



**Deep Learning  
Final Project  
March 10, 2025  
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## Final Project

The objective of the final project is to apply what you have learned in this course to a real world problem – a problem in your area of interest. You can apply any deep learning network to the problem, and you can use either TensorFlow or PyTorch for training and inference. You can work on teams of up to 3 people, but each person must contribute substantially to the work. If you work on a team, you will submit both a Group Report and Individual Reports at the end of the semester. If you would like to work on a team and don't have a teammate, let me know.

## Potential Topics

Here are some potential topics that you can choose for your final project. (This list is not complete.)

- **Computer Vision** (Image classification, object detection, image segmentation, image generation, style transfer, super-resolution, facial recognition, pose estimation, emotion recognition, ...)
- **Sequence Processing** (Speech recognition, speaker identification, audio classification, DNA analysis, sound event detection, stock prediction, music generation, text to speech, source separation, ...)
- **Natural Language Processing** (Text classification, machine translation, summarization, question answering, information extraction, speech recognition, text generation, sentiment analysis, ...)
- **Tabular Data** (Fraud detection, disease diagnosis, equipment failure detection, recommender systems, imputation, multi-task learning, dimensionality reduction, clustering, sales forecasting, ...)

Here are some websites for trending research and datasets.

Trending Research

<https://paperswithcode.com/>

Dataset Search

<https://datasetsearch.research.google.com/>

# 1 Deliverables

## 1.1 Proposal

Contact me as soon as possible after you decide whether you will be working in a group or as an individual. If you want to work in a group, and have a group in mind, send me everyone's name. If you want to work in a group, but do not have a group in mind, send me your name. After I have approved your group, or if you have told me you are working individually, you can proceed to the next step.

After you have selected a topic, a network, and a data set, submit a proposal of what you plan to do for the project. The proposal should be a few hundred words, and should address the following items.

- What problem did you select and why did you select it?
- What database/dataset will you use? Is it large enough to train a deep network?
- What deep network will you use? Will it be a standard form of the network, or will you have to customize it?
- What framework will you use to implement the network? Why?
- What reference materials will you use to obtain sufficient background on applying the chosen network to the specific problem that you selected?
- How will you judge the performance of the network? What metrics will you use?
- Provide a rough schedule for completing the project.

## 1.2 Presentation

You will give a 15 to 20 minute presentation (including 5 minutes to respond to questions) of your final project during the regular class periods on April 29 or May 1 (and, if necessary, during the Final Exam time on May 6 from 2:00-3:50pm). If you work in a group, the presentation will be prepared by the group. Each team member will give part of the presentation, and each team member will answer questions.

## 1.3 Final Report

If you are working in a group, there will be a Group Final Report as well as Final Reports for each individual. (The Individual Reports for group members are described in a later section of this document.) If you are working individually, then there will be one report.

1. Introduction. An overview of the project and an outline of the report.
2. Project schedule. Provide an overview of your project schedule, including dates when tasks were started and completed and who they were assigned to. Use the project management features of GitHub to provide charts.
3. Description of the data set.

4. Description of the deep learning network and training algorithm. Provide some background information on the development of the algorithm and include necessary equations and figures.
5. Experimental setup. Describe how you used the data to train and test the network. Explain how you implemented the network in the chosen framework and how you judged the performance. How did you determine batch size? How did you determine training parameters (e.g., learning rate)? How did you detect/prevent overfitting, extrapolation, data imbalance? What type of data augmentation did you use? Describe your data loader.
6. Results. Describe the results of your experiments, using figures and tables wherever possible. Include all results (including all figures and tables) in the main body of the report, not in appendices. Provide an explanation of each figure and table that you include. Your discussions in this section will be the most important part of the report.
7. Summary and conclusions. Summarize the results you obtained, explain what you have learned, and suggest improvements that could be made in the future.
8. References. In addition to references used for background information or for the written portion, you should provide the links to the websites or github repos you borrowed code from.
9. A separate appendix should contain documented computer listings (code).

## **1.4 Individual Final Report for Group Members**

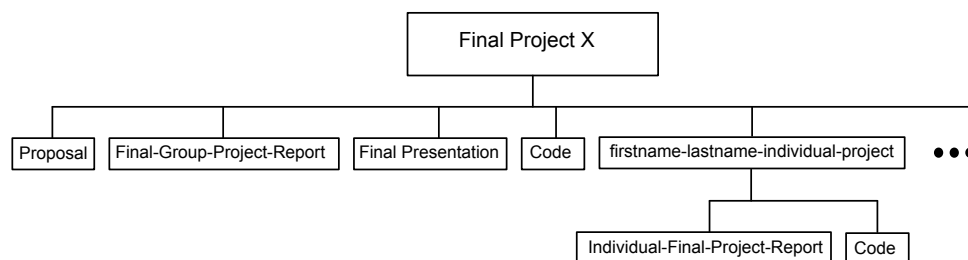
For those working on a Group Project, you will also submit Individual Final Reports. It will be similar to the Group Report, but it will be shorter and will focus on the specific tasks that the individual performed. There can be some segments that are included in both the Group and some Individual Reports.

1. Introduction. An overview of the project and an outline of the shared work.
2. Description of your individual work. Provide some background information on the development of the algorithm and include necessary equations and figures.
3. Describe the portion of the work that you did on the project in detail. It can be doing training, doing pre-processing, creating figures, writing code, providing explanations, developing algorithms etc.
4. Results. Describe the results of your experiments, using figures and tables wherever possible. Include all results (including all figures and tables) in the main body of the report, not in appendices. Provide an explanation of each figure and table that you include. Your discussions in this section will be the most important part of the report.
5. Summary and conclusions. Summarize the results you obtained, explain what you have learned, and suggest improvements that could be made in the future.
6. References.

## 2 Method for Delivery

You will use a GitHub repository for all of your code and reports. You will share your repository with me, so that I can clone the repository and download reports and/or code and follow your progress. You will use the **project management** (<https://docs.github.com/en/issues/planning-and-tracking-with-projects>) features of GitHub to plan your project and share milestones. The following describes how you will set up your GitHub repository.

- Make the following folders: **Proposal**, **Final-Group-Project-Report**, **Final-Presentation**, **Code**.
- If yours is a group project, also make folders titled **firstname-lastname-individual-project** for each member of the group. Inside each of these folders place two folders titled **Individual-Final-Project-Report** and **Code**.
- Create a GitHub repository for the project and name it **Final-Project-X** where X is your project number (If it is a group project, one member will create the repository, and the rest of the group members can be added in as collaborators. Fork it, so you only need one repo for the project). Then, push the folders described in the previous two items into the repository that you created. You should have a markdown file (README.md) that explains the structure of the repository and how it works. Make it as clear as possible. The GitHub repository should have the following structure.



- Write your final proposal and save it as a PDF file. Place the proposal in the **Proposal** Folder and push it to your GitHub repo. At this time you will post your GitHub repo link to canvas so that I can clone your repo. (March 27)
- Save all of your code for the final project in the upper level **Code** folder and push them regularly to your GitHub repo. For example, if you write different code for different parts of the project, give them descriptive names and write a **README** file that describes how to use them. This **README** file should explain what order the code needs to be run in (e.g., code to fetch data should be run first, then code to preprocess, and then modeling, etc.) and a short description of what each script does. (This applies to the top level Code folder, which contains all of the code used for the project. If it is a group project, there are also individual Code folders, which contain only the code written by one individual. The code in the individual Code folders will also appear in the top level Code folder.)
- Create a presentation document (for example, using powerpoint) for your group presentation. Save the presentation as a PDF file and move it to the **Final-Presentation** folder and push it to your GitHub repo. (May 1)

- Write your final group project report and save it as a PDF file. Move it to the [Final-Project-Report](#) folder and push it to your GitHub repo. (May 6)
- If you are in a group project, write your individual project report, save it as a PDF file with the name [firstname-lastname-final-report.pdf](#) in the folder [Individual-Final-Project-Report](#). Also, put your individual code in the Code folder under [firstname-lastname-individual-project](#). (May 6)

### 3 Grading

The final project will be worth 25% of your course grade. The final project grade will be made up of two equal parts.

- The first half of the final project grade will come from your technical reports and working code.
- The second half of the final project grade will come from your presentation and your answers to oral questions following the presentation.
- For group projects, each team member will have their own final report and code contributions (as described above), in addition to the group report.
- In addition, each team member will speak during the Oral Presentations and each team member will answer questions during the presentations.
- Online students who are available during class time will give their oral presentations to the class through zoom link. For online students who are not available during class time, another suitable time will be arranged for a live zoom presentation.

### 4 Full Schedule

Date	Item
03/11/25	Project description in Canvas
03/27/25	Proposal Due (GitHub link posted to Canvas.)
04/29/25	Oral presentations – First Day
05/01/25	Oral presentations – Second Day
05/06/25	Oral presentations – Third Day (if needed)
05/06/25	Final reports due