

Minor - 2

Submission Deadline: 11:59 PM, 28th March 2023

Instructions:

Submission Policy and Requirements :

- You can use whatever resources you want but you should not discuss with any living being in any manner whatsoever (except the Course Instructor).
- We will perform a plagiarism check on your submission. Any case of violation would call for an action as per the institute policies.
- Programming languages and framework allowed: Python + PyTorch (use of Tensorflow will fetch no marks)
- Do cite references (if 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 (not given in the paper).
- List down the hyperparameters that are fit to you as per your details (see the question for more details).

Guidelines for Submission:

- A single report (in 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: <Roll_Number_minor2.zip>
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Minor - 2

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Question 01 [75 marks] :

Let your date of birth be DD/MM/YY. Let the last three digits of your roll number at IITJ is ABC. Finally, let your first name be FIRST and last name be LAST. And your program will be PROG.

- Train Student-Teacher model with the following details.

Dataset details

- For **B.Tech** students:
 - CIFAR10 dataset if ABC is even; SVHN otherwise.
- For **M.Tech/PhD** students:
 - TinyImageNet dataset

Weight Initialization:

- Xavier initialization if MM is even; He initialization otherwise.

Pooling Operation Details:

- AvgPool if MM is even; MaxPool otherwise.

Model Details:

- For **B.Tech** students:
 - Teacher Network layers:
 - If last digit of ABC is less than 6:
 - If ABC is even, your network should have 7 conv layers and 1 pool layer.
 - If ABC is odd, your network should have 8 conv layers and 1 pool layers.
 - If last digit of ABC is greater than or equal to 6:
 - Your network should have 10 conv layers and 1 pooling layer.
 - If ABC is even, your network will have 6 filters in the first layer.
 - If ABC is odd, your network will have 8 filters in the first layer.
 - Student Network:
 - If DD is even then student network is 2 conv layers + 1 pool layer
 - Else 3 conv layers + 1 pool layer
 - Fully-Connected layers (in both teacher and student networks):
 - If the sum of digits of ABC is even, your network should have 1 FC layer with 512 nodes.

Minor - 2

Submission Deadline: 11:59 PM, 28th March 2023

- If the sum of digits of ABC is odd, your network should have 1 FC layer with 256 nodes.
- For **M.Tech/PhD** students:
 - Teacher Network layers:
 - If ABC is even, your network should have 10 conv layers and 2 pool layers.
 - If ABC is odd, your network should have 12 conv layers and 1 pool layer.
 - If ABC is even, your network will have 8 filters in the first layer.
 - If ABC is odd, your network will have 12 filters in the first layer.
 - Student Network:
 - If DD is even then student network is 3 conv layers + 1 pool layer
 - Else 4 conv layers + 1 pool layer
 - Fully-Connected layers (in both teacher and student networks):
 - If the sum of digits of ABC is even, your network should have 1 FC layer with 1024 nodes.
 - If the sum of digits of ABC is odd, your network should have 1 FC layer with 512 nodes.

Report the performance of the student network and compare it with the teacher model. Also compare the performance with and without EMA (Exponential Moving Average) updates.

Question 02 [25+25 = 50 marks] :

Suppose your instructor is working on creating a question set for the DL course. Since we have finished $\frac{2}{3}$ of the DL course so far, your instructor wants your help in creating an interesting question.

- (a) Based on all the topics we have studied, design 3 interesting and challenging DL questions (Min. 1 question numerical and Min. 1 question theoretical). Simple questions and textbook questions are not allowed.
- (b) Run ChatGPT and obtain the answers to your questions. Justify that the answer produced by ChatGPT is correct.