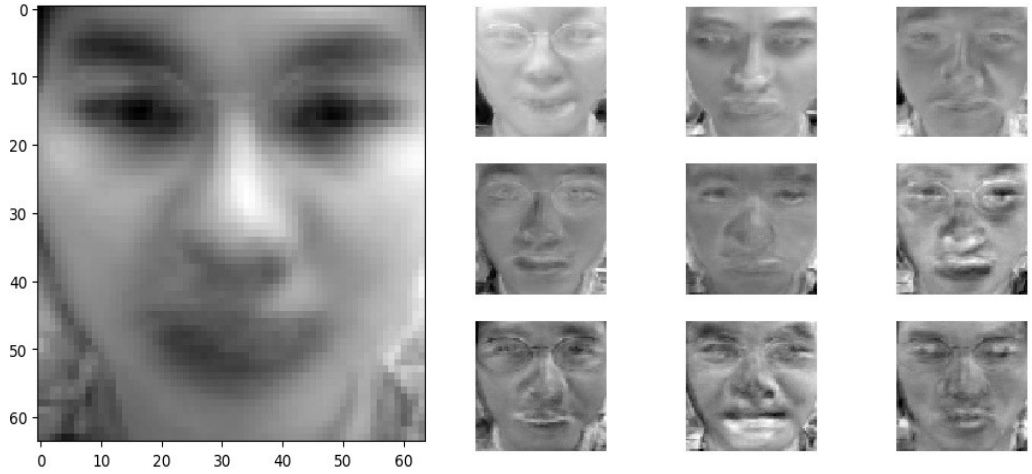
學號：R05921086 系級： 電機碩一 姓名：邱名彥

1.1. Dataset 中前 10 個人的前 10 張照片的平均臉和 PCA 得到的前 9 個 eigenfaces:

答： (左圖平均臉，右圖為 3x3 格狀 eigenfaces, 順序為 左到右再上到下)



Average Faces　　Top 9 Eigenfaces

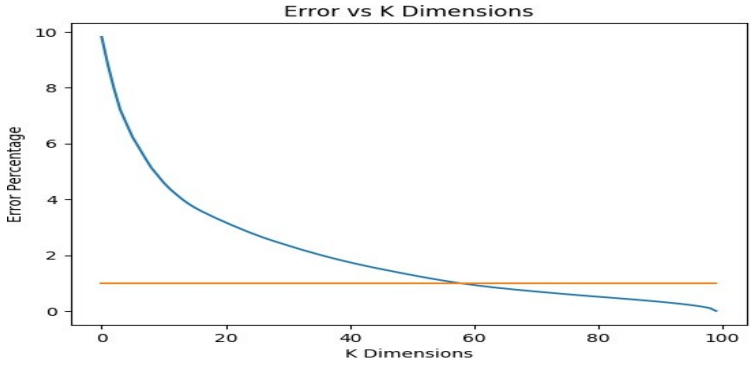
1.2. Dataset 中前 10 個人的前 10 張照片的原始圖片和 reconstruct 圖 (用前 5 個 eigenfaces):

答：(左右各為 10x10 格狀的圖, 順序一樣是左到右再上到下)

Original 10x10 faces　　Reconstructed 10x10 Faces

1.3. Dataset 中前 10 個人的前 10 張照片投影到 top k eigenfaces 時就可以達到 < 1% 的 reconstruction error.

答： (回答 k 是多少) k = 59



2.1. 使用 word2vec toolkit 的各個參數的值與其意義:

答：

word2vec parameters:

size: set size of word vector.

Alpha: set starting learning rate

window: set maximum skip length between words

min_count: searches for words that appear greater than or equal to n

iter: number of iterations to run

sample: set threshold for word occurrence and downsample if freqeuncy is too high

verbose: print values

JJ: Adjective

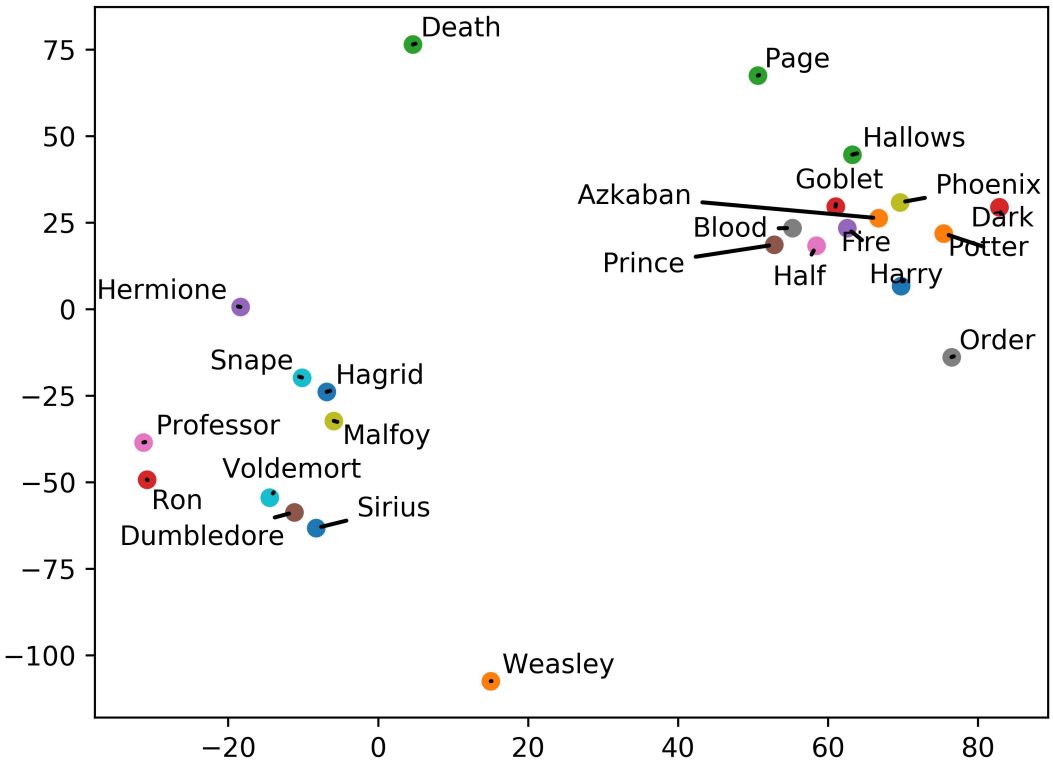
NN: Noun, singular or mass

NNP: Noun, plural

NNS: Proper Noun, singular

2.2. 將 word2vec 的結果投影到 2 維的圖:

答：(圖)



2.3. 從上題視覺化的圖中觀察到了什麼？

答：We can see from the 2D visualization that the cartesian distance between each word is symbolic of their relationship to each other. In the lower left, we can see that the tags grouped together are nouns associated with names. In the top right, we see nouns associated with objects grouped together. There are some outliers like 'Professor' or 'Weasley' which may be bad training or require further adjustments

3.1. 請詳加解釋你估計原始維度的原理、合理性，這方法的通用性如何？
答：
Since we know the original dimensions range from 1-60, then we can use the given data to recalculate the original dimensions. Since it is possible to recalculate the original dimensions, all the inherent characteristics (such as features) in the original data is also preserved. When we extend the given data to recalculate the dimensions using the transformation f(Wx+b), the inherent characteristics/features are preserved. It is possible to extract these features out to recalculate the original dimension.

Since we only have unlabeled test data, we can only generate our own training data to determine all the possible dimensions. We use the Nearest Neighbor algorithm's Ball Tree method to extract the training data features and use those features in Support Vector Regression (SVR). This is how we train our model which accepts features as inputs and outputs a prediction of the original dimension. This means we must extract the features from the test data which is also extracted using SVR and Ball Tree method.

If we did not know the original dimension range, then we must train our model by starting with a short range (for example 1-10) and iteratively expand the range until the testing accuracy falls within tolerances. Since we iteratively expand the matrix, the matrix parameters greatly increases with each iteration. This can cause out of memory problems.

3.2. 將你的方法做在 hand rotation sequence datatset 上得到什麼結果？合理嗎？請討論之。
答: Since there are MxN dimensions in each dataset, there are many extra dimensions we do not need. We segment the data to extract out the Regions of Interest (ROI) that contain the features we want to reduce the computational requirements necessary for each image. In the code, we have segmented an image into 8 parts. For example 25x25,

We use the same method using SVR and the Ball Tree method to extract out the features as shown in Q3.1. The only difference is that we have segmented the data. This results in 8 possibilities which is used to calculate the final dimensional intrinsic prediction using the equation shown below.

$$dim = \ln\left(\sum x_i\right)$$

i is an integer from 1 to 8 for the 8 possibilities generated by 8 segments

x_i is the ith dimension.

After we use the equation, we calculate the dimension to be 9.29172, or 9 when rounded off.