COLUMBIA BUSINESS SCHOOL

ARTIFICIAL INTELLIGENCE (B9654) – FALL 2018

Dr. George A. Lentzas
Email: gl2543@columbia.edu

Time & Location: Wednesdays B Term, 6-9pm at Uris 331

Teaching Assistant: TBD

Course Description: This course is the second of two courses that will introduce business students to the exciting and growing literature in machine learning / artificial intelligence, with a focus on applications in finance and marketing. We will cover advanced topics in neural networks, deep learning and artificial intelligence and their potential applications in the areas of finance and marketing.

Course Requirements: Students are expected to have completed the spring semester Machine Learning course offered by the instructor (similar graduate level courses will be acceptable with instructor approval). Students should be familiar with probability theory, matrix algebra, maximum likelihood, and basic concepts/models in machine learning. Familiarity with programming is a prerequisite as we will make extensive use of the programming languages Python/Tensorflow.

Required Text: The main reading for this course will be the textbook “Deep Learning” by Goodfellow, Bengio and Courville, referred to as DL, (http://www.deeplearningbook.org/).

Class Preparation: Students are expected to have completed the session reading ahead of class to facilitate class participation and discussion. You need to take this seriously to be able to make the most out of this class as we will cover a lot of very advanced material.
**Research Paper:** Students will write a research paper that addresses a well-defined finance or marketing question using the deep learning/artificial intelligence toolkit. Potential research projects will be circulated in class [more to follow].

**Grading:** Class Participation 25%, Homework 25%, Research Paper 25%, Final 25%. Homework is due promptly at 11:59pm, a week after it is released. Late homework will be penalized by 10% per 1hr delay.

**Office Hours:** TBD

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**SCHEDULE**

**SESSION 1 (Neural Networks) — October 24th**

- Introduction to Neural Networks
- Practical Issues
- Deep Feedforward Networks
- Introduction to Tensorflow
- **Reading:** ESL Ch. 11| DL Ch. 1-3 (optional), 4.3-4.5, 5, 6

**SESSION 2 (Regularization & Optimization) — October 31st**

- Regularization for Deep Learning
- Optimization for Deep Learning
- Implementing Neural Networks in Tensorflow
- **Reading:** DL Ch. 7-8

**SESSION 3 (Convolutional Networks) — November 7th**

- Introduction to Convolutional Networks
- Implementing a simple Convolutional Network in Tensorflow
- **Reading:** DL Ch. 9
SESSION 4 (Recurrent Networks) – November 14th

- Introduction to Recurrent Networks
- Long Short Term Memory Models and Gated RNNs
- Deep Learning Practical Issues and Applications
- Reading: DL Ch. 10-12

SESSION 5 (Autoencoders & Representation Learning) – November 28th

- Introduction to Autoencoders
- Stochastic, Denoising and Sparse Autoencoders
- Greedy Layer-Wise Pretraining
- Reading: DL Ch. 14-15

SESSION 6 (Probabilistic and Deep Generative Models) – December 5th

- Structured Probabilistic Models
- Log Likelihood and Contrastive Divergence
- Deep Generative Models
- Reading: DL Ch. 16, 17, 18.1, 18.2, 20.1 – 20.5