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Course outline

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Week 11 : Assignment 11

The due date for submitting this assignment has passed.

Due on 2025-10-08, 23:59 IST.

Assignment submitted on 2025-09-27, 15:24 IST

1) What constraint must be satisfied by the mixing coefficients (π_k) in a GMM? ***1 point***

- $\pi_k > 0 \, \forall \, k$
- $\sum_k \pi_k = 1$
- $\pi_k < 1 \, \forall \, k$
- $\sum_k \pi_k = 0$

Yes, the answer is correct.
Score: 1

Accepted Answers:
$\sum_k \pi_k = 1$

2) The EM algorithm is guaranteed to decrease the value of its objective function on any iteration. ***1 point***

- True
- False

No, the answer is incorrect.
Score: 0

Accepted Answers:
False

3) Why might the EM algorithm for GMMs converge to a local maximum rather than the global maximum of the likelihood function? ***1 point***

- ○ The algorithm is not guaranteed to increase the likelihood at each iteration
- ◉ The likelihood function is non-convex
- ○ The responsibilities are incorrectly calculated
- ○ The number of components K is too small

Yes, the answer is correct.
Score: 1

Accepted Answers:
The likelihood function is non-convex

4) What does soft clustering mean in GMMs? ***1 point***

- ○ There may be samples that are outside of any cluster boundary.
- ○ The updates during maximum likelihood are taken in small steps, to guarantee convergence.
- ○ It restricts the underlying distribution to be gaussian.
- ◉ Samples are assigned probabilities of belonging to a cluster.

Yes, the answer is correct.
Score: 1

Accepted Answers:
Samples are assigned probabilities of belonging to a cluster.

5) KNN is a special case of GMM with the following properties: ***1 point***

- ☐ $\gamma_i = \frac{i}{(2\pi\epsilon)^{1/2}} e^{-\frac{1}{2\epsilon}}$
- ☐ Covariance = $\epsilon\mathbb{I}$
- ☐ $\mu_i = \mu_i \forall i, j$
- ☑ $\pi_k = \frac{1}{k}$

Partially Correct.
Score: 0.5

Accepted Answers:
Covariance = $\epsilon\mathbb{I}$
$\pi_k = \frac{1}{k}$

6) We apply the Expectation Maximization algorithm to $f(D, Z, \theta)$ where D denotes the data, Z denotes the hidden variables and θ the variables we seek to optimize. Which of the following are correct? ***1 point***

- ○ EM will always return the same solution which may not be optimal
- ○ EM will always return the same solution which must be optimal
- ◉ The solution depends on the initialization

Yes, the answer is correct.
Score: 1

Accepted Answers:
The solution depends on the initialization

Problem Solving Session - July 2025 ()

7) **True or False:** Iterating between the E-step and M-step of EM algorithms always converges to a local optimum of the likelihood. ***1 point***

- (•) True
- ( ) False

Yes, the answer is correct.
Score: 1

Accepted Answers:
True

8) The number of parameters needed to specify a Gaussian Mixture Model with 4 clusters, data of dimension 5, and diagonal covariances is: ***1 point***

- ( ) Lesser than 21
- ( ) Between 21 and 30
- (•) Between 31 and 40
- ( ) Between 41 and 50

No, the answer is incorrect.
Score: 0

Accepted Answers:
Between 41 and 50