**Design of Assignment 3**

The program has two main models and two predicting function based on each model. Aside from those function, I also design an *input\_data* function and a *output\_result* function.

The input\_data function is based on text file reading method. I input all 32\*32 digits into a vector as a list. Then I created a dictionary to classify all these list. The return of the function is a dictionary whose keys are number 0-9, and values are matrixes including corresponding vectors as lists.

The *output\_result* function is based on some formatting methods. There is no necessity to talk about it in details.

Then the first main model is *model\_1* as a function. In this model, the program compared all the testing vectors to all the training vectors, which cost a lot of time to run the model. However, this model shows high and stable accuracy. The comparing method is using dot product of two vectors. If the product is large, it means that the two vectors share high similarity. So, by sorting all the products of testing vectors and training vectors, the largest product indicates the matched number.

The second model is *model\_2*. In this model, instead of comparing all the vectors, the program would randomly choose 10 vectors from each number in the training dictionary compare by using dot product. Then create a list to sort these products. Finally, using weighted algorithm, the number that shows the largest similarity would be matched. This model is much faster than the last one, but the accuracy is unstable and lower than that in last one.