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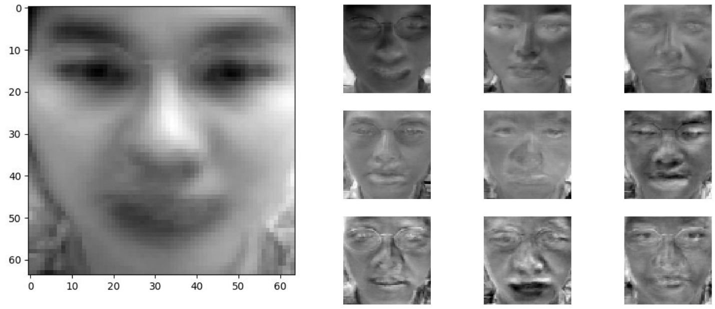
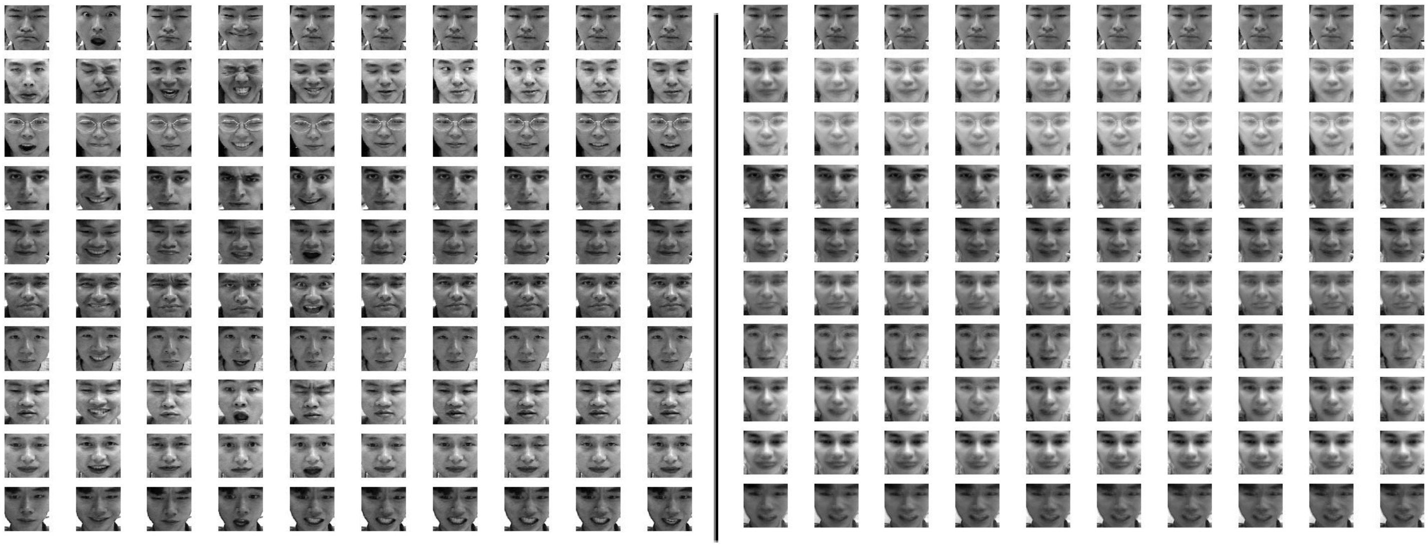
1.1. Dataset 中前 10 個人的前 10 張照片的平均臉和 PCA 得到的前 9 個 eigenfaces:
答： (左圖平均臉，右圖為 3x3 格狀 eigenfaces, 順序為 左到右再上到下)



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：

(original) (reconstruct)

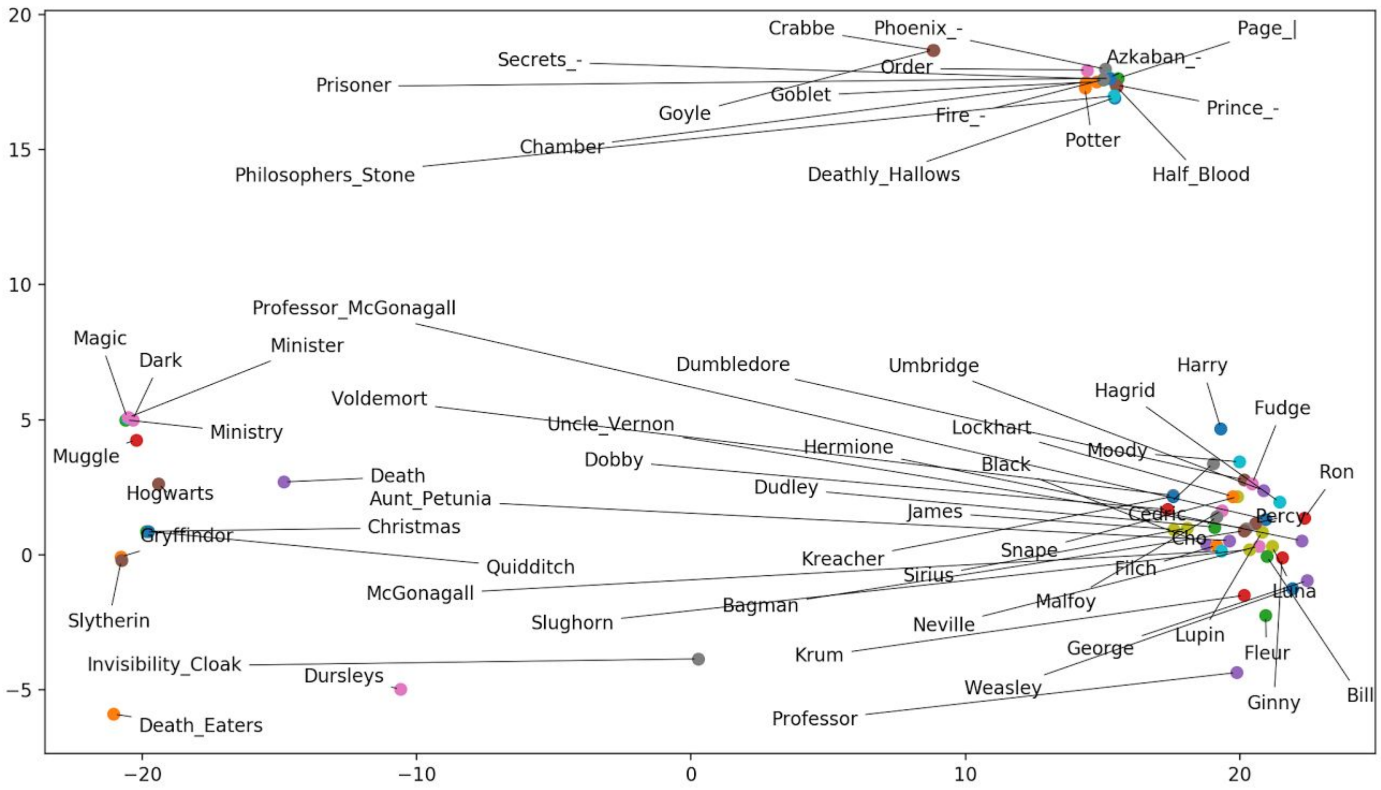


1.3. Dataset 中前 10 個人的前 10 張照片投影到 top k eigenfaces 時就可以達到 < 1% 的 reconstruction error.
答：
k = 59

2.1. 使用 word2vec toolkit 的各個參數的值與其意義:
答：
min_count = 5. This discards words than appear less than min_count. I chose 5 which is the default value.
wordvec_dim = 300. Size of a word vector. The default value is 100 and I picked 300. Usually a large vector size will result in a better prediction.
window = 5. The max skip length between words. 5 is the default value.
negative_sample = 5. Number of negative words. 5 is the default value.
iteration = 6. Training iterations. The default is 5 but I chose 6 to see if it gives a better result.

model = 0. 0 means skip-gram. This model uses the current word to predict surrounding context, which does a better job for infrequent words.
learning_rate = 0.025. This is the default learning rate for skip-gram.

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：
From the above diagram, the first thing spotted is that character names are grouped together on the bottom right. For example, Harry, Ron and Hermione are close friends so obviously they would be together, which also reflected in the diagram. On the left bottom corner, Slytherin and Gryffindor are close to each other and adjacent to Hogwarts. This is probably because there are many conflicts between these two major houses in the book, and both of them are in Hogwarts. The top cluster of words seem to be words from the book titles. Furthermore, words displayed on the diagram should be keywords that appear very frequently. Many of these words are names, which make sense because there are many characters in the Harry Potter series. In conclusion, this diagram gives us a general idea of important characters or objects in the series.

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：
My code is based on the example provided by TAs, which uses the nearest neighbors to estimate dimensions. It is a good method when decision boundary is irregular. The code first takes N random sample points and pick k neighbors to compute the eigenvalues. After normalizing the eigenvalues, it is then feed into a decision tree model for fitting. In the example, SVD is used but I change it to a decision tree model because non-linear

relationships between parameters will not affect the result as greatly. My kaggle accuracy is around 0.069 with SVD and 0.059 with decision tree. I also change y labels to be ln(dimensions) instead of just dimensions, this improves Kaggle accuracy. The number of examples and neighbors are 20 and 400 respectively. I have tried 512 neighbors but the result was not better. This might be because it makes boundaries between labels less distinct. Overall, my model did quite well.

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：