

QHM6702 Deep Learning with Neural Networks

Deep Learning for Fashion-MNIST Classification with Transfer Learning

Coursework 15%

Group Project

2024/2025

Deadline: 31st of May 2025 at 23:59GMT

1 Objective:

The goal of this project is to develop and evaluate a deep learning model for classifying images from the Fashion-MNIST dataset. Students will build a custom neural network and compare its performance with at least two pre-trained models using transfer learning.

2 Dataset Overview:

- The Fashion-MNIST dataset consists of grayscale images (28x28 pixels) belonging to 10 categories.
- Training set: 60,000 images (6,000 per category).
- Test set: 10,000 images (1,000 per category).
- The test dataset must be used strictly for evaluation and not for training.

3 Project Requirements:

3.1 Custom Model Development

- Design and implement a deep learning model using PyTorch or TensorFlow/Keras.
- Optimize hyperparameters such as number of layers, activation functions, and learning rate.

3.2 Transfer Learning Comparison

- Use at least two pre-trained models (e.g., VGG16, ResNet50, MobileNet, or EfficientNet) for comparison.
- Implement transfer learning by fine-tuning these models on Fashion-MNIST.

3.3 Performance Evaluation

- Compare the custom model with transfer learning models.
- Plot training and validation accuracy/loss curves.

4 Group Formation:

- The project is to be completed in groups of three students.
- Each group is responsible for only one submission.

5 Deliverables:

5.1 Code Submission

- A Python script or Jupyter Notebook containing the implementation.
- Clearly commented code explaining each step.

5.2 Video Presentation

- A recorded video (5-10 minutes) where students present their methodology, results, and findings.
- The video should capture the computer screen and include a verbal explanation.

6 Submission Guidelines:

- Submit the Jupyter Notebook/Python script and the recorded video as a single ZIP file.
- Only one submission per group.
- The deadline for submission is 31st May of 2025 at 23:59GMT.

7 Assessment Criteria:

- Correct implementation of the neural network and transfer learning models (40%)
- Comparison and evaluation of models using appropriate metrics (30%)
- Clarity and structure of code (15%)
- Quality of the video presentation (15%)

8 Resources:

- Fashion-MNIST Dataset: [https://pytorch.org/vision/0.19/generated/torchvision.datasets.FashionMNIST.h](https://pytorch.org/vision/0.19/generated/torchvision.datasets.FashionMNIST.html)
- TensorFlow/Keras: <https://www.tensorflow.org/>
- PyTorch: <https://pytorch.org/>
- Transfer Learning Guide: https://www.tensorflow.org/tutorials/images/transfer_learning

9 Notes:

- Students are encouraged to explore data augmentation techniques to improve model performance.
- Visualization tools such as Matplotlib and Seaborn should be used to present findings effectively.

Good luck, and happy coding!