CS F425 Deep Learning: Lab Assignment 1

Department of Comp. Sc., BITS Pilani, Goa Campus

September 18, 2021

1 Logistics

1.1 Groups

This assignment is to be completed in groups. Please fill in your group details in this sheet. Maximum group size is 3.

1.2 Deadline

11:59PM IST on Saturday 25th September 2021.

1.3 Submission

The link for the submission will be put up on Google Classroom. Please make only one submission per team. The names, BITS ID and contributions of each team member must be mentioned in the submitted Jupyter Notebook.

2 Background

Skip Connections are extra connections between layers of a Neural Network to skip one or more layers of non linear processing and connect to layers further up the network, allowing for information to flow more easily up the network to improve the performance and convergence of deep neural networks.
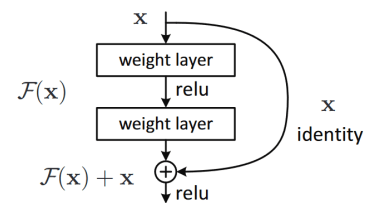

Figure 1: Simple type of skip connection over two layers

3 Problem Statement

In this assignment we will explore the impact of Skip Connections in Multi Layer Perceptron networks. Your tasks are to -

1. Compare the performance of MLPs with skip connections to those without skip connections.

2. Analyse multiple different types of skip connections (at least 2) and compare their performance.

3. Perform ablation studies over different (at least 2) characteristics of skip connections (e.g. number of layers skipped) to see how this effects performance.

4. BONUS: Attempt to explain, through an experiment of your own, why Skip Connections help or hurt.

For training and performance evaluation in the above tasks use both CIFAR-10 and MNIST. Both of these datasets are easily available as part of common Deep Learning frameworks such as PyTorch or Tensorflow so no need to download then separately.

You are required to make your submission in the form of a Jupyter Notebook on Google Colaboratory, Kaggle or similar notebook hosting platforms. Since you are only required to a single notebook (and not any additional reports), please make full use of the Jupyter Notebook format by including thorough explanations, figures, plots and an appropriate commentary to your code. The notebook satisfy the following -

- Contain your implementations for the models and experiments required for the given 3 tasks.

- Contain explanations of how and why you have performed various experiments as well as thorough and theory driven analysis of the results.

- Be self complete - it should be runnable by any third party without requiring modifications.

While you are free to use the DL framework of your choice for building models and performing experiments, we expect you to keep the use of 3rd party libraries to a minimum. All models must strictly be implemented from scratch by your group in the DL framework you are using. If you are unsure of which framework to use we recommend PyTorch which is being taught and used in the course labs.

4 Evaluation

This assignment counts for 10% (10 marks) towards your final grade. You will be evaluated based on the following:

- Quality of code and whether it successfully executes.

- To what extent you have examined the central idea (Skip Connections in MLPs) through building models and experimentation.

- How you make use of theory taught in class to motivate and design your experiments.

- How well you present your results and analysis both in terms of technical depth and aesthetic. (Hint: think about why Skip Connections are important)

All code, models and analysis must be your own. No stealing from GitHub. Any kind of plagiarism is strictly prohibited. If these rules are broken, no marks will be awarded to the entire team.