Final Project Description

1 Project Topics

In the CS6140, you will learn about majority of ML applications. Part of the learning will be online, during in-class lectures and when completing assignments, but you will really experience hands-on work in your final project. This is an **individual project** where you will apply concepts learned in class (before mid-term) to implement a supervised or unsupervised machine learning model. The goal is to demonstrate your understanding of data preprocessing, model selection, training, and evaluation. We would like you to choose wisely a project that fits your interests. One that would be both motivating and technically challenging.

- **Application project:** This is by far the most common: Pick an application that interests you and explore how best to apply learning algorithms to solve it.
- **Algorithmic project:** Pick a problem or family of problems, and develop a new learning algorithm, or a novel variant of an existing algorithm, to solve it.
- **Theoretical project:** Prove some interesting/non-trivial properties of a new or an existing learning algorithm. (This is often quite difficult, and so very few, if any, projects will be purely theoretical.) Some projects will also combine elements of applications and algorithms.

Many fantastic class projects come from students picking either an application area that they're interested in or picking some sub-field of ML that they want to explore more. So, pick something that you can get excited and passionate about! Be brave rather than timid and do feel free to propose ambitious things that you're excited about. (Just be sure to ask us for help if you're uncertain how to best get started.) Alternatively, if you're already working on a research or industry project that Artificial Intelligence might apply to, then you may already have a great project idea.

2 Hint

A very good CS6140 project will be a publishable or nearly-publishable piece of work. Each year, some number of students continue working on their projects after completing CS6140, submitting their work to a conferences or journals. Thus, for inspiration, you might also look at some recent research papers. You may also want to look at class projects from previous years online (other AI/machine learning/deep learning classes) is a good way to get ideas. Finally, here is a list of topics can be used:

1. Healthcare: Predicting Disease from Medical Images
2. Finance: Stock Price Prediction
3. Computer Vision: Object Detection in Drone Footage

4. Autonomous Vehicles: Lane Detection and Tracking
5. Autonomous Vehicles: Lane Detection and Tracking
6. E-commerce: Product Recommendation System
7. Cybersecurity: Anomaly Detection in Network Traffic
8. Environmental Science: Weather Prediction

Once you have identified a topic of interest, it can be useful to look up existing research on relevant topics by searching related keywords on an academic search engine such as: http://scholar.google.com. Another important aspect of designing your project is to identify one or several datasets suitable for your topic of interest. If that data needs considerable pre-processing to suit your task, or that you intend to collect the needed data yourself, keep in mind that this is only one part of the expected project work, but can often take considerable time. We still expect a solid methodology and discussion of results, so pace your project accordingly.

3 Project Deliverables

This section contains the detailed instructions for the different parts of your project.

Individual: The project is done individually.

Submission: We will be using Canvas for submission of all four parts of the final project. We'll announce when submissions are open for each part. You should submit on Canvas.

Evaluation: Please refer to syllabus.

The technical quality of the work: Does the technical material make sense? Are the things tried reasonable? Are the proposed algorithms or applications clever and interesting? Do the authors convey novel insight about the problem and/or algorithms?

Significance: Did the author choose an interesting or a "real" problem to work on, or only a small "toy" problem? Is this work likely to be useful and/or have impact?

The novelty of the work: Is this project applying a common technique to a well-studied problem, or is the problem or method relatively unexplored?

In order to highlight these components, it is important you present a solid discussion regarding the learnings from the development of your method, and summarizing how your work compares to existing approaches.

4 Details

The report should contain a comprehensive account of your project. We expect the report to be thorough, yet concise. Broadly, the final project should be in the format of IEEE conferences. Details will be shared later through Canvas. In general, we will be looking for the following:

- Good motivation for the project and an explanation of the problem statement
- Description of the data
- Any hyperparameter and architecture choices that were explored
- Presentation of results
- Analysis of the results
- Any insights and discussions relevant to the project
- References