# Assignment 3 - Multi Layer Perceptron + Backpropagation

Neural Networks

Due date: 11-11-2024

## Homework - 30 points

Implement a Multi Layer Perceptron (MLP) and the Backpropagation algorithm using NumPy operations. The MLP architecture should consist of 784 input neurons, 100 hidden neurons, and 10 output neurons. Use the MNIST dataset to evaluate your implementation. Measure the accuracy for both training and validation. The tasks for this assignment and their respective points are as follows:

1. Implement forward propagation. **(1 points)**
2. Implement the backpropagation algorithm using the chain rule. Refer to the provided resources. **(15 points implementation + explanation)**
3. Utilize batched operations for enhanced efficiency. **(4 points)**
4. You must achieve at least 95% accuracy on the validation split of the MNIST dataset, in 5-6 minutes. **(5 points)**
5. Choose one: **(5 points)**
   (a) Implement dropout on the hidden layer.
   (b) Implement L1 or L2 regularization.
   (c) Create a dynamic learning rate scheduler that decays the learning rate when training metrics reach a plateau.

Things you may try to improve the accuracy:

- Weight initialization
- Changing the learning rate
- Normalizing and shuffling the training data
- Dropout and other forms of regularization

**Bonus** : Strive for higher accuracy (not graded, but always try to be better).