1928 K. N. Toosi University of Technology	*In the name of God* **Artificial Intelligence**	Faculty of mechanical engineering
Instructors: Dr. Esmaeil Najafi Javad Khoramdel	Assignment 4	Due date: 99/03/11

1. Design a CNN and train it on Fashion Mnist Dataset such that there's not dimensionality reduction in convolutional layers and the network shouldn't be over fitted. The Architecture of the network (no. layers, activations, filters, loss and etc.) is arbitrary.
    a) Plot training and validation loss against epochs.
    b) Plot training and validation accuracy against epochs.
    c) Download one photo per each class from internet and evaluate the network on these images. These images should be attached to your homework files.

2. Stock market's price prediction can be modeled a time series problem. A dataset is attached which shows stock price on each day. We want to predict the stock price on the next day, based on the price on the past days. Fit the following models on the dataset:
    a. MLP
    b. RNN
    c. LSTM
    d. Bidirectional LSTM

    Plot MAE of training and validation data against epochs for each part and compare the results. Network architecture and window size is arbitrary.

3. Rock-Scissors-Paper is famous simple game. In this part we want to see whether a computer can play with us! Link for dataset is provided here. In this part you need to design an arbitrary CNN architecture and:
    a. Without data augmentation, train your network and plot train/validation loss and accuracy.

b. Apply data-augmentation and train longer than previous step. Plot train/validation loss and accuracy to compare the result with previous step.

4. History (You can skip History if you are not in mood!):

If you've ever had your blood drawn, chances are that you've had a blood test where your doctor looked up the following statistics about your blood among others:

- The total number of White Blood Cells (WBCs) in your blood stream.
- The number of Neutrophils, Lymphocytes, Basophils, and Eosinophils (all types of WBCs) in your cell. This is known as a differentiated blood cell count.

The density of WBCs in our blood stream provides a glimpse into the state of our immune system and any potential risks we might be facing. In particular, a dramatic change in the WBC count relative to your baseline is generally a sign that your body is currently being affected by an antigen. Moreover, a variation in a specific type of WBC generally correlates with a specific type of antigen. For instance, Leukemia patients often see a dramatically higher level of Lymphocytes in their blood stream relative due to a malfunctioning immune system. Likewise, people fighting allergies generally see an increase in their Eosinophil counts as these WBCs are key to fighting allergens.

As such, understanding the count of White Blood Cells in our blood stream can provide us a powerful quantitative picture of our health. There are two main ways we count the different types of WBCs in your blood stream: Coulter Counters and Laser Flow Cytometry. Both Coulter Counters and Laser Flow Cytometers cost in the tens of thousands of dollars. However, there's no doubt that have played a fundamental role in improving our quantitative understanding of our health. Now we want to take advantage of deep learning to do this task with high accuracy and

Question:

a. Use VGG19 model for transfer learning and add train few layers on top of the model, plot validation and training loss an accuracy against epochs. Use early stopping callback.

b. Use ResNet50 model for transfer learning and add train few layers on top of the model, plot validation and training loss an accuracy against epochs. Use early stopping callback.

c. (extra credit question) Apply drop-out regularization technique and repeat the previous step, then compare the results.

Good Luck