Machine Learning and Fintech Hw 4. Due 2020/10/19

1. [*Portfolio Management*] Download the dataset on NewE3 "Stocks_ClosePrice.csv" and start with the five stocks. Answer the following questions. [Hint: You can use (but not limited to) the cvxpy in python https://www.cvxpy.org/examples/basic/quadratic_program.html]

   PART A. Minimum variance portfolio

   a) What is the portfolio weight of the global minimum variance portfolio using the theoretical formula (when short sell is allowed)? What is the expected return and risk of the global minimum variance portfolio?

   b) In contrast to a), if short sales are prohibited for constructing a portfolio, find the portfolio weight for the global minimum portfolio. What is the expected return and the risk of this portfolio.

   c) Draw the efficiency frontier in the figure of b), assuming that short sales are allowed.

   d) Check if the efficiency frontier in e) is the envelope line of the blue points in d) of Hw 3.

   PART B. Using hierarchical clustering to form a portfolio.

   a) Let all historical returns be the feature for each stock. With Euclidean distance and average linkage method, use the hierarchical clustering to assign portfolio weights. What are the portfolio weights for each stock?

   b) Using the portfolio weights obtained in (b), what are the expected return and risk?

2. [Confusion matrix] Consider the following true and predicted labels:
   y_true = [0, 1, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1]
   y_pred = [0, 0, 1, 0, 0, 1, 1, 1, 1, 1, 1, 0]
   a) Use hand calculation to show the confusion matrix based on the above data, and calculate Precision, Recall, F1score.
   b) Use pythons (or other programming language) to double confirm your answer in a).