

ECE NTUA Machine Learning

Final Report Guidelines

1 Abstract [\approx 1 paragraph]

The abstract is optional, depending on your available space. It should consist of 1 paragraph consisting of the motivation for your paper and a high-level explanation of the methodology you used/results obtained.

2 Introduction [\approx 1 page]

Explain the problem and why it is important. Discuss your motivation for pursuing this problem. Give some background if necessary. Clearly state what the input and output is. Be very explicit: “The input to our algorithm is an {image, amplitude, patient age, rainfall measurements, grayscale video, etc.}. We then use a {SVM, neural network, linear regression, etc.} to output a predicted {age, stock price, cancer type, music genre, etc.}.” This is very important since different teams have different inputs/outputs spanning different application domains. Being explicit about this makes it easier for readers.

3 Related work [\approx 1/2 page]

You should find existing papers, group them into categories based on their approaches, and discuss their strengths and weaknesses, as well as how they are similar to and differ from your work. In your opinion, which approaches were clever/good? What is the state-of-the-art? Do most people perform the task by hand? You should aim to have at least 5 references in the related work. Include previous attempts by others at your problem, previous technical methods, or previous learning algorithms. Google Scholar is very useful for this: <https://scholar.google.com/> (you can click “cite” and it generates MLA, APA, BibTeX, etc.)

4 Dataset and Features [≈ 1 page]

Describe your dataset: how many training/validation/test examples do you have? Is there any preprocessing you did? What about normalization or data augmentation? What is the resolution of your images? How is your time-series data discretized? Include a citation on where you obtained your dataset from. Depending on available space, show some examples from your dataset. You should also talk about the features you used. If you extracted features using Fourier transforms, word2vec, histogram of oriented gradients (HOG), PCA, ICA, etc. make sure to talk about it. Try to include examples of your data in the report (e.g. include an image, show a waveform, etc.).

5 Methods [≈ 2 pages]

Describe your learning algorithms, proposed algorithm(s), or theoretical proof(s). Make sure to include relevant mathematical notation. For example, you can briefly include the SVM optimization objective/formula or say what the softmax function is. It is okay to use formulas from the lecture notes. For each algorithm, give a short description (≈ 1 paragraph) of how it works. Again, we are looking for your understanding of how these machine learning algorithms work. Although the teaching staff probably know the algorithms, future readers may not. Additionally, if you are using a niche or cutting-edge algorithm (e.g. long short-term memory, SURF features, or anything else not covered in the class), you may want to explain your algorithm using $1/2$ paragraphs.

6 Experiments/Results/Discussion [$\approx 2 - 4$ pages]

You should also give details about what (hyper)parameters you chose (e.g. why did you use X learning rate for gradient descent, what was your mini-batch size and why) and how you chose them. Did you do cross-validation, if so, how many folds? Before you list your results, make sure to list and explain what your primary metrics are: accuracy, precision, AUC, etc. Provide equations for the metrics if necessary. For results, you want to have a mixture of tables and plots. If you are solving a classification problem, you should include a confusion matrix or AUC/AUPRC curves. Include performance metrics such as precision, recall, and accuracy. For regression problems, state the average error. You should have both quantitative and qualitative results. To reiterate, you must have both quantitative and qualitative results! This includes also unsupervised learning. Include visualizations of results, heatmaps, examples of where your algorithm failed and a discussion of why certain algorithms failed or succeeded. In addition, explain whether you think you have overfit to your training set and what, if anything, you did to mitigate that.

Make sure to discuss the figures/tables in your main text throughout this section. Your plots should include legends, axis labels, and have font sizes that are legible when printed.

7 Conclusion/Future Work [\approx 2 paragraphs]

Summarize your report and reiterate key points. Which algorithms were the highest-performing? Why do you think that some algorithms worked better than others? For future work, if you had more time, more team members, or more computational resources, what would you explore?

8 References/Bibliography (No page limit)

This section should include citations for: (1) Any papers mentioned in the related work section. (2) Papers describing algorithms that you used which were not covered in class. (3) Code or libraries you downloaded and used. This includes libraries such as scikit-learn, Matlab toolboxes, Tensorflow, etc. Acceptable formats include: MLA, APA, IEEE. If you do not use one of these formats, each reference entry must include the following (preferably in this order): author(s), title, conference/journal, publisher, year. If you are using TeX, you can use any bibliography format which includes the items mentioned above. Main body text, figures, and any discussions are strictly forbidden from this section. We are excluding the references section from the page limit to encourage students to perform a thorough literature review/related work section without being space-penalized if they include more references.