# SI251 Convex Optimization
# Project

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- The project will be completed in **teams of 1 to 4 members**.
- Please register your topic on https://kdocs.cn/l/chQ4Dh1tzytw.
- If the paper you seek to reproduce is not included in the supplementary materials, you must send an email to inform instructors.
- For each paper, no more than 3 teams to reproduce it.
- The presentation is scheduled for Week 16, with the final report due in Week 17.

## Project Overview

In this project, you will explore advanced topics in optimization by engaging deeply with recent research papers. The goal is to enhance your understanding and ability to implement, analyze, and possibly extend current optimization techniques. This project will require you to select a paper, replicate its results, and develop incremental improvements or new insights related to the work.

## Project Requirements

1. **Paper Selection**:
   - You can choose from the list of papers provided in the accompanying folder, but for each paper, **no more than 3 teams** to reproduce it. Alternatively, you are encouraged to select a paper from reputable optimization journals or machine learning conferences published in recent years (after 2019), **but you must send an email to inform instructors**. Here are some recommended conference and journal:
     - (Mechine Learning) NeurIPS, ICLR, ICML, JMLR, TPAMI, etc.
     - (Operation Research) Operational Research, Mathmatical Programming, etc.
   - The topic of the paper should align with one or more of the following keywords or themes discussed in the course:
     - Optimal transport
     - Bi-level optimization
     - Implicit differentiation
     - Diffusion model
     - Federated learning
     - Smart predict-then-optimize

2. **Project requirement**:

   - **Replication (Basic Pass Score)**: You should successfully replicate the study presented in your chosen paper. This involves understanding, coding, and achieving similar results as those documented in the original work.
   - **Incremental Work (Higher Score)**: To achieve a higher grade, you are expected to make some original contribution. This could be an improvement on the existing methods, application to a new problem, or a novel insight or analysis. If the paper you selected has released its code, you will need to present more substantial work.

3. **Assessment Criteria**

   - **Replication Accuracy**: How closely your results match those of the original paper.
   - **Original Contribution**: The significance and relevance of any improvements or new insights you provide.
   - **Clarity and Quality of Presentation and Report**: How well you communicate your ideas and findings.

4. **Project Report**:

   - Submit a report of at least 4 pages, distinct from the original paper. It should detail your replication process, any incremental work, and present your results clearly.
   - The report should reflect a comprehensive understanding of the topic and document any new contributions made during the project.
   - The submission should use the NeurIPS 2024 template attached in the accompanying folder.

5. **Team Collaboration**:

   - Groups of 1-3 students are allowed. Collaboration within your group is essential, as all members will share the same grade. Contributions by all team members should be equitable, with no adjustments made for individual efforts.

**Hint: Use of Large Language Models (LLMs)**:

- You are permitted to use LLMs for assistance with coding, understanding concepts, or generating ideas.
- However, it is imperative that you critically evaluate and understand the output from LLMs. You are **responsible for the content and integrity** of the final submission.

This project is an opportunity to delve into the complexities of optimization, challenge your understanding, and contribute to the field. We look forward to your innovative approaches and solutions.