FALL 2020 COURSE ANNOUNCEMENT

ECSE 6810
Introduction to Probabilistic Graphical Models

Course Objectives:

As a marriage between probability theory and graph theory, Probabilistic Graphical Models (PGMs) provide a tool for dealing with two problems that occur throughout applied mathematics and engineering – uncertainty and complexity. Under probabilistic models, data are modeled as a collection of random variables with a particular pattern of possible dependences among them. Using PGM model, we can discover knowledge, predict future events, and infer hidden causes.

This 3-credit graduate level course will introduce theories and applications of both directed and undirected PGMs, including Bayesian Networks, Markov Random Fields, Hidden Markov Models, Dynamic Bayesian Networks, Influence Diagram, and Factor Graph. Theoretically, we will discuss various model learning and inference methods. For learning, the course will cover parameter and structure learning under both complete and incomplete data. For inference, the course will cover exact inference methods, approximated methods (e.g. Loopy belief propagation), and the numerical sampling methods (e.g. MCMC). Application-wise, we will demonstrate the application of PGMs to different fields including computer vision and deep learning. Through this course, students will learn and understand the basic theories underlying different graphical models, implement certain important PGM learning and inference techniques, and solve real world problems using PGMs.

Optional Textbooks:

- Probabilistic Graphical Models for Computer Vision, Qiang Ji
- Probabilistic Graphical Models: Principles and Techniques, Daphne Koller and Nir Friedman

Course Coordinator: Qiang Ji, Professor, Dept. Electrical, Computer, and Systems Eng.

Meeting Times: 12:30-1:50 pm, Online and RCKTTS 203, Tuesdays and Fridays

Prerequisites by Topic: Students taking the class should have a pre-existing working knowledge of probability, statistics, and adequate programing skills, though the class has been structured to allow students with a strong analytic background to catch up and fully participate.

Topics: Probability Calculus, Bayesian Networks, Learning and Inference in Bayesian Networks, Dynamic Bayesian Networks, Influence Diagram, Hidden Markov Model, Markov Network, Factor Graph, and various application examples of different graphical models.

Course Evaluation:

The evaluation of this course will be based on homework assignments (15%), a midterm exam (25%), class projects (40%) and the final project (20%).

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Covid-19 Related Additions:
We are committed to the health and safety of students as well as a high-quality educational experience. Rensselaer continues to monitor new developments regarding covid-19 and determine a best course of action to support student well-being and outstanding education.

- **Masks**: Wearing a mask in public can help prevent the spread of COVID-19. Masks will be worn by all students in this class and while in the building. Students violating this policy will be requested to leave classroom/building and return to their living quarters; they will also be reported to the Dean of Students for appropriate sanctions per code of conduct expectations.
- **In-Class Seating: Students will sit only in the appropriate designated seating in the classroom, to ensure social distancing. Moving furniture or sitting in undesignated seats is not permitted.**
- **Cleaning of Spaces**: Students are encouraged to clean the surfaces of the chairs/tables/desks they occupy before they sit down and as they prepare to leave.
- **Refusal**: Refusal to comply with any appropriate request will be treated as would any classroom disruption and disciplinary actions and sanctions will be taken through judicial process outlined in the Student Handbook.