4. Comparing K-means and EM

Generate analogous plots to K-means using your EM implementation. Note that the EM algorithm can also get stuck in a locally optimal solution. For each value of K, please run the EM algorithm with seeds $0, 1, 2, 3, 4$ and select the solution that achieves the highest log-likelihood. Compare the K-means and mixture solutions for $K = [1, 2, 3, 4]$. Ask yourself when, how, and why they differ.

Reporting log likelihood values

0.0/1.0 point (graded)
Report the maximum likelihood for each K using seeds $0, 1, 2, 3, 4$:

$\text{Log-likelihood}|_{K=1} =$ **Answer:** -1307.2234

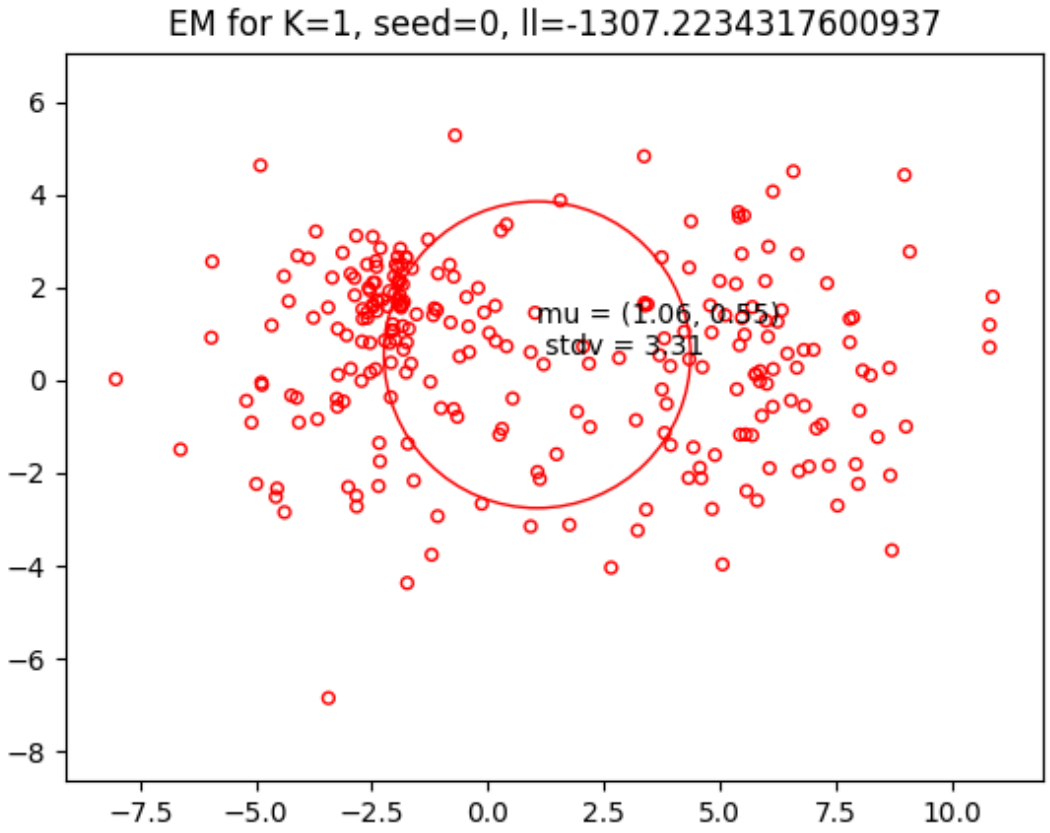
$\text{Log-likelihood}|_{K=2} =$ **Answer:** -1175.7146

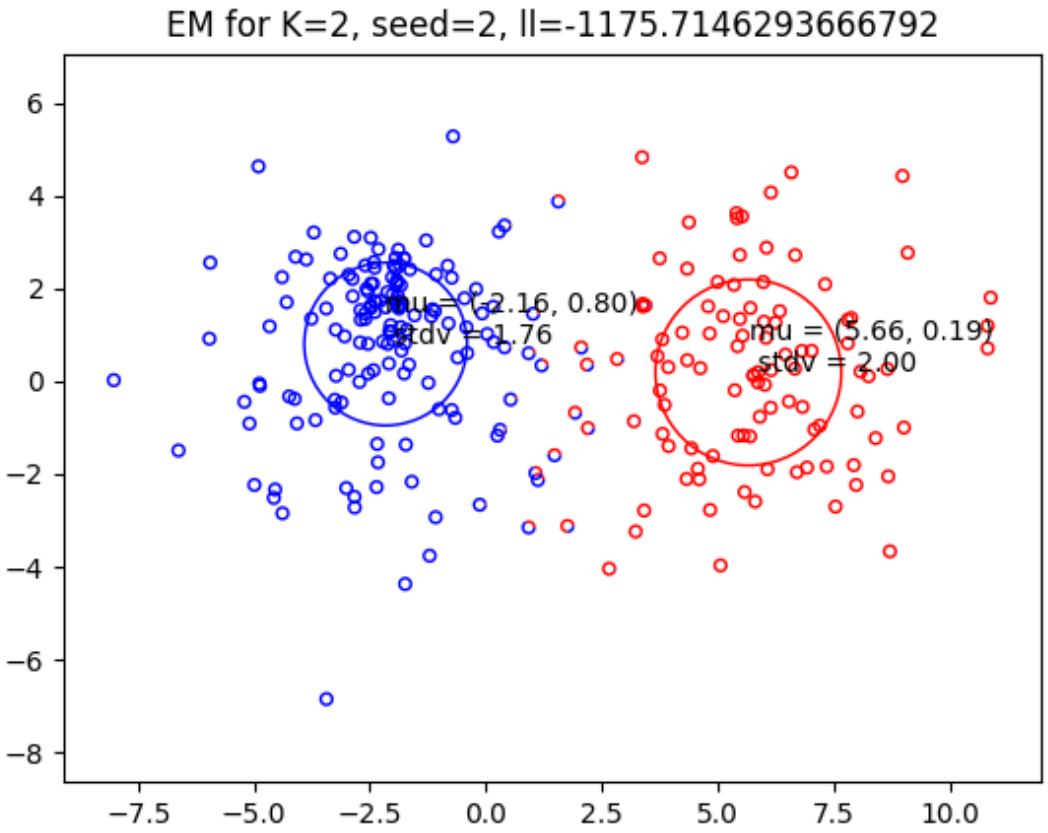
$\text{Log-likelihood}|_{K=3} =$ **Answer:** -1138.8908

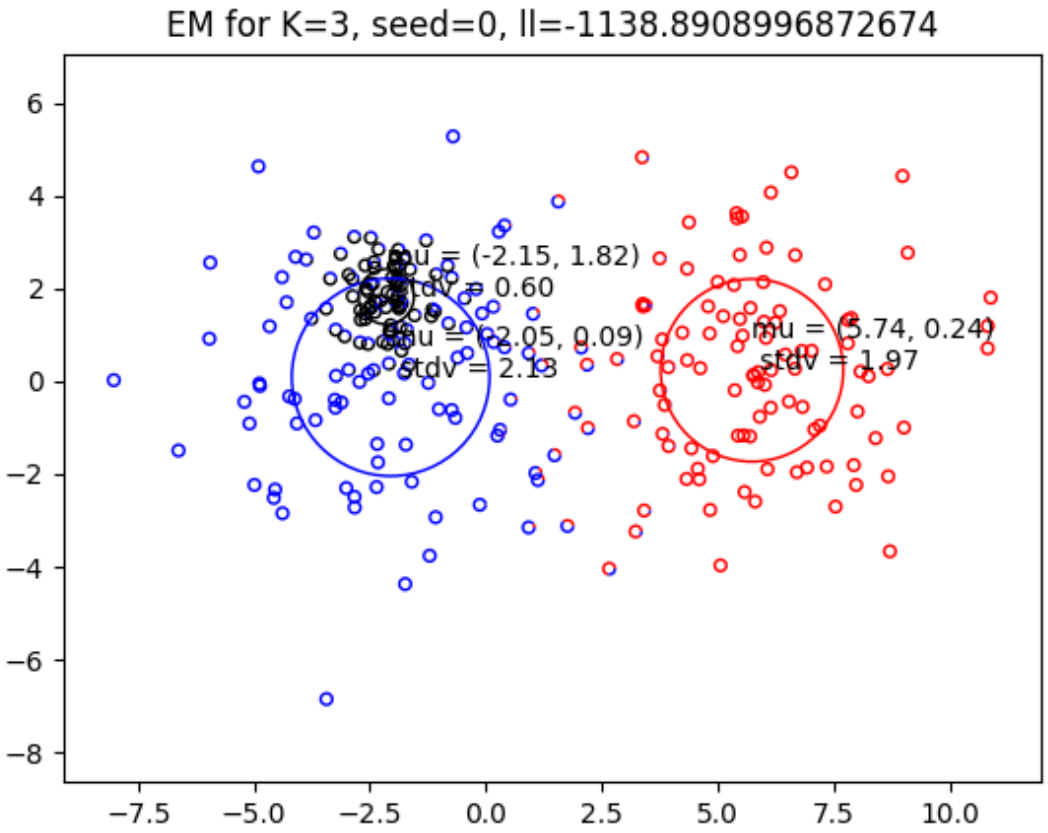
$\text{Log-likelihood}|_{K=4} =$ **Answer:** -1138.6011

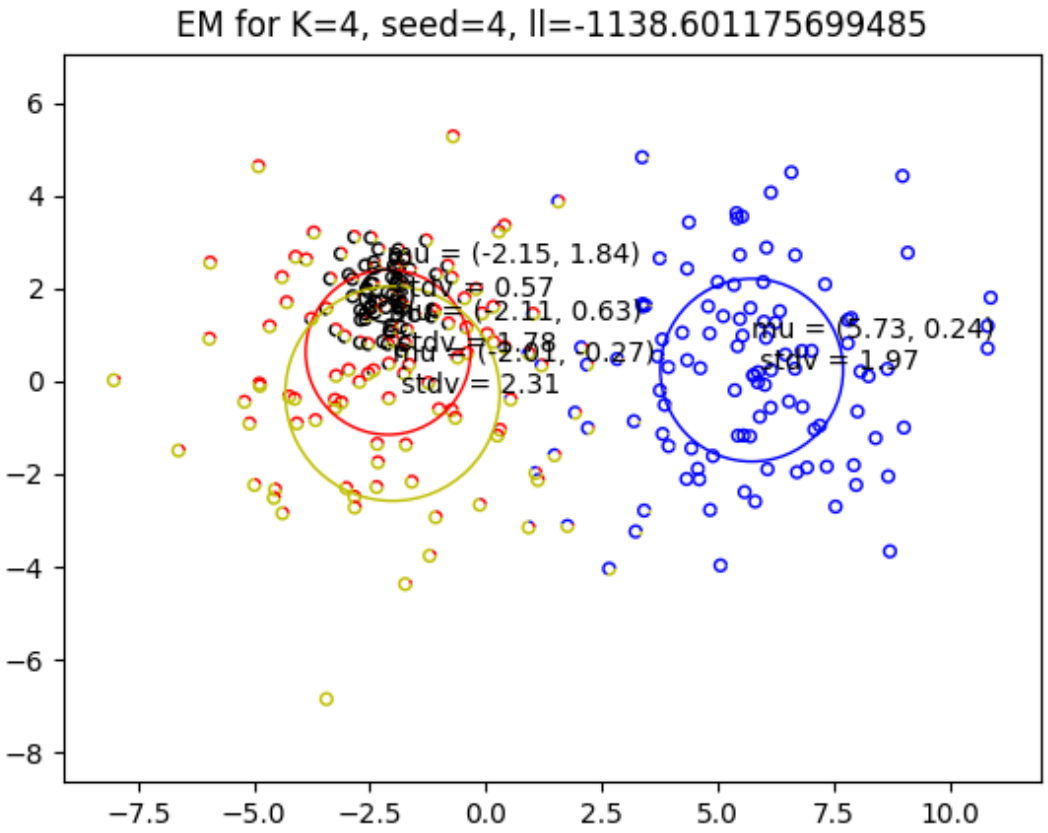
Solution:

Plots:




EM for K=2, seed=2, ll=-1175.7146293666792
mu = (-2.16, 0.80)
stdv = 1.76
mu = (5.66, 0.19)
stdv = 2.00
6
4
2
0
−2
−4
−6
−8
−7.5
−5.0
−2.5
0.0
2.5
5.0
7.5
10.0


EM for K=3, seed=0, ll=-1138.8908996872674
mu = (-2.15, 1.82)
stdv = 0.60
mu = (2.05, 0.09)
stdv = 2.13
mu = (5.74, 0.24)
stdv = 1.97
6
4
2
0
−2
−4
−6
−8
−7.5
−5.0
−2.5
0.0
2.5
5.0
7.5
10.0



Submit You have used 0 of 25 attempts

Answers are displayed within the problem

Analysing plots

0.0/1.0 point (graded)

Which of the following sentences are true? (Check all that apply)

Note: This question is the multichoice version of the free-text question: “Compare the K-means and mixture solutions for $K = [1, 2, 3, 4]$. Ask yourself when, how, and why they differ."

In order to answer this, you should look at the plots side by side, either by adapting the code to plot them together or by simply saving the plots as you go. For each value of K, ask yourself whether the plots you see are similar or different. If they are different, why are they different?

Hint: What are we optimizing for in each case? What are we plotting? In the case of K-means, we have clusters, with EM, can these really be called clusters? What is EM optimizing for?

Now, write a descriptive paragraph of your observations as if it were part of a report for this project and you were going hand this back for us to grade. Try matching your paragraph with the options provided. If they don 't match, then we wouldn't have given you full credit for this question.

Note: We have increased the attempt by 1.

- [x] In the case K=1, the mixture parameters and point assignments are the same for both methods ✔
- [x] In the case K=2, both methods have simlilar parameters and point assignments ✔
- [ ] In the case K=3, the k-means solution accounts for point density better than EM
- [x] In the case K=4, the k-means solution equally spaces the clusters to minimize distortion cost ✔

Solution:

The $K = 1$ case is exactly the same since all the data is assigned to the same cluster and both methods compute the mean. The $K = 2$ case is very similar in terms of cluster mean and point assignment, but since EM uses a spherical Gaussian model with varying deviations the points midway between the two are assigned slightly differently. The $K = 3$ case equally spaces the clusters for k-means to minimize the overall distortion cost, but the left two clusters for EM are closely packed with very different variances because EM wants to account for the densely set of points on the left side. The $K = 4$ case is similar to the $K = 3$ case where all of the clusters in k-means are equally spaced, but the EM has significant overlap on the left side.

Submit You have used 0 of 4 attempts

Answers are displayed within the problem

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Topic: Unit 4 Unsupervised Learning (2 weeks) :Project 4: Collaborative Filtering via Gaussian Mixtures / 4. Comparing K-means and EM

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?	[STAFF] - Analysing plots - second option	5
?	[STAFF] Q1: Not getting same results	1
?	Wording is really poor >> In the case K=1, the mixture parameters and point assignments are the same for both me...	12
?	Request for One More Attempt Hi staff, I have a vague understanding of the plot analysis, but I have lost the four attempts. C...	2
?	What is meant by point density? In reference to K=3 question, what is meant by point density? How do we define point density?	5
?	Analysing Plots Can the attempt count be increased by one? I have lost all 4 attempts. Please increase it to 5.	2
?	For K=4 , I am getting the following error: "RuntimeWarning: divide by zero encountered in log" I solve this problem by substituting all of the probabilities that are less than 0.0001 with 0.00...	2
?	Better and worse algorithm results Do you agree, that results obtained from K-means look better than results from EM? Or this i...	2
☑	Need hints for Analysing Plots Option 3 What does it mean to account "better"? Does it mean that it creates a special cluster...	18

☑	Whats the seed for this question? Which seed should I use?	2
?	Couldn't answer even with plots Although I plotted both K-means and EM for each K and everything, still I couldn't answer the...	2
?	Analysing plots : How is the color assigned to a cluster? When I read the code of common.plot, I understand that the first cluster has the color red, th...	6
💬	Definition of "similar"	