

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.

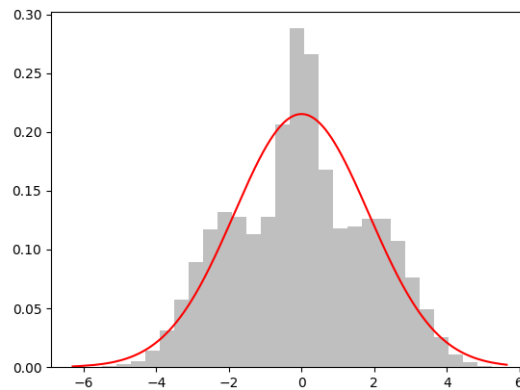


Figure 1: 1 component Gaussian mixture model

## 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.

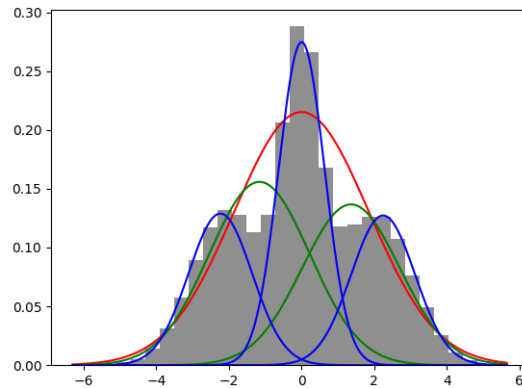


Figure 2: 1, 2, and 3 component Gaussian mixture model

## 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.

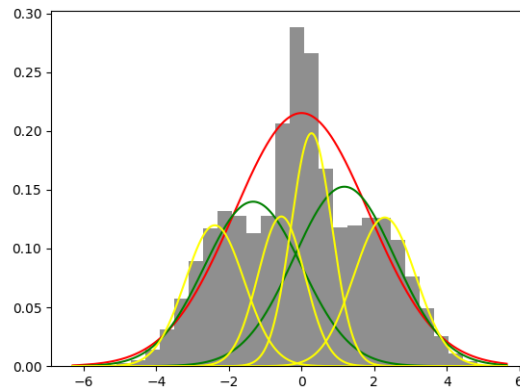


Figure 3: 1, 2, and 4 component Gaussian mixture model

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

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.

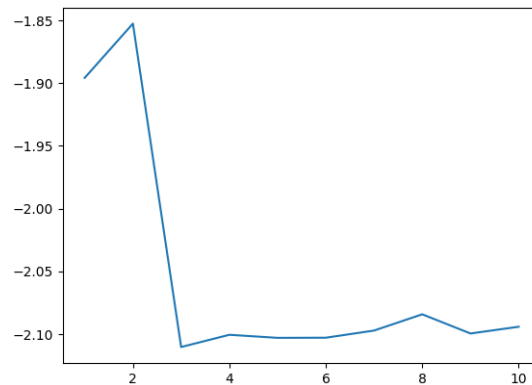


Figure 4: 1, 2, and 4 component Gaussian mixture model

## E. SUMMARY