# PA 2 - Feed Forward Neural Networks

Due Feb 24 11:59 PM

## Overview

In this assignment you will implement a basic feed-forward neural network from scratch and train it to recognize handwritten digits from the classical MNIST dataset. All graded tasks are marked with TODO comments in PA2_starter.ipynb

## Learning Goals

- Implement basic feed forward neural network (structure, forward and backwards passes, etc.)
- Implement utility functions e.g. loss functions, accuracy, etc.
- Train a basic FFNN to classify image classifiers.
- Create a custom model to improve performance.

## Allowed Libraries

- No machine learning packages e.g. Sci-kit Learn, Pytorch, etc. for FFNN implementation.

## Deliverables

- Submit PA2_starter.ipynb with all TODOs completed.
- Do not rename the notebook (the autograder expects this filename).

## Point Distribution (100 points)

**Part 1: Value Nodes and Computational Graph (0 points)**

**Part 2: Operations — Forward and Backward (15 points)**

**Part 3: Softmax and Building the MLP (30 points)**

**Part 4: Loss Functions (5 points)**

**Part 5: Backpropagation (0 points)**

**Part 6: Training on MNIST (50 points)**

**Part 7: (Extra credit) Softmax and Building the MLP (20 points)**

## Notes

- Some functions are already provided (e.g. the main backwards pass, create_value, etc.)
- The baseline model takes around 10 minutes to run. (2 minutes per epoch)
- Limit the size of your custom model as training may take a while.

## Submission Checklist

- All TODOs are implemented.
- Notebook runs end-to-end without errors.
- You did not change function signatures.

## Tips

- Submit each part as you go, as previous functions are used in latter parts.
- Don't wait till the last minute, training the model takes time!