CSE 841: Artificial Intelligence

Project Proposal Guidelines
Fall 2020

1 Guidelines

- The project proposal is an opportunity for me to give you feedback on your proposed project before you start work.
- The goal of the class project is to give each student the opportunity to gain practical, hands-on experience with the concepts, models, and algorithms that we discussed throughout the semester.
- With this goal in mind, each project proposal should contain the following elements:
  - Empirical data from public databases and past studies and/or synthetic data from model-based simulations.
  - Some programming. Where possible, utilize existing software libraries and extend open-source software implementations.
  - A scientific question that has been explored in the scientific literature. Make sure that at least one peer-reviewed publication from a scientific journal or conference proceedings has discussed the computational problem(s) that you plan on addressing. Remember to cite the relevant peer-reviewed publication(s) in your proposal document.
- The scope of the project should be suitable for completion in a three to four week timeline.
- It's fine if the outcome of your project is a negative result, i.e. if no new scientific discovery arises from your work. The primary goal is to gain practical experience, rather than make scientific progress.
- The following project proposal sketches are intended to give you some idea of the content of a suitable class project. Feel free to propose different ideas.
- Project proposal handout was announced on October 26. Project proposals are due at the start of class on Monday November 2. Proposal documents must be submitted via the official class D2L website (click "Assessments" tab, select "Assignments", and then select "Project Proposal").

2 Sketch of an example project proposal

Propose an NP-hard computational problem from your field of research. Implement three different local optimization algorithms to solve the computational problem (e.g., hillclimbing, simulated annealing, and genetic algorithms). Using both empirical and synthetic data, compare the results obtained by the three algorithms. Visualize your results.

3 Sketch of another example project proposal

Implement a hidden Markov model (HMM) to compute biomolecular sequence profiles for the purpose of protein family identification. Use existing HMM libraries such as Jahmm (`https://code.google.com/p/jahmm/`) and GHMM (`http://ghmm.org/`). Download amino acid sequence data from Pfam (`http://pfam.xfam.org`). Split your data into training and test data. Use the training data to learn the parameters of your HMM, and then try to test it on the test data. Visualize your results.

4 Other possible project ideas

Any of the following projects would be suitable. The projects were originally proposed in AAAI's Educational Advances in Artificial Intelligence symposia (`http://modelai.gettysburg.edu/`).

- The game theory project proposed by Neller and Lanctot: `http://modelai.gettysburg.edu/2013/cfr/index.html`. Make sure to apply your algorithms and software tools to an existing scientific question.
- The gesture recognition project proposed by Zheng and Koenig (including extra credit): `http://idm-lab.org/project-m/project3.html`. Make sure to apply your algorithms and software tools to an existing scientific question.