

A8) STEP 1  $\rightarrow \forall x_1, x_2, \dots, x_N$

find minimum among  $\|x_i - z_1\|_2, \|x_i - z_2\|_2, \dots, \|x_i - z_k\|_2$

For each  $i$

NO. OF STEPS

subtraction

$$n * k$$

norm

$$2n * k$$

min among all

$$k$$

TOTAL

$$(3n+1)*k$$

\* k for k repetitions of the operation with each cluster center.

This is done  $N$  times.

$$\text{Hence total steps} = N(3n+1)k$$

$$= \underline{\underline{O(Nnk)}}$$

STEP 2  $\rightarrow$  For each cluster  $1, 2, \dots, k$

$$z_i = \frac{1}{|G_i|} \sum_{x \in G_i} x$$

Total number of additions  $\approx N$  [Exact value is  $N-k$ ]

Each addition  $\rightarrow n$  steps

We divide after adding all  $x_i$  of a cluster together

Number of divisions =  $k$ .

Each division takes  $n$  steps.

$$\text{Hence total steps} \approx \underline{\underline{kn + Nn}}$$

$$\text{Combining both COMPLEXITY} \approx N(3n+1)k + Nn + kn$$

The first term dominates.

Hence complexity is roughly of the order  $\underline{\underline{Nnk}}$ .

For 10 iterations

$$\text{Number of steps} = 10 * [N(3n+1)k + Nn + kn]$$

$$\approx \underline{\underline{30Nnk}}$$