# CSE 6363 Machine Learning Assignment 3

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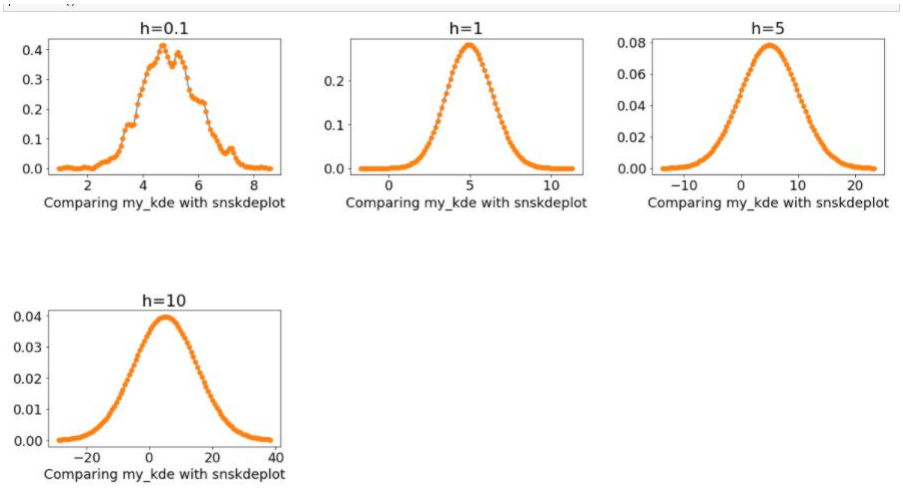
December 7, 2020

## 1 Problem 1

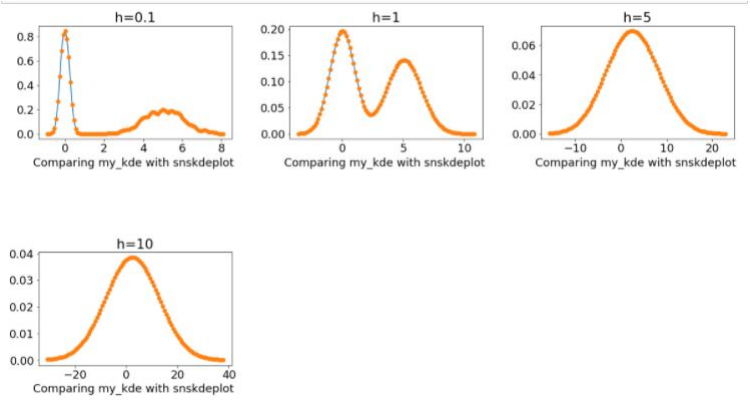
Non-parameteric density estimation with a function [p, x] = mykde(X,h)

### 1.1

a) Below is the graph that shows the variance of the random gaussian data for the bandwidth of h = 0.1, 1, 5, 10, For the small value of bandwidth, the Kernel density estimation is detailed overall the data points which shows the steep curves on the graph, but as the bandwidth increases, the Kernel density estimation is smoothing and the graph becomes smooth curves.

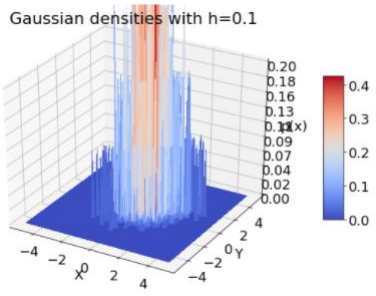


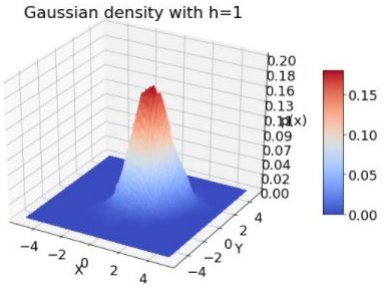
b) Here the gaussian data is generated with the mean,μ1 = 5 and 1 = 1 and μ2 = 0 and 2 = 0.2, and we have data with the two steps and graph is more steep curve with all the data points connected as detailed and graph starts smoothing as the bandwidth increases with range of h = 0.1, 1, 5, 10

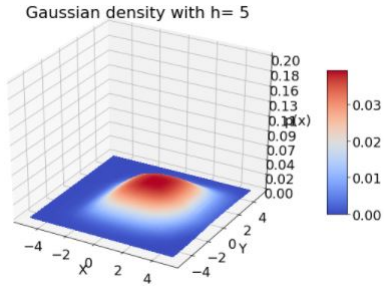


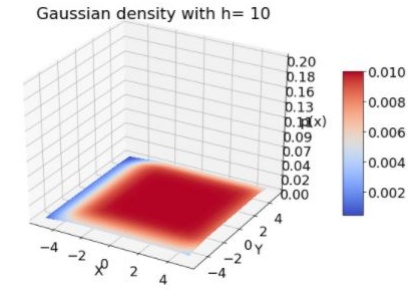

## 1.2

a) Below is the 3d graphs of the 2d gaussian data with the h = 0.1, 1, 5, 10 , we could see that the graphs is with the steeps of the step and its keeping staying falt as the value of the bandwidth increases.



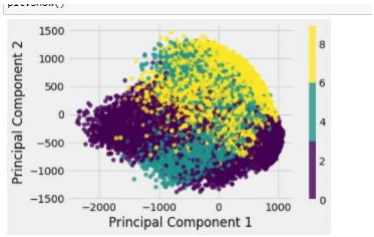


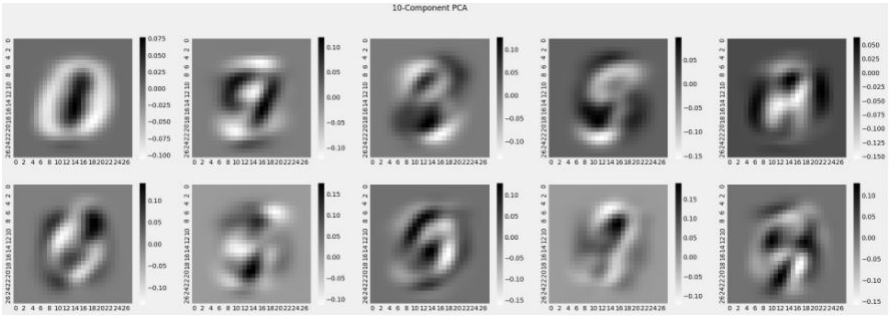




# 2 Problem 2

a)Implementation of the function with the k principle components and below is the scatter plot of the data, with PC2



b)Below is the 10PC images with 28x28 image, from which can analyze that the 10 PC images as 28X28 shows that these images are labels of numneric digits and numberrs like are 0,3,5,6,8,9 are clearly visible and other labels are little unclear.




c)Using the 30PC dimension reduction and Logistic regression with softmax function, with the epochs of 10 we can see that running time has gradual improvement from 36 secs to 0.9secs and looking the performance of the 30PC and raw-data, the classification accuracy is more on the data compared to the 30PC data

d)Here it is output nodes data labels of 28x28 image using the raw data,comparing the label images of PCA and these shows that PCA images are little more clearer than the raw data images, its more smoother label images for the PCA data than the raw data images and labels more clearly visual.