

Homework Assignment No. 04:

HW No. 04: Gaussian Mixture Distribution Parameter Estimation

submitted to

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ECE 8527: Introduction to Pattern Recognition and Machine Learning
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A. GENERATE DATA AND PLOT A SINGLE COMPONENT GAUSSIAN MIXTURE MODEL

In terms of the nature of the fit seen below, it's clear that a single component Gaussian distribution is insufficient for representing this dataset. There are clearly 3 peaks which represent the three means. The reason the middle peak is largest is due to the variance of the other sets overlap.

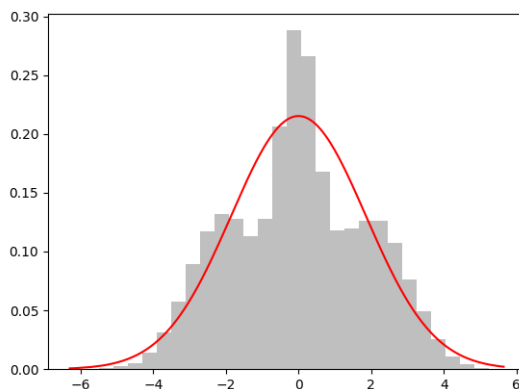


Figure 1: 1 component Gaussian mixture model

B. PLOT A 1,2, AND 3 COMPONENT GAUSSIAN MIXTURE MODEL

As can be seen below, a two component mixture model clearly does a significantly better job than a single component mixture model, but the nature of the fit really only begins to be well represented when we have a component for each mean.

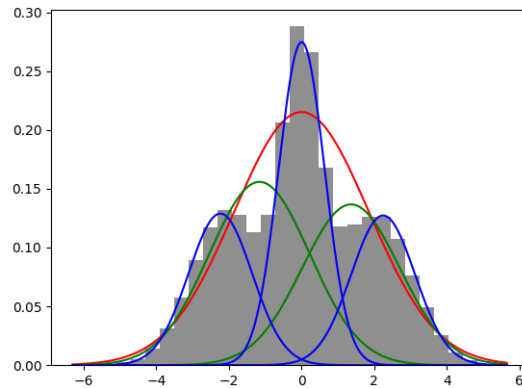


Figure 2: 1, 2, and 3 component Gaussian mixture model

C. PLOT A 1,2, AND 4 COMPONENT GAUSSIAN MIXTURE MODEL

When comparing to the figure from the last section, we can see that having a fourth mixture component maintains the representation of a three component mixture model, but the change is small and the peak that is second from the left seems to just be subcomponent of the middle peak shown in a three component mixture model.

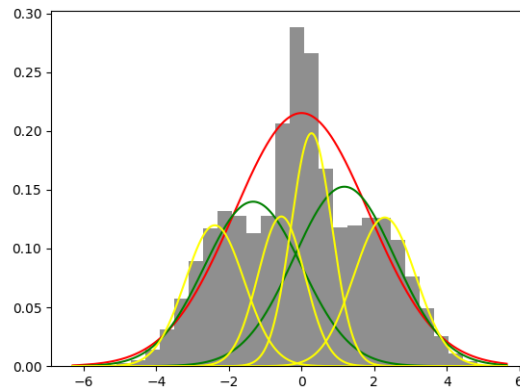


Figure 3: 1, 2, and 4 component Gaussian mixture model

D. PLOT THE LOG PROBABILITY OF THE DATA BELONG TO N COMPONENT GAUSSIAN MIXTURE MODELS

As can be seen, the log likelihood of the data set peaks when the Gaussian mixture model has three components, but levels out afterwards. Since this dataset has 3 peaks, this is logical and we can see the rapid rise of log likelihood between one component and three components.

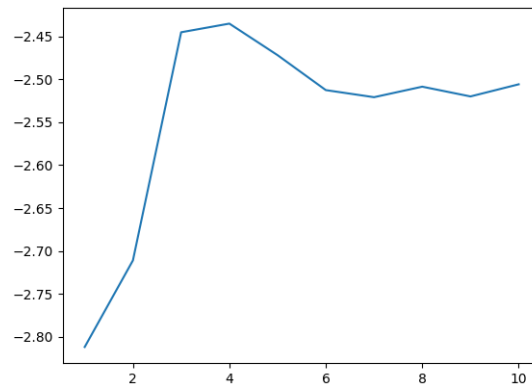


Figure 4: Log likelihood as a function of Gaussian mixture model components

E. SUMMARY