Assignment - 1

Submission Deadline: 11:59 PM, 29th January 2023

Submission Policy and Requirements :

- Any kind of plagiarism is not accepted. We will strictly follow institute policies for plagiarism
- Programming languages and framework allowed: Python + PyTorch (use of Tensorflow will attract no marks)
- Do cite references (if using any)
- Submissions should include a working code (with readme) for the questions asked, a report to show the analysis of results in each of the parts, and a video demonstration indicating the functional codes.
- Submission of the report is mandatory.

Assessment criterion:

The assessment will be done on the basis of the following components:

- Working codes
- Analysis and clarity of results (drawing comparisons across different parts) & clarity of the report
- Understanding the theoretical concepts and the choice of hyperparameters

Guidelines for Submission:

- A single report(pdf) for all questions
- Mention all the relevant results and comparisons as asked or wherever required for a better understanding of the results
- A single zip file containing the report, codes, video demonstration of working codes, and readme
- Name the file with roll number, for example, Roll_Number_PA1.zip

---

Question 01 [50 marks] :

Implement a neural network and utilize the CIFAR-10 dataset for the analysis.

1. Utilize various activation functions like sigmoid, tanh and critique the performance in each case.
2. Increase the depth of the given network by adding more Fully-Connected layers till the point you encounter the vanishing gradient problem. With the help of the results, mention how to identify it.
3. Suggest and implement methods to overcome the above problem.

Question 02 [50 marks] :

Implement a neural network on the Gurmukhi dataset and implement the following regularization techniques from scratch:

1. L-1 regularization
2. L-2 regularization

3. Dropout

Compare the performance of the above techniques and mention reasons to support your answer. You are free to utilize PyTorch's inbuilt functions for implementing activation and loss functions. However, various regularization techniques must be implemented from scratch without the support of any library.

Also, implement gradient checking (from scratch) to verify the values of gradients during backpropagation.

(refer to this hint for gradient checking)