

EEL6812 Final Project - Guidelines

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March 11, 2024

1 Project Overview

The final project of our course EEL-6812 provides a unique opportunity to delve into a specific research topic within deep learning. The primary aim is to understand deep learning models and their training strategies, and apply these algorithms to solve some of the interesting applications. There is no strict rule in terms of selecting the topic, but some topics that may be of interest to you:

- **Robust deep learning:** Problems that typically affect the conventional application of deep neural networks, e.g., the presence of noisy labels, distribution shift between training data and test data. More advanced topics include fairness issues in deep neural network classifiers, adversarial attacks on deep learning models and so on. For your reference, see some survey papers and the references therein for some topics:
 - H. Song, M. Kim, D. Park, Y. Shin and J. -G. Lee, “Learning From Noisy Labels With Deep Neural Networks: A Survey,” in IEEE Transactions on Neural Networks and Learning Systems, vol. 34, no. 11, pp. 8135-8153, Nov. 2023
 - Mei Wang, Weihong Deng, “Deep visual domain adaptation: A survey”, Neurocomputing, Volume 312, 2018, Pages 135-153, ISSN 0925-2312,
- **Applications of deep learning in socially and environmentally impactful applications:** e.g., climate prediction, hyper-spectral imaging in remote sensing, medical image analysis and so on.
- **Applications of deep learning in wireless communications/wireless networks:** See some survey papers in this topic.
 - Q. Mao, F. Hu and Q. Hao, “Deep Learning for Intelligent Wireless Networks: A Comprehensive Survey,” in IEEE Communications Surveys & Tutorials, vol. 20, no. 4, pp. 2595-2621
 - L. Dai, R. Jiao, F. Adachi, H. V. Poor and L. Hanzo, “Deep Learning for Wireless Communications: An Emerging Interdisciplinary Paradigm,” in IEEE Wireless Communications, vol. 27, no. 4, pp. 133-139, August 2020
- **Any other interesting and relevant application of deep learning:** For inspiration, you can take a look at the recent publications in top AI conferences such as NeurIPS, ICML, ICLR, CVPR etc.

Key dates for the final project are as follows:

1. **Initial Project Idea and Group** (Points 5): Due by 11.59 PM on March 28, 2024
2. **Project Proposal Presentation** (Points 10): April 5, 2024 10.30AM-1.20PM (in-class) at BA1 O216A and via zoom for students who registered for the remote session
3. **Final Report Submission** (Points 30): Due by 11.59 PM on April 29, 2024

2 Initial Project Idea and Group

Student should form a group of three and submit an initial idea of the project for review. Only one member per group needs to submit. Considering the volume of the work, I strongly advise you to form groups of three, collaborate, and produce quality project submissions.

Initial project idea must include the following details:

- Who is on the team?
- A tentative title for the project
- Brief description of project goals and proposed methods
- Reference to at least 3 related works

Submit this in pdf format in webcourse page (preferably latex generated pdf; word file converted to pdf is also accepted). Only one team member need to submit this pdf. The due date for the submission is 11.59 PM on March 28, 2024. No late submissions are accepted.

3 Project Proposal Presentation

The students are expected to make a presentation (no longer than 10 minutes) to convey the key idea of their project. The presentations should include content to address the following questions:

- **What is your project about?** Describe your goals without using many technical terms. Imagine explaining your project to someone unfamiliar with machine learning.
- **How is this done currently, and what are its limitations?** Describe at least three related works and understand their limitations with technical details.
- **What is innovative about your approach, and why do you believe it will succeed?** Explain what is unique about your work. How does it differ from existing methods, and why do you think it will be more effective?
- **What are the challenges, and how long will it take?** Provide a timeline for your project and identify the most challenging parts of the proposed approach.
- **How do you evaluate your approach?** Which dataset or experiment will you use? What metrics will you employ?

The presentations will be evaluated based on

- Overall quality of the presentation materials including well-represented figures or tables
- Clarity of presentation delivery with convincing details about the proposed method and technical correctness

The project proposal presentation will be held on April 5, 2024 10:30AM-1:20 PM (in-class) at BA1 O216A. Students who registered in the remote session can join via zoom. The proposal slides should be uploaded in webcourse page after the presentation.

4 Final Report

Each team should submit a final report (latex generated pdf; no other format is allowed) of the project through webcourse page. Only one team member need to submit the report and make sure all the team members' names are shown in author list of paper.

Report Format: The format/template for the report can be downloaded by clicking here or copy and paste the following link to your browser: <https://media.icml.cc/Conferences/ICML2024/Styles/icml2024.zip>. The students must use the template provided. Any report which do not use the posted template will not be evaluated. The report should look similar to a publishable paper, having a title, an introduction about the topic you worked on and the background of your work, discussing related works, technical approach including the mathematical formulations/optimization problem, an experiment section consisting of experiment design and experiment results, and finally a section on conclusion and future work. You should also cite the list of references you used.

The grading of the final report will be based on clarity (5 points) and intellectual merit (25 points)

Clarity. For clarity, clear descriptions of the problems, mathematical formulations, methods, experimental settings, and results are expected. To accomplish this clarity, the final report must be at least 4 pages long (3 full page write up and in the fourth page, you can present the references) and cannot be more than 8 pages (including appendices, figures, references, and everything else you choose to submit).

Intellectual Merit An ideal report should be a nearly publishable piece of work. I strongly encourage you to continue developing your final project beyond EEL6812 and consider submitting it to a suitable conference or journal. The final report will be evaluated based on several criteria:

- **Effort:** Did the team approach the project seriously, obtain results, and make improvements to their technical approach if initial attempts failed? Were the teams actively engaged and able to convey novel insights about their projects? Do the strategies attempted make sense?
- **Significance:** Did the authors select an interesting or real problem to address, rather than just a small, trivial problem? Is the work likely to be useful and impactful?
- **Novelty:** While groundbreaking novelty is not necessary, the best final projects should offer a slightly different perspective from anything previously published. Just executing the code of an existing work without changing anything will result in considerable score reduction. The evaluation criteria is roughly detailed as follows:
 - Points 25-23: Projects that make significant, novel, nearly publishable deep learning approach
 - Points 22-20: Projects that are well-executed for complex problems but do not lead to significant contribution with limited novelty.
 - Points 19-17: Not so well-executed with a straight-forward application of an exiting deep learning method
 - Points 17-0: Poorly executed with lack of technical understanding of deep learning or just copied an existing approach and their implementation

The final report submission is due by 11.59 PM on April 29, 2024. No late submissions are accepted.