

Machine Learning: HW1

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1 KMeans Theory:

Given Kmeans Objective discussed in class with Euclidian distance:

$$\min \sum_i \sum_k \pi_{ik} \cdot \|X_i - \mu_k\|^2$$

A) prove that E step update on membership (π) achieves the minimum objective given the current centroids (μ)

answer: During the E step, we are given current centroids (μ) = $\{\mu_1, \mu_2 \dots \mu_k\}$

Goal: Calculate the memberships (π_{ik}) = $\{\pi_{i1}, \pi_{i2} \dots \pi_{ik}\}$ such that the result is the best possible memberships closest to center (μ_k).

B) prove that M step update on centroids (μ) achieves the minimum objective given the current memberships (π)

answer: During the M step, we are given current memberships (π) = $\{\pi_{i1}, \pi_{i2} \dots \pi_{ik}\}$

C) Explain why KMeans has to stop (converge), but not necessarily to the global minimum objective value.

answer: