Title: Deep Learning
Instructor: Oladunni, Timothy
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Class Location: TBA
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Class Hours: TBA
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A. Course Description

Deep Learning is an emerging field of computer science that is built on the success of machine learning. Deep learning systems use high-level abstraction to improve the predictive capability of machine learning. With deep learning approach, we can build reliable predictive models that can 'see', 'talk', 'hear', 'type', 'read', etc. Deep learning research is the technology behind self-driving car (autonomous vehicle), pilotless airplane (drones), and non-invasive surgery. Thus, we can apply the technology of deep learning to engineering, physics, medicine etc. Just as the discovery of electricity changed our ways of life, deep learning has been described as the new transformative discovery. Artificial Intelligence has come to stay!

This class will a combination of the theoretical and empirical approach to deep learning predictive models. We will use state of the art tools for the implementation of our class projects. Furthermore, we will familiarize ourselves with the main building blocks of deep learning with practical application to real world problems. Our approach will be based on statistics, linear algebra, calculus and computer science.

B. Prerequisites

Students are expected to have completed the following courses before registering for this class.

I. Linear algebra
II. Programming
III. Discrete mathematics
IV. Statistics
V. Calculus
VI. Introduction to Machine Learning

C. Learning outcome

At the end of this course, students are expected to have understood:

- Supervised and unsupervised learning
- Design, development and evaluation of learning algorithms
- Application of Deep Learning to real world problems

D. **Course Schedule (Tentative)**

Week	Topic	Projects
Week 1	Machine Learning Basics	
Week 2	Probability and Information Theory	
Week 3	Deep Feedforward Networks	Project 1
Week 4	Regularizations for Deep Learning	
Week 5	Optimization for Training Deep Models	
Week 5	Deep convolutional neural network — DCNN 1	Project 2 **Project 1 is due**
Week 6	Deep convolutional neural network — DCNN 2	
Week 7	Word Embeddings and Language Models	Project 3 **Project 2 is due**
Week 8	Sequence Modeling: Recurrent and Recursive Nets	
Week 9	Linear Factor and Auto Encoders	Project 4 **Project 3 is due**
Week 10	Representation Learning	
Week 11	Structured Probabilistic Models for Deep Learning	Final Project **Project 4 is due**
Week 12	Monte Carlo Methods	
Week 13	Project Presentations/Demo	
Week 14	Final Exam	**Final Project is due**

E. Evaluation

Final grade will be based on the following:

Project 1 10%

Project 2 10%

Project 3 10%

Project 4 10%

Project 5 20%

Mid-Term 20%

Final 20%

F. Textbook

1. Deep Learning by Goodfellow, Bengio, Courville

   http://www.deeplearningbook.org/

G. Resources

1. Pattern Recognition and Machine Learning (Information Science and Statistics) by Christopher M. Bishop
2. Pattern Classification Richard O. Duda, Peter E. Hart, David G. Stork

H. **Format and Procedures**

This course will employ lectures, exercises, assignments, and examinations. Students are strongly encouraged to participate extensively, ask questions, express ideas and opinions, and challenge traditional ideas and concepts. Instructional methodologies will emphasize critical thinking, problem solving, and reasoning over simple memorization.

I. Assessment Procedures

All students need to finish any given programming assignments in a timely manner. Assignments, Mid-term exam, and Final exam will take place to measure their ability of understanding the concepts and techniques of big data analysis.