EEE 443/543 Neural Networks: Final Project

(Due 05/01/2021, 17:00PM)

General Instructions

Groups: You are expected to form groups of **4** students. If necessary you may also form groups of two or work individually, but note that the same breadth and depth of work will be expected regardless of the number of group members. Groups can include both graduate and undergraduate members. Once you form your group, **you have to send an email to your TA (Salman Dar) that lists the names of group members by 16 October 2020**. **The title of the email should be *Neural Networks Fall 20/21 Project Group*. Students who have not sent an email by this deadline will be randomly matched. In any case, you won't be allowed to change your preferences later.**

Project: For training and validation of the neural network architectures, we will post on Moodle one or more datasets to choose from. Each group will use a single dataset available for their project. Please note that you are not allowed to choose alternative datasets for this assignment.

Important remarks:

(a) You have to implement the neural networks in a popular deep learning framework (e.g., TensorFlow, PyTorch etc).

(b) Since the libraries available in the abovementioned frameworks will facilitate your work, you are expected to experiment with many different state-of-the-art network architectures (e.g., do NOT simply come back to us with a multi-layer feed-forward network or a bare-bones CNN).

(c) Any network architecture and training algorithm described in class or discussed in literature can be used.

(d) Your projects will be evaluated based on the complexity of the chosen methods, their fit to the problem, and their performance.

(e) If a group member decides to withdraw from the course, remaining members will continue the project according to the original plan.

(f) Collaboration and code sharing among separate groups are prohibited.

Final Report (10 pages + appendix, 25% pts): After the project is completed, a final report must be prepared by each group to describe in detail the following information:

(a) Information about the dataset.

(b) Detailed description of the tasks (e.g., classification, regression, etc.).

(c) Simulation setup (e.g., how was the data split for training/validation? how many layers in the network? how many neurons in each layer? learning rate? etc.).

(d) Training methods and training times for neural networks.

(e) Figures that illustrate the network performance at different stages (i.e., training, validation).

(f) A critical discussion of the implemented networks, noting both advantages and disadvantages.

(g) Discussion of changes to the project based on feedback provided on the Preliminary Report.

(h) An appendix section that contains all code used during the project.

The deadline for the Final Report is 5 January 2021, 17:00PM. No late submissions will be allowed.

Report Preparation

1. Each report should be typeset, **no handwriting is allowed**.
2. Each report must be uploaded to Moodle.
3. **A single PDF file** should be submitted titled `'name_lastname_studentid_prelim.pdf'` (for the preliminary report) and `'name_lastname_studentid_final.pdf'` (for the final report).
4. Each report should contain the following sections clearly separated with headings: **Abstract/Introduction/Methods/Results/Discussion/References**.
5. The final report should also contain an Appendix section containing all of your code.

Abstract: A one-paragraph summary of all major aspects of your report from Introduction to Discussion. No references should be given, and the abstract should be self-contained.

Introduction: Establish the topics under study by briefly overviewing the existing literature. State the purpose of your work, and why it is an interesting/important question to tackle. Explain the methodology that you will be using to address these questions, and what outcomes are expected as a result of your efforts.

Methods: Explain the data that you will be examining. If working on an experimental dataset, you should describe the experiment that was used to collect the data. If working on a simulated dataset, you should describe the conditions under which the simulation takes place. Describe all qualitative/quantitative analyses used to examine the data. If parameter/model selection is necessary in the analysis routines used, clearly state the motivation for the specific set of parameters/models selected. The methods section should be fully referenced, and should contain subheadings for explaining different methods/analyses.

Results: Present your key results, illustrate your outputs visually with the help of figures and tables. Detailed numbers/plots should be provided in illustrations, and each figure or table should contain a paragraph-long, self-contained caption that explain the contents. Information presented in a table or a figure should not be covered at a microscopic level in the main text, but figures/tables should be referenced in appropriate sections and the main trends/results should be stated in the text. Statistical significance of any measurement should be reported along with the effect size.

Discussion: Interpret your results in light of previous work on the project topic. Did you run any new analyses on existing data? If so, did these analyses tell you anything new about neural structure or function beyond current knowledge? Did you apply advanced analyses on new, real-life datasets? If so, what structure did you recover from these datasets compared to other datasets? Which parts of your analyses worked, and which failed? What could you do to improve your results? Did you reach the goals that you set out in the Introduction? Did your work produce the expected outcome?

References: A list of all referenced material formatted according to standard conventions used in journals. Crude, unformatted lists are not acceptable.