecture #8	OpenCV Part 1	In-class examples and hands-on exercise Peer review journal presentation #4
10/27/2019 Lecture #9	OpenCV Part 2	In-class examples and hands-on exercise OpenCV Exercises #1
11/3/2019 Lecture #10	TensorFlow & CNN Part 1	In-class demonstration OpenCV Exercises #2
11/10/2019 Lecture #11	TensorFlow & CNN Part 2	In-class examples and hands-on exercise
11/17/2019 Lecture #12	LSTM	In-class examples and hands-on exercise Peer review journal presentation #5
11/24/2019 Lecture #13	GANs	In-class examples and hands-on exercise
12/1/2019 Lecture #14	Presentations Wrap-up	Deep Learning Blog Presentation

Grading Policy:

***In-class Exercises and Presentations* (25%):**
Students are expected to participate in all in-class exercise and discuss their results. These in-class exercises will be extended as homework for the following class. The student will be asked to find peer review journal articles based on their interests. A summary of these articles will be presented in class with each presentation being no more than 10 minutes.

***Course Project* (50%)**

Reviewed during class. The goal is a blog level article on a deep learning problem. Expect it should be supported by 5 peer review journal articles.

***Class Participation* (25%):**
Students are expected to attend the class periods of the courses for which they register. In-class participation is important not only to the individual student, but also to the class as a whole. Instructors may use absence, tardiness, or early departure as de facto evidence of non-participation.

Expectations for Participation:

- Students prepare for and actively engage in class discussion (e.g., demonstrate active listening, not distracted by electronics or peers)
- Students thoughtfully engage in in-class assignments and activities
- Students constructively participate in-group activities
- Students participate in class discussion by:
    - raising informed discussion points;
    - connecting discussion to reading material, news, and relevant experiences;
    - asking questions;
    - listening to other perspectives;
    - sharing the floor with others.

GMU Email Accounts & Blackboard:
You must use and regularly check your GMU email account and Blackboard to receive information for this class. Please do not send emails from non-GMU accounts, they will be ignored. I will normally respond within 24 hours.

Honor Code:
You are expected to follow the George Mason University rules of student conduct as noted in the catalog.

Office of Disability Services:
If you require academic accommodations due to a permanent or temporary disability, please contact the Office of Disability Services (ODS) at (703)993-2474, http://ods.gmu.edu. ODS will then contact me to arrange appropriate accommodations.

Classroom Expectations and other Miscellaneous:
Students are expected to be on time for class.

1. Should circumstances arise that make you late, do not disrupt the class as you enter.
2. Clean up after yourself. Leave your seat better than you found it.
3. In the event of any class cancellation, including inclement weather (e.g. snow), the class will resume where we left off, adjustments, if necessary, will be made later.
4. Please turn cell phone sounds off and do not text or talk during class.
5. Please be respectful of your peers and your instructor and do not engage in activities that are unrelated to the class. Such disruptions show a lack of professionalism and may affect your participation grade.
6. Lecture slides will be provided within 24 hours after the lecture. If you feel note taking is necessary, research has shown that pen and paper is the most effective.