6.853 Spring 2019 Project Proposal Guidelines

March 13, 2019

This document contains guidelines for project proposals, as well as projects themselves, for 6.853 Spring 2019 (Algorithmic Game Theory and Data Science).

You should submit a concrete 1-2 page proposal by April 3, 2019, and a final project based on this proposal by Friday, May 10, 2019. You may form teams of 2-3 for the project, though note that our expectations will be accordingly higher for group projects than for individual projects. The purpose of the proposal is to let us know what you are planning on doing and to let us give you feedback. Generally speaking, most strong projects fall into a few types:

- **Theoretical improvements or extensions to algorithms related to AGT and data science.** Here you are asked to improve the state of the art in a topic related to ones covered in class. You should also give a sufficiently thorough literature review in your paper for a reader to understand the problem and the scope of your contribution.

  In the proposal, you should address the following: 1) Why do you think an improvement is possible (maybe there is a better algorithm for special cases, a gap between upper and lower bounds, or an aspect of this problem that has not been addressed or utilized by previous work) and 2) If your improvement does not work out, what is a reasonable fall-back option (e.g. would it be possible to formalize why your approach did not work out?).

- **Computational simulations and literature review.** Here you are asked to pick a topic related to the class, do a thorough literature review of one or more papers on the topic, and implement some of the ideas and algorithms from the paper(s) to see how they perform. You may also choose to do more original work, and suggest some new mechanisms / algorithms and argue about their performance via simulations.

  In the proposal, you should include what topic and paper(s) you want to address. You should also make it clear why your project would contribute something new to the literature; maybe the results are theoretical and the empirical evaluation is lacking (or absent), or you are suggesting mechanisms / algorithms that have some desirable property not currently found in the literature. More concretely, you need to include details on what you are planning to do. How do you plan to set up your experiments? What metrics will you use to evaluate them? What questions are you looking to answer with your experiments, and why are they interesting?

- **Analysis of real world data sets and literature review.** Here you are asked to analyze some publicly available real world dataset related to some game-theoretic or economic scenario, such as an auction. You should use statistical techniques from the relevant literature, such as the value distribution estimation we will see in class. You should also do a thorough literature review on the topic related to the dataset; for example, by reviewing some papers that work with or analyze this dataset.

  In the proposal you should include the datasets that you are intending to look into, as well as related papers. You should also include your planned methodology, why you believe your work will contribute to analysis of this dataset, and what conclusions you think could possibly be made.

- **Survey of existing literature.** Here you are asked to look into a topic related to one we have discussed in class, read multiple papers related to this topic, and write a survey of them.

  In your proposal, you should include: What are the results you plan to cover and why? Are they related? Is it possible to present them in a unified way? Do existing surveys on this topic exist? If
so, how will your survey be different? Note that you must survey multiple papers for this topic, your survey should be readable for a non-expert in the field, and it should not be subsumed by existing, publicly accessible literature.

**How to structure your project proposal:** The main text should contain the following aspects:

1. Explain in 3 sentences the topic you have chosen, and the problem you are addressing.

2. Explain in up to 5 sentences the relevant existing literature.

3. Explain in up to 4 sentences why is your project challenging and/or interesting.

4. List down up to 3 deliverables.

5. Describe a timeline to achieve these deliverables by considering the necessary subtasks, e.g. research papers which you will read, subproblems or proofs which you will pursue, code which you will borrow or implement yourself, data sets which you will obtain or generate under appropriate modeling assumptions, etc.

The main text of the project proposals should be contained in 1 page. The second page can be used for references and figures/tables, if any.

**Miscellaneous Notes:**

- It is okay if your project overlaps with your current research topic, but it should not be subsumed by something you are already doing; that is, there should be a substantial component of your project that is new.

- We will post a list of example projects by the end of this week.

- We will hold office hours in the week of March 18, to provide preliminary feedback on your ideas, if you would like.