

# DAI Programming Assignment - 3

## Federated Learning

**Deadline:** 26-04-2023

**Max. Marks:** 100

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### Assignment Guidelines

1. Any kind of plagiarism is not accepted. We will strictly follow institute policies for plagiarism.
2. Recommended programming languages: Python + PyTorch.
3. You may use any external libraries or GitHub codes. However, the evaluation will test your knowledge of the algorithm and the choice of hyperparameters. Do cite the libraries/codes.

### Assessment criterion

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

1. Working codes
2. Analysis and clarity of results (drawing comparisons across different parts) and clarity of the report.
3. Understanding the theoretical concepts and the choice of hyperparameters.

### Submission Guidelines

1. A single report(.pdf) for all questions.
  2. Mention all the relevant results, comparisons as asked or wherever required for better understanding for the results.
  3. A single zip file containing the report, codes and readme if required. The zip file should be named as **Rollno\_PA3.zip**.
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## Q1. Federated Learning

Implement any federated learning algorithm of your choice using **Pytorch** with MNIST dataset on first client model, Coloured MNIST dataset on second client model, and SVHN dataset on third client model. Take 10,000 samples (i.e., 1000 per class) for each dataset in training set on their respective client and 5000 (i.e., 500 per class) samples of each dataset for a test set.

- A. Perform (0-9) digit classification task using federated setup by performing aggregation at the central server. **[20 Marks]**
- B. Report the class-wise accuracy results for all three datasets at their respective client side and at the central server also. Report overall classification Accuracy and Confusion Matrix. **[20 Marks]**
- C. Write the mathematical explanation of the function used to perform the aggregation at the central server. **[20 Marks]**
- D. Write the detailed explanation of the federated learning algorithm with the diagrammatic representation used for the above solution. **[20 Marks]**
- E. Compare the results of overall accuracy in federated setup with the baseline results calculated by combining all the datasets and training in non-federated setup. Do you observe any decrease/increase in accuracy for both the setups? State your answer with proper reasoning. **[20 Marks]**

**OR**

Implement any federated learning algorithm of your choice using **FedML library** with SVHN dataset distributed on three clients.

- A. Perform (0-9) digit classification task using federated setup by performing aggregation at the central server. **[20 Marks]**
  - B. Report the class-wise accuracy results at each client side and at the central server also. Report overall classification Accuracy and Confusion Matrix. **[20 Marks]**
  - C. Write the mathematical explanation of the function used to perform the aggregation at the central server. **[20 Marks]**
  - D. Write the detailed explanation of the federated learning algorithm with the diagrammatic representation used for the above solution. **[20 Marks]**
  - E. Compare the results of overall accuracy in federated setup with the baseline results calculated by combining all of the dataset and training in non-federated setup. Do you observe any decrease/increase in accuracy for both the setups? State your answer with proper reasoning. **[20 Marks]**
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