Machine Learning HW2

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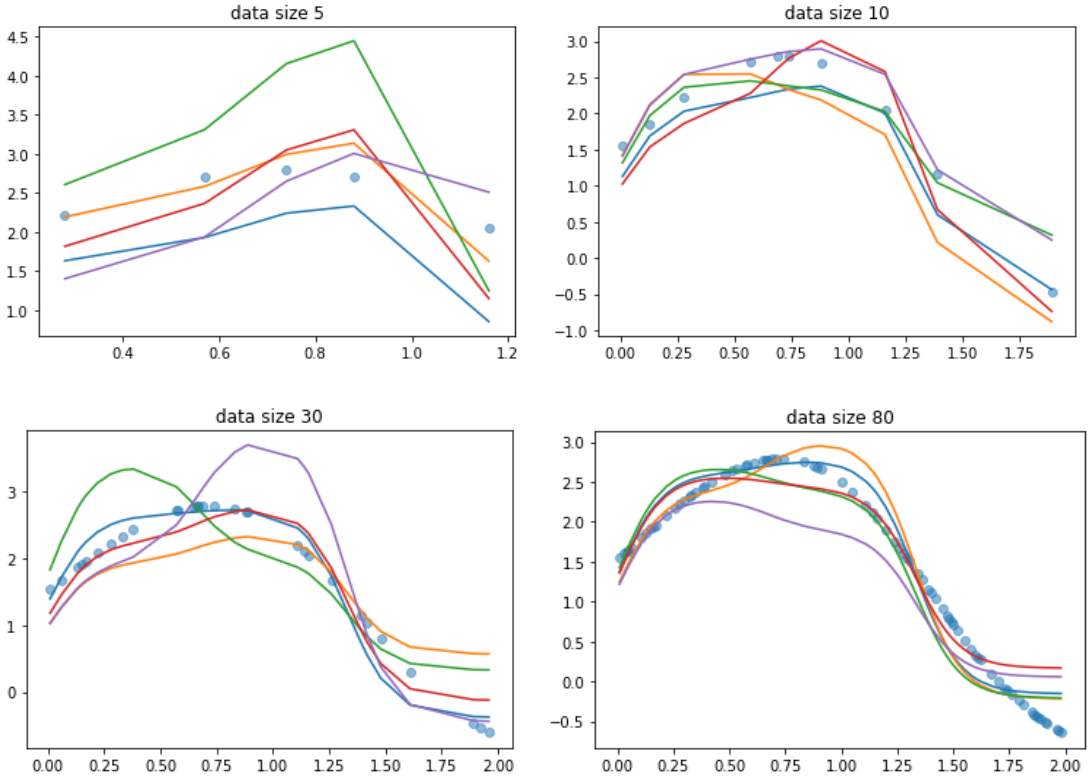
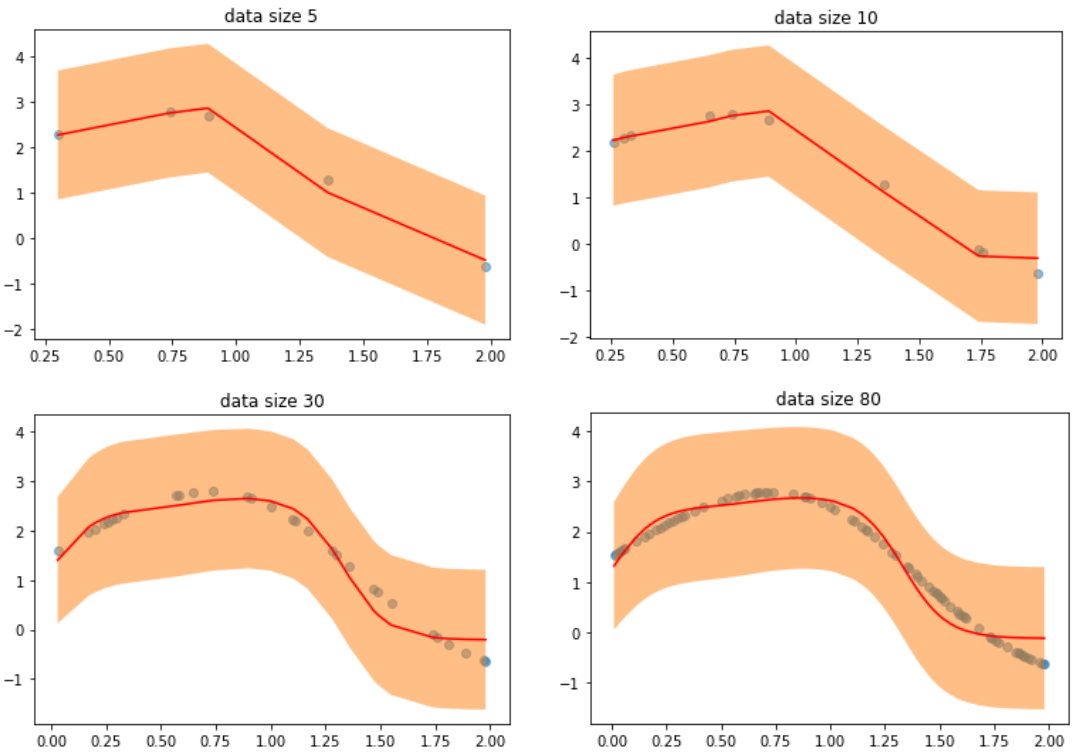
1. Sequential Bayesian Learning

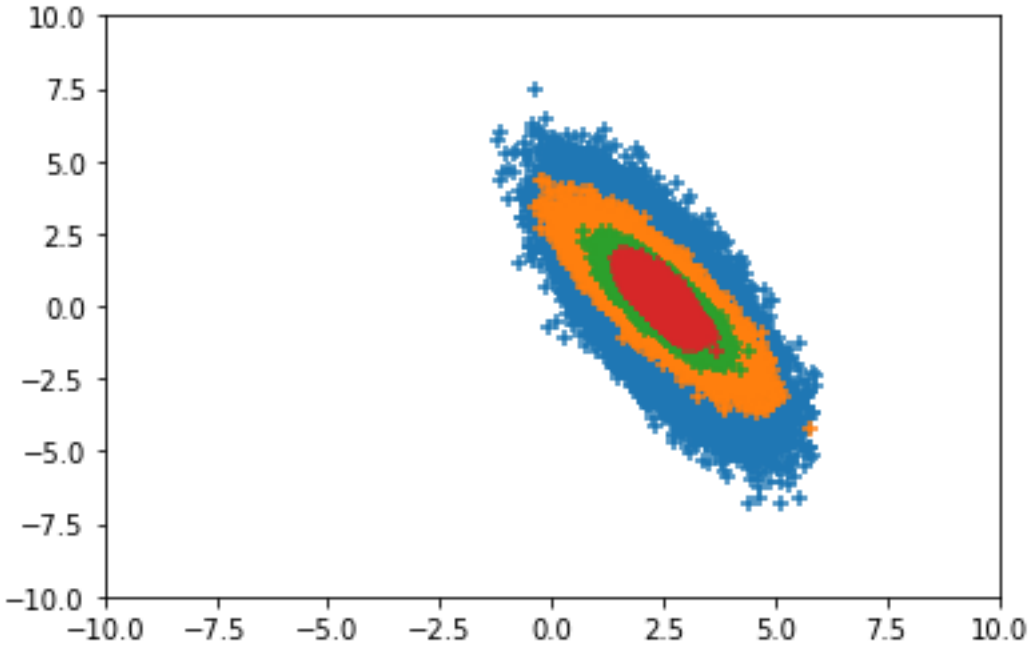
1.1 generate five curve samples from the parameter posterior distribution



1.2 plot the predictive distribution of target value t and show the mean curve and the region of variance with one standard deviation on either side of the mean curve.

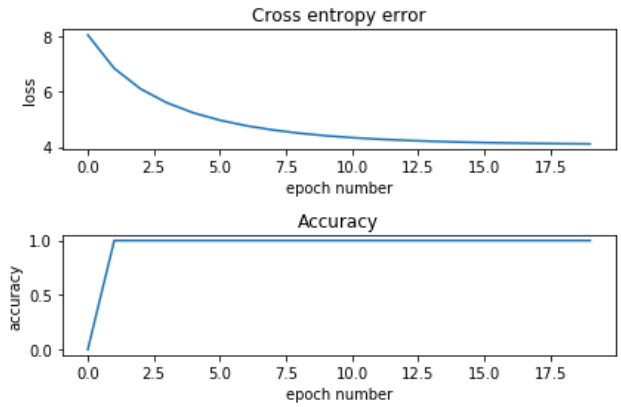


1.3 Arbitrarily select two weights by yourself and carefully plot the corresponding prior distributions when N = 5; 10; 30 and 80.



2 Logistic Regression

2.1、2.2

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classification result of test data: [2 1 1 2 1 4 1 4 2 2 4 2 2 1 2 2 1 4 2 2 4 1 1
1 4 1 4 1 1 1 2 2 2 2 2 2 2
 1 2 1 1 2 1 2 1]
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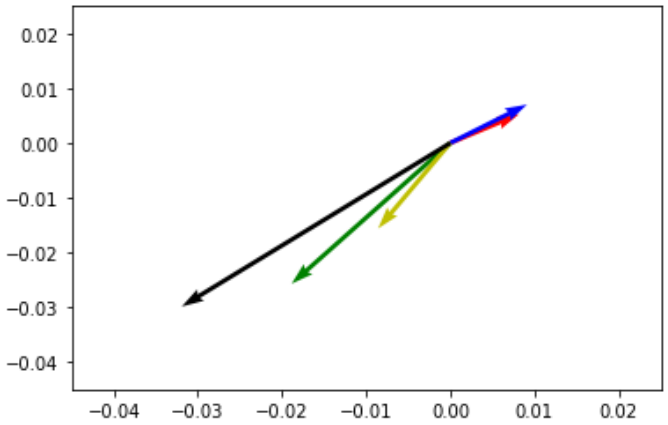
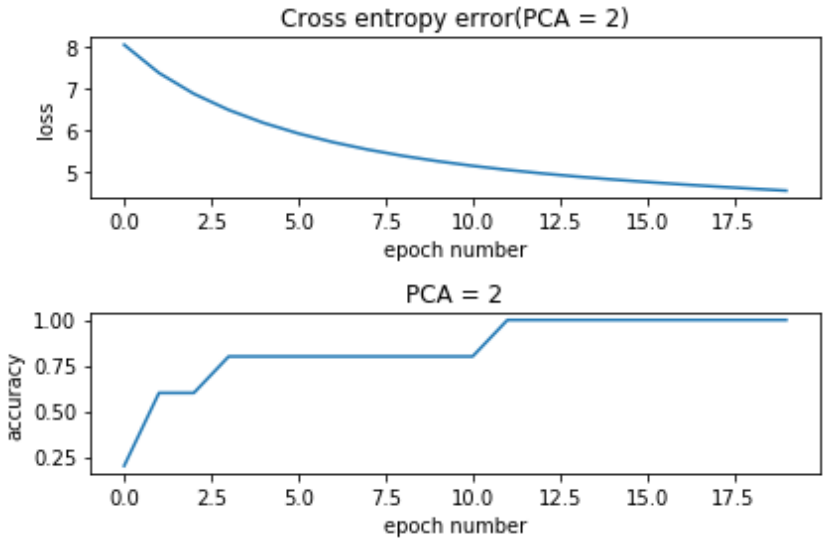
2.3 Use the principal component analysis (PCA) to reduce the dimension of data and plot five eigenvectors corresponding to top five eigenvalues.



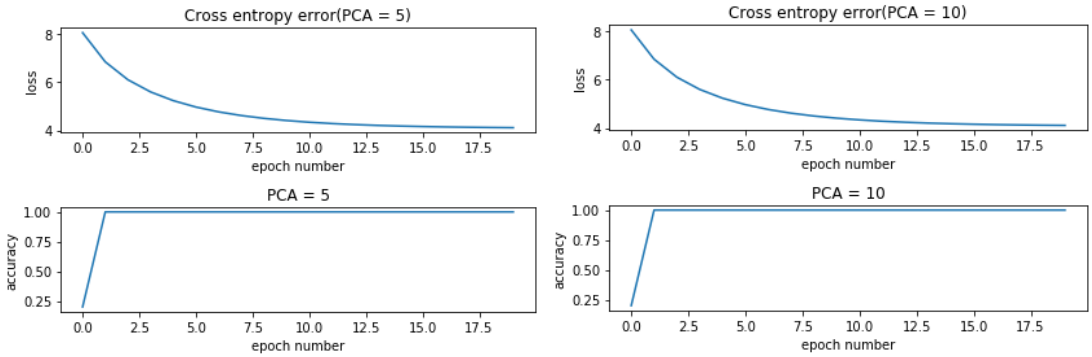
分別用最高的 5 個特徵值所對應到的 eigenvectors，將其 plot 出來，如上圖所示。

2.4 Repeat 1 and 2 by applying Netwon-Raphson algorithm. PCA should be used to reduce the dimension of face images to 2, 5 and 10. Make

some discussion.



當取的PCA為2，在第11個epoch時也能達到我們要的效果，雖然訓練的epoch較多，但比起原本所有資料進去train的時間已經大幅下降很多，這樣的結果令我滿驚訝的，接著後面用pca =5, pca =10分別測試，甚至可以直接得到我們原本將所有資料進去train的結果，表示PCA的方法十分有效，這題的結果讓我十分感到有成就感，以下分別為pca=5及pca=10的圖。

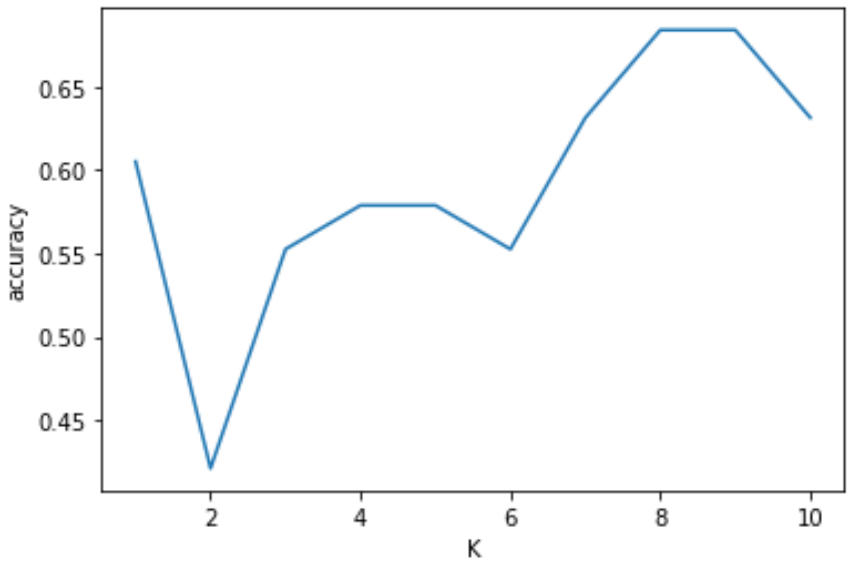


2.5 Make some discussion on the results of Netwon-Raphson and gradient descent algorithms.

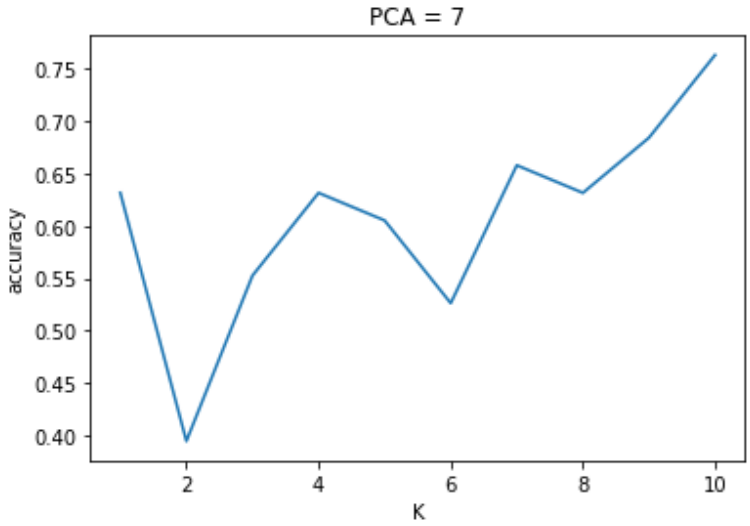
從上圖的E(w)的learning curve可以看出，error有持續下降，另外由於error function是convex，所以只要learning rate夠小，可以持續往global minimum converge，因此在這邊我們設以0.01做訓練。從這題的練習，實踐梯度下降法，讓我更了解到怎麼逼近我們要的解，得到的結果也讓我很滿意，也為未來如何設定error function打好基礎。

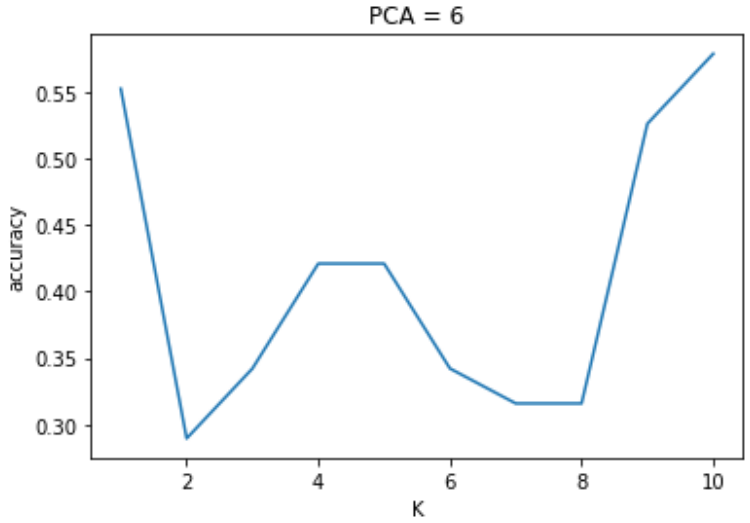
3 Nonparametric Methods

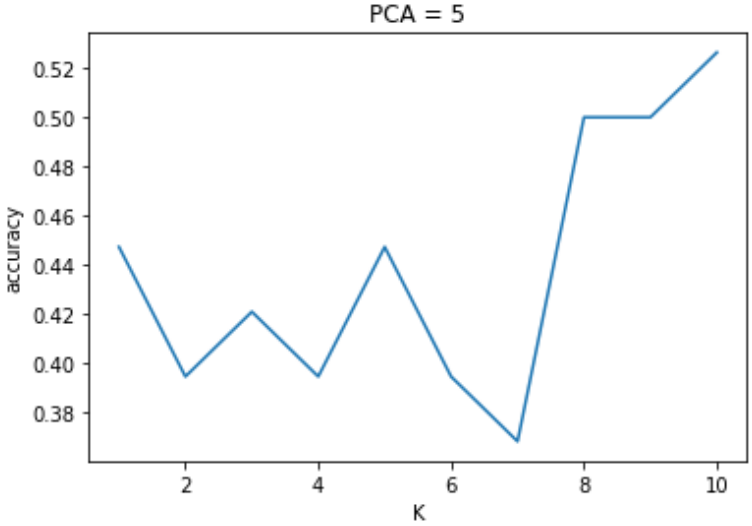
3.1 Plot the figure of accuracy where horizontal axis is K and vertical axis is accuracy.



3.2 Please implement the principal component analysis (PCA) for training samples and reduce the dimension of training and test data to 7, 6, and 5 by using the bases obtained from PCA. Repeat the above procedure.







以上三圖分別是降到PCA=7,6,5的結果，令我比較驚訝的是PCA=7的時候結果

非常的好，而如預期的PCA從7至5所得到的accuracy也是越來越低。

這次的作業內容非常多也很具有挑戰，真的是耗費苦心終於完成了...

收穫很多，也謝謝老師及助教的辛勞。