Course title and number: Machine Learning with Networks (ECEN 765)
Term: 2016 Fall
Meeting times and location: MWF 16:10-17:00 @ CHEM 2122

**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. 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 any programming language (Matlab, R, Python, C, C++, Java, etc.)

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 on analyzing real-world data with the integration of relationships among different variables.

**Instructor Information**

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**Textbook and/or Resource Material**

Textbook: Bayesian Reasoning and Machine Learning by D Barber (ISBN 9780521518147)
Recommended Reading:
4. Elements of Statistical Learning by T Hastie, R Tibshirani, and J Friedman (ISBN 0387952845)
6. 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 (tentative):
Homework assignments (60%) + Midterm exam (20%) + Final project (20%)

Grading scale: 90-100 A, 80-89 B, 70-79 C, 60-69 D, below 60 F.
Collaboration Policy: You are welcome to collaborate on homework and the final project. However, you must write the solutions and reports on your own and acknowledge your collaborators.

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 1-2 | Course overview; Math refresher: graph and probability theory; estimation theory |
| Week 3-6 | Learning with unstructured data (supervised and unsupervised linear models) |
| Week 7-10 | Structured sparse models (learning with network prior) |
| Week 11-13 | Markov models (network clustering and network diffusion) |
| Week 14-15 | Bayesian filtering 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

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