

EM for Gaussian mixtures

9 试题

1
point

1.

(True/False) While the EM algorithm maintains uncertainty about the cluster assignment for each observation via soft assignments, the model assumes that every observation comes from only one cluster.

☒ True

☐ False

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2.

(True/False) In high dimensions, the EM algorithm runs the risk of setting cluster variances to zero.

☒ True

☐ False

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3.

In the EM algorithm, what do the E step and M step represent, respectively?

☒

-
- ☐ Estimate cluster responsibilities, **Maximize likelihood** over parameters
 - ☐ Estimate likelihood over parameters, **Maximize cluster responsibilities**
 - ☐ Estimate number of parameters, **Maximize likelihood** over parameters
 - ☐ Estimate likelihood over parameters, **Maximize number of parameters**
-

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4.

Suppose we have data that come from a mixture of 6 Gaussians (i.e., that is the true data structure). Which model would we expect to have the highest log-likelihood after fitting via the EM algorithm?

- ☐ A mixture of Gaussians with 2 component clusters
 - ☐ A mixture of Gaussians with 4 component clusters
 - ☐ A mixture of Gaussians with 6 component clusters
 - ☐ A mixture of Gaussians with 7 component clusters
 - ☒ A mixture of Gaussians with 10 component clusters
-

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5.

Which of the following correctly describes the differences between EM for mixtures of Gaussians and k-means? Choose all that apply.

- ☐ k-means often gets stuck in a local minimum, while EM tends not to
- ☒ EM is better at capturing clusters of different sizes and orientations

☐

- ☐ EM is better at capturing clusters with overlaps
- ☐ EM is less prone to overfitting than k-means
- ☒ k-means is equivalent to running EM with infinitesimally small diagonal covariances.
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6.

Suppose we are running the EM algorithm. After an E-step, we obtain the following responsibility matrix:

Cluster responsibilities	Cluster A	Cluster B	Cluster C
Data point 1	0.20	0.40	0.40
Data point 2	0.50	0.10	0.40
Data point 3	0.70	0.20	0.10

Which is the **most probable** cluster for data point 3?

- ☒ Cluster A
- ☐ Cluster B
- ☐ Cluster C
-

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7.

Suppose we are running the EM algorithm. After an E-step, we obtain the following responsibility matrix:

Cluster responsibilities	Cluster A	Cluster B	Cluster C
Data point 1	0.20	0.40	0.40
Data point 2	0.50	0.10	0.40
Data point 3	0.70	0.20	0.10

Suppose also that the data points are as follows:

Dataset	X	Y	Z
Data point 1	3	1	2
Data point 2	0	0	3
Data point 3	1	3	7

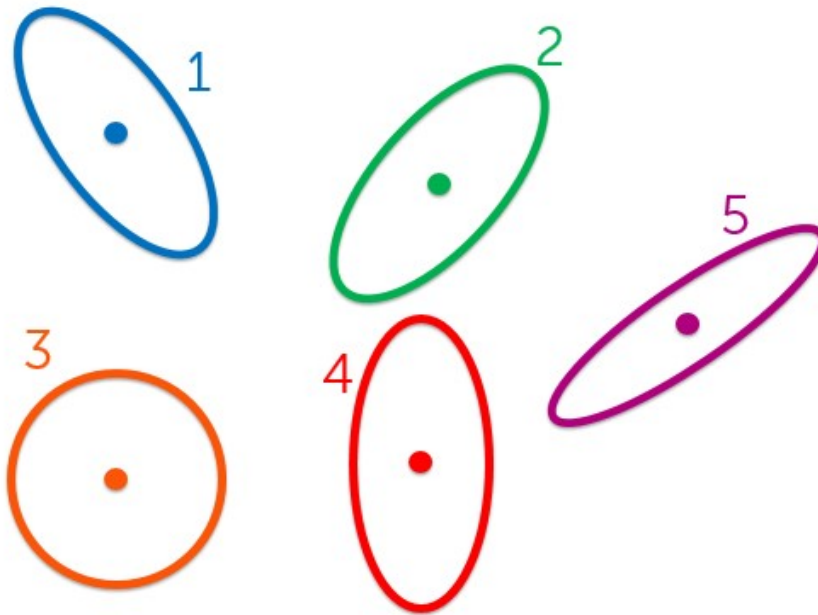
Let us compute the new mean for Cluster A. What is the **Z coordinate** of the new mean? Round your answer to 3 decimal places.

4.86

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8.

Which of the following contour plots describes a Gaussian distribution with diagonal covariance? Choose all that apply.



☐ (1)

☐ (2)

☒ (3)

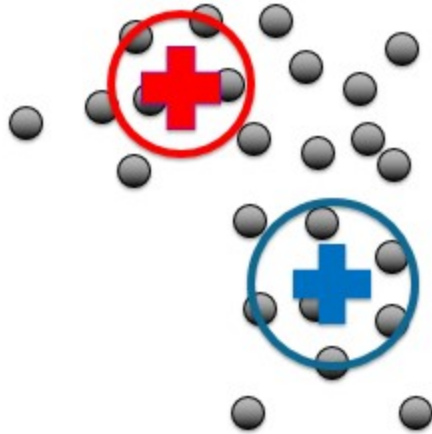
☒ (4)

☐ (5)

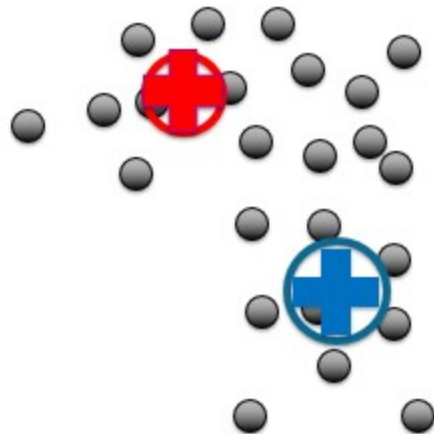
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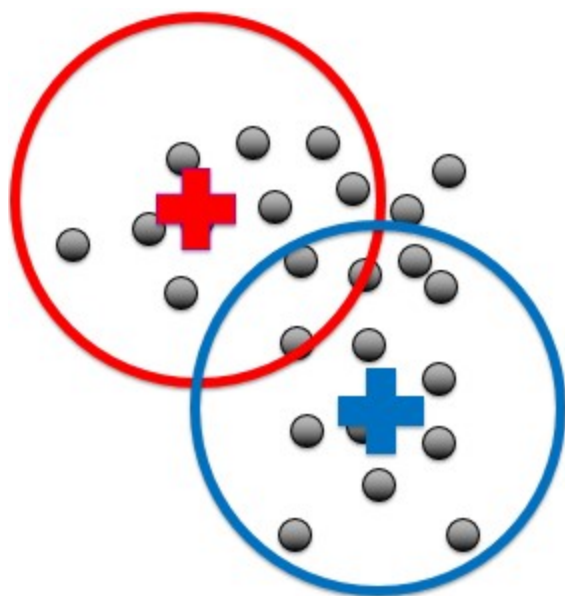
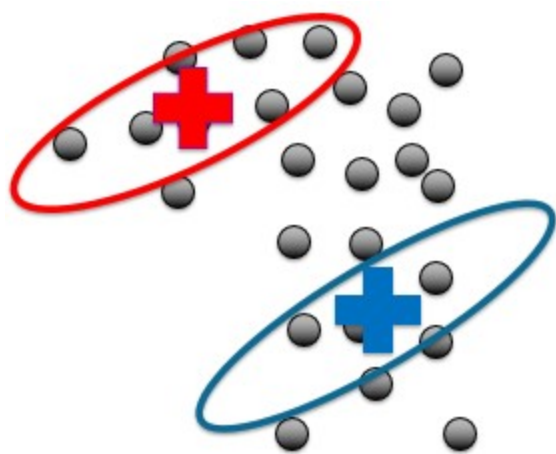
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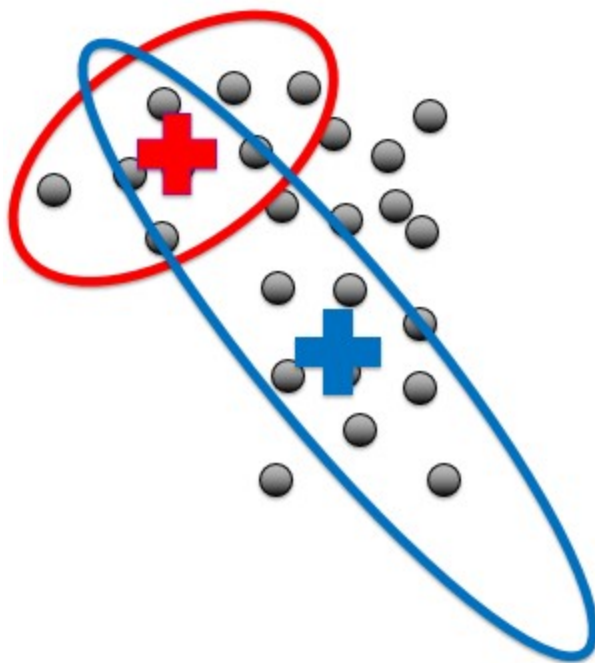
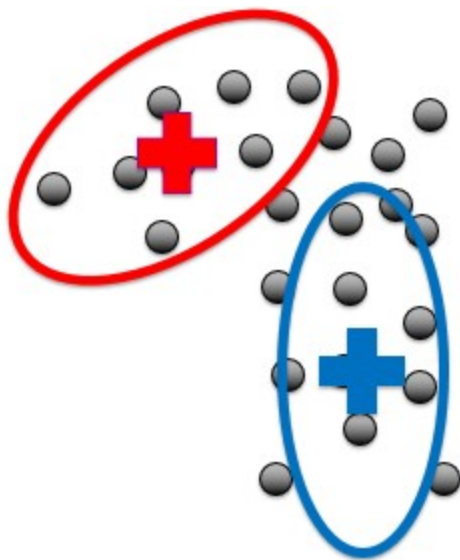
Suppose we initialize EM for mixtures of Gaussians (using full covariance matrices) with the following clusters:



Which of the following best describes the updated clusters after the first iteration of EM?







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