CS674: Final Project

November 1, 2016

The main source of grading for this course will be a final project, consisting of two elements: a short (10-15 minute) presentation, and a corresponding writeup. The goals (and rough basis for grading) are as follows:

- Do something interesting with the ideas presented or discussed in class.
- Identify some element or idea that we did not discuss in detail, push it further, and be able to present it to your classmates.

That is largely the extent of it. Ideally, find a problem based on actual data or an interesting optimal decision / online learning problem, and implement a solution or analysis of it based on the ideas we have discussed, and potentially new ideas or material that we have not discussed. This could potentially take many forms: i) attempting to find optimal solutions/models or make optimal decisions based on data; ii) looking at the various performance benefits and constraints of algorithms, for instance as applied to extremely large data sets; iii) extensions of discussed algorithms like various hyperparameter schemes; iv) optimal sequential control or game theoretic problems, having to monitor and control the behavior of a (simulated) dynamical system. There are many possibilities and I do not want to artificially limit you.

This project is not meant to be groundbreaking research - simply implement, explicate, and present an interesting idea. This will likely require some background research on your part, to know what is out there and available to do. Some potential areas of interest:

- Recommendation Systems that must adapt over time to potentially changing preferences.
- Generative Models that can generate novel instances of learned classes or generalized from data sets.
- Distributed Optimization Learning Algorithms that can yield good results without centralized processing of the whole dataset.
- Dynamic Bandit Problems in which the decision to take an action can influence the future effects of that action.
- Monitor and Control Problems subject to Uncertainty.
• Expert Pooling or Consensus Models which improve performance of individual agents (for instance trained neural networks) by combining their knowledge.

The final presentation should cover: i) a overview of the problem and the approach taken to solve it; ii) a short summary of prior or related work; iii) the technical or theoretical concerns underlying your approach; iv) your results; v) any generalizations or extensions that might be considered for future work. Take this opportunity to try to introduce your classmates to an idea that they might not otherwise be exposed to.

The final writeup should be: i) a more detailed version of the information and material you present in your presentation; ii) any relevant code and computed results; iii) in the case of a group project, a short writeup of the contributions of the various members.

I am open to small groups (please no more than three to a group) but please check with me for approval before getting in too deep.

Relevant Dates:

• **Nov. 1 - Nov. 22, 2016**: Please arrange to meet with me outside of class at least once to discuss potential projects and progress.

• **Nov. 14, 2016**: Submit a formal proposal for a topic (1 page), including an outline of the relevant problem and proposed approach for solutions.

• **Dec. 12, 2016**: Final presentations in class, submit associated writeups.

But again, let me emphasize: the goal is to do something interesting. Interesting can be a variety of things, for instance, i) interesting from a mathematical perspective, ii) interesting from a technical perspective, iii) interesting from a practical perspective. Have some fun with this.