

Machine Learning

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Discussion 10

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# Expectation-Maximization Algorithm

## Problem 1

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Maximize the lower bound  $F(\theta, \{q_n\})$  over  $q_n$  assuming that  $\theta$  is fixed. See slides 18-19 in lecture 10.

## Problem 2

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In the slide 21 in lecture 10 we have defined a complete likelihood  $Q(\theta; \theta^{(t)})$ . Maximize  $Q$  over  $\mu_k$  to get

$$\mu_k = \frac{\sum_n \gamma_{nk} x_n}{\sum_n \gamma_{nk}}$$

## Problem 3

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There is a set of  $n$  points that we cluster using  $k$ -means and Gaussian mixtures. Suppose that in both cases we obtained 5 clusters and in both cases the centroids are the same.

Can 3 points that are assigned to different clusters in the  $k$ -means solution be assigned to the same cluster in the Gaussian mixture solution?