Introduction:

In this lab, we compare the performance of three different methods, utilizing both the MNIST digit dataset and the MNIST fashion dataset. The three methods under consideration are:

- Single layer network
- Multi-Layer Perceptron
- Fully Connected DNN

Datasets:

1. **MNIST Digit:**
   The MNIST digit dataset consists of 28x28 gray-scale images of handwritten digits. It contains 60,000 training images and 10,000 test images. Each image is labeled with the corresponding digit it represents.

2. **MNIST Fashion:**
   MNIST fashion dataset is similar in structure to the MNIST digit dataset. However, instead of digits, it contains gray-scale images of fashion items across 10 different categories. Each image is labeled with the corresponding fashion category.

Methods:

1. **Single layer network:**
   Single layer network, also known as single layer perceptron, is the simplest form of neural network architecture. It consists of only one layer of neurons connected directly to the output layer.

2. **Multi-Layer Perceptron:**
   An MLP is a type of feedforward neural network with multiple layers of neurons, including an input layer, one or more hidden layers, and an output layer. Each neuron in the network is connected to every neuron in the adjacent layers.

3. **Fully Connected DNN:**
   A fully connected DNN is a neural network architecture consisting of multiple layers of neurons. It allows for learning complex patterns and features from the input data.

Results:

The following table shows the accuracy achieved by each method on both datasets:

Method	MNIST Digit	MNIST Fashion
Single layer network	0.9269	0.8447
Multi-Layer Perceptron	0.9767	0.8647
Fully Connected DNN	0.9776	0.8663

From the above results, we can observe that:

1. The fully connected DNN achieved the highest accuracy on both datasets. This demonstrates the effectiveness of deeper architectures in learning complex patterns.
2. The performance may vary depending on the dataset. Here, MNIST Digit is a simple dataset while MNIST Fashion is a complex dataset.

Conclusion:

In this report, we compared the performance of three different methods. While all methods showed reasonable results, the fully connected DNN showed highest results, indicating the importance of deeper architectures for learning complex patterns. Further experimentation and optimization can be done to improve the performance of each method.