

ECE 4800 Final Project

The project can be in any area related to the topics of the course. Projects can be done individually, or in teams of up to two people. You have broad scope to choose the topic of your course project, but *with the caveat that it makes non-trivial use of some subset of the {models, methods, algorithms} covered in the class/book, or extensions of the techniques presented in the class/book.*

The project will be evaluated according to a written report that is at most 15 pages in length, not including figures, tables, references, and code.

Types of Projects: There are various project types, including:

- *Application-Focused Project:* Focus on an optimization problem grounded in a specific application area of interest (e.g., robot path planning and control, epidemics, aerospace, finance, automotive, power systems, e-commerce, machine learning, circuit design, game theory). Build an optimization model for the system being considered, and design a solution approach that yields optimal (or reasonable) performance in one or more suitable metrics. Test your proposed solutions using either real or synthetic data sets.
- *Survey Project:* Choose an interesting problem area related to the topics covered in this course (e.g., optimization algorithms, robust optimization, traveling salesperson problem, bipartite matching, network flow, maximum cut problems, image classification). Read and survey a range of competing techniques, implement them using real or synthetic data sets to gain some intuition, and explore the trade-offs between the competing techniques in terms of their robustness, performance, computational complexity, etc.
- *Methodology Project:* Develop and implement a *new* algorithm or methodology to solve a particular class of problems. If theoretically inclined, prove something about the behavior of the proposed algorithm or methodology. Test your new algorithm or methodology on real or synthetic data sets.

If you're unsure about the suitability of a topic, or if you have an idea for a project that does not seem to fit into one of these categories, please drop by my office hours to discuss. If you cannot make my office hours, please contact me to schedule an alternative time to meet.

Project Proposal: Your project proposal should motivate and summarize your intended project. It should include:

- a descriptive title
- description of the questions/problem/area you intend to explore,
- motivation for studying this specific problem, and relevant scientific or engineering background (make sure to include references),

- the approach you intend to take,
- and anticipated project outcomes.

Please keep your project proposal to at most 5 pages in length. If your project involves two team members, please make sure to clearly indicate both project team members on the front page of your proposal.

Final Project Report: The project will be evaluated according to a written report that is at most 15 pages in length, not including figures, tables, references, and code. A typical organization of the project report:

1. *Abstract:* Briefly summarizing the problem being addressed, your approach to the problem, and findings.
2. *Introduction:* Description of the problem, motivation for studying it, related scientific or engineering background.
3. *Past/related work:* What techniques have been used to date? What has been successful or not? What are limitations of current methods?
4. *Models/algorithms:* What models did you use? What were the main modeling and computational challenges? What algorithms did you apply or consider?
5. *Results:* What types of results did you obtain? How did different methods/models compare? What was the running time of your algorithms for different problems?
6. *Conclusion:* What did you learn? What are some open questions that your work raised? What would you do if you had more time to spend on the project?

Important Dates and Submission Instructions:

- The project proposal is due Nov 13, 2020.
- The final project report is due Dec. 16, 2020.
- Both the project proposal and final report must be typed (i.e., no handwritten reports will be accepted).