ECE 594 Project Guidelines (Fall 2019)

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September 16, 2019

The purpose of this note is to describe the guidelines for the course project of ECE 594 (Convex Optimization) taught in Fall 2019 at the University of Illinois at Chicago. Part of the note has been inspired by the project guidelines from EE 364b taught by Stephen Boyd at Stanford.

1 Project Requirements

The course project consists of 40% of the total grade. The project can be done in groups of a maximum of three students. The expected effort depends on the group size; we expect more outcomes from larger groups. In addition, we will evaluate individual contributions within each group. Therefore, members within the same group will not necessarily receive the same grades. Each group needs to jointly submit a proposal, a midterm progress report, and a final project report throughout the semester. The due dates are listed in Section 1.2. In addition, each group should make an in-class presentation during the last week of lectures.

1.1 Submission format

General formatting requirements Below you will find general formatting requirements that apply to all submissions.

- You will need to submit all your project reports, including the proposal, the midterm and final reports, on BlackBoard. We do not accept submission via any other methods such as email or Piazza.
- All reports need to be in IEEE style and double-column. MS Word and LaTeX templates are available at: `https://www.ieee.org/conferences/publishing/templates.html`.
- All reports need to be in PDF. We do not accept other formats such as .doc, .docx, or .tex.
- In the spirit of reproducible research, you are encouraged to submit code used in your project along with your final report. The code can be attached as a single compressed archive in common formats (e.g., ZIP, RAR, GZIP) on BlackBoard or hosted in public domain (e.g., GitHub).
- All reports must include proper citations when external material is being referred to.

Proposal Maximum length is 1 page.

Midterm progress report Maximum length is 4 pages.

Final project report Maximum length is 8 pages. The final report must contain at the end a separate section named "Contributions," in which the individual contributions are clearly stated. This section allows us to evaluate individual efforts from members in the same group.

Final in-class presentation The expected length of the presentation is 10–15 minutes, including a brief Q&A after the presentation. The exact duration will depend on the actual number of groups and will be determined after all the proposals have been received. Each group can choose a single or multiple members to present. The presentation will be evaluated by the instructor and all other students. Details of evaluation can be found in Section 3.

1.2 Important dates and milestones

The deadlines will be strictly enforced by the submission system on Blackboard. No late submission will be accepted.

- Project proposal: Oct 13, 2019, 11:59:59 PM U.S. Central Time (end of Week 7)
- Midterm report: Nov 10, 2019, 11:59:59 PM U.S. Central Time (end of Week 11)
- Final report: Dec 8, 2019, 11:59:59 PM U.S. Central Time (end of Week 15)
- In-class presentation: Dec 3 and 5, 2019 (Week 15). Attendance is mandatory for all students (regardless whether presenting or not).

2 Types of projects

We encourage you to choose your own project topic. However, if you need suggestions, feel free to discuss with me during office hours. We list in this section a few different types of projects that you may consider. While the course focuses on convex optimization, the topic of your project can be about nonconvex optimization. However, you are strongly discouraged from choosing a topic on generic nonconvex optimization, for which algorithms often have weak or no guarantees. Below are examples of a good and a bad topic:

- Good topic: The convex geometry of nonconvex phase retrieval problems.
- Bad topic: Empirical evaluation of the genetic algorithm.

Aside from the final report, you are expected to submit a proposal and a midterm progress report during the semester. These two will allow us to give timely feedback and will also make sure that you are making good progress:

Proposal The proposal should describe the topic that you would like to investigate and a tentative plan on how you would like to proceed. The description of the topic should contain both the necessary background in non-technical terms as well as a mathematical formulation of the problem. For explorative topics, you should also include a contingency plan on the potential difficulties and challenges, for example, if something you would like to try failed, what a backup option would look like.

Midterm report The midterm report should describe your attempts so far and relevant preliminary theoretical results and/or numerical experiments that you have. We would like to see evidence that you are making good progress to ensure that you will be able to finish the project on time. You should summarize your findings (what worked and what did not) and describe what you still plan to do for the final report.

2.1 Modeling using optimization

For this type of project, you are expected to identify a practical problem (from science, engineering, medicine, or finance) and model the problem as an optimization problem. You are encouraged to make reasonable assumptions that allow you to formulate the problem as a convex problem if necessary. You are then expected to use tools from optimization to obtain a solution to that problem and validate your results using numerical simulations or, if applicable, physical experiments. An example of this type of project is "Network intrusion detection using convex optimization."

2.2 Topical survey in optimization

For this type of project, you are expected to study in-depth a topic in optimization that is not covered during the lectures. The final outcome of this type of project should be of tutorial nature. Therefore, you are encouraged to design and include necessary numerical experiments in the report to help illustration. We expect the final report to contain enough material that can be served as course material for 1–2 lectures. An example of this type of project is "A survey of accelerated gradient methods."

2.3 New theory or algorithms

We do encourage capable students to work on innovative theory or algorithms related to (convex) optimization. Students who wish to pursue this type of project should discuss with the instructor to work out a viable plan.

3 Evaluation

The maximum number of total points for the course project is 100, with the possibility of an additional 20 bonus points given based on the novelty of the project.

3.1 Evaluation of submitted material: 80 points + 20 bonus points

Proposal (10 points) and midterm report (10 points) For both of these, you will receive a grade of "satisfactory" or "unsatisfactory." "Satisfactory" will give your the full credit, whereas "unsatisfactory" will give you none. Normally, you will receive a "satisfactory" as long as you show that you have made enough effort. You will also receive comments and feedbacks that help you improve your project such as whether the chosen topic is appropriate (for proposals) and what additional work we expect from you (for midterm reports).

Peer review (10 points, midterm report only) We will make all the midterm reports available to everyone. You will be assigned to a report from another group and asked to provide anonymous comments. You will receive a grade of "satisfactory" (10 points) or "unsatisfactory" (0 point) for your completed review.

Final report (50 points) It will be evaluated in the following aspects:

- Effort (35 points):
  - For explorative projects: How challenging is the problem? How strong are the theoretical results? Are the numerical experiments, if needed, sufficient to support the theoretical results or demonstrate the effectiveness of the proposed method?
  - For surveys: How comprehensive is the topic? How well are the related work covered in the report? Are there enough illustrative examples to help understand the material?
- Writing (15 points):
  - Exposition: Is the problem or topic clearly described? Is the review of existing work comprehensive? Are the results clearly presented? Is the mathematical notation clear?
  - Grammar and formatting: Is it free of typos? Are citations given when appropriate? Does the report meet the formatting requirements?
- Novelty (bonus 20 points): Although we do not expect new and publishable results, we will give up to 20 bonus points if there is novelty in the results.

3.2 Evaluation of in-class presentation: 20 points

- Presentation (15 points): For explorative projects, you need to describe the problem and the main results (theoretical and/or experimental). For surveys, you need to describe the topic and some results that demonstrate why the topic is useful and/or interesting — imagine these examples as "teasers."
- Peer evaluation (5 points): You will be asked to fill out a survey form that reflect your evaluations of each presentation.

4 Academic Integrity

We treat academic integrity seriously. Any form of plagiarism will result a letter grade of F for the course. In particular, you are expected to give proper citations and use your own words in all the reports. We have access to automatic plagiarism checker software to detect duplication, so do not even risk it. Our standard will follow the section "Out expectations" on the following webpage:

`https://courses.engr.illinois.edu/cs374/sp2018/A/integrity.html`

Read the section carefully before writing. If you are ever in doubt, just ask!