TEXAS A&M UNIVERSITY

SYLLABUS

Course title and number	Machine Learning with Networks (ECEN 765-600)
Term	2018 Fall
Meeting times and location	TTh 14:20-15:35 @ ZACH 341

Course Description and Prerequisites

In the past decades, with several important technology advancements, including Internet, ubiquitous sensing, and high-throughput molecular profiling techniques, we have witnessed the outburst of the unprecedented amount of data from different disciplines, such as biology, engineering, social science, etc. The scientific analysis of these extremely large-scale data is critical to discover useful knowledge that benefits human beings. Machine learning provides a set of important tools to find patterns and generalize rules from data. With the available modern computing resources, deep learning has been endowed with the hope to take over the artificial intelligence to help decision making in diverse applications. While many machine learning courses focus on analyzing data in a matrix format without seriously taking care of relationships among variables, the major focus of this course is to introduce basic machine learning techniques together with the advanced methods that are designed to analyze structured data, typically represented as graphs or empirical networks. The course covers the basics of machine learning (supervised and unsupervised learning) focusing on Bayesian reasoning, basic graph theory, as well as some advanced, recent research topics.

Prerequisites:
1. Undergraduate-level linear algebra, vector calculus, and probability theory
2. Basic programming skills in Python

There will be a lot of math and statistics in this course, please do talk to me about prerequisites if you are not sure.

Learning Outcomes

At the end of this course, the students should
1. Have good knowledge of basic machine learning and Bayesian reasoning methods.
2. Identify and understand real-world applications of machine learning methods.
3. Have hands-on experience with scikit-learn and TensorFlow on analyzing real-world data with the integration of relationships among different variables.

Instructor Information

Name	Xiaoning Qian
Telephone number	979-845-6268
Email address	xqian@ece.tamu.edu
Office hours	Friday 11:00AM-noon
Office location	WERC205J

Textbook and/or Resource Material

Textbook: Hands-on Machine Learning with Scikit-Learn & TensorFlow by *A Géron* (ISBN 9781491962299) GitHub: https://github.com/ageron/handson-ml

Recommended Reading:
1. Understanding Machine Learning by *S Shalev-Shwartz* and *S Ben-David* (ISBN 9781107057135)
2. Bayesian Reasoning and Machine Learning by D Barber (ISBN 9780521518147)
3. Machine Learning in Action by *P Harrington* (ISBN 9781617290183)
4. Networks: An Introduction by *MEJ Newman* (ISBN 9780199206650)
5. Pattern Recognition and Machine Learning by *C Bishop* (ISBN 0387310738)

6. Machine Learning by *KP Murphy* (ISBN 9780262018029)
7. Elements of Statistical Learning by *T Hastie, R Tibshirani*, and *J Friedman* (ISBN 0387952845)
8. Pattern Classification (Second Edition) by *RO Duda, PE Hart*, and *DG Stork* (ISBN 0471056693)
9. Other relevant surveys and papers will be distributed in class.

Grading Policies

Grading is relative. The final grade will be based on the following weights:
Homework assignments (30%) + Midterm exam (30%) + Final project (40%)

Grader(s): TBA
Grading scale: 90-100 A, 80-89 B, 70-79 C, 60-69 D, below 60 F.

Attendance and Make-up Policies

Attendance and make-up policies will follow the general student rule of the university: http://student-rules.tamu.edu/rule07.

Course Topics, Calendar of Activities, Major Assignment Dates

Week 1-3	Course overview; Math refresher: graph and probability theory; estimation theory; Programming prerequisites: Python, Jupyter notebook, TensorFlow
Week 4-5	PAC learnablity & basic classifiers
Week 6-8	Optimization; Learning with unstructured data (supervised and unsupervised linear models)
Week 9-10	Structured sparse models (learning with network prior)
Week 11-12	Artificial neural networks and deep learning
Week 13-14	Markov models (network clustering and network diffusion)
Week 15	Reinforcement learning and real-world applications

Americans with Disabilities Act (ADA)

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit http://disability.tamu.edu

Academic Integrity

For additional information please visit: http://aggiehonor.tamu.edu

"An Aggie does not lie, cheat, or steal, or tolerate those who do."