

Assignment - 1

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- Q1.
- Both algorithms k-means and GMM are capable of identifying clusters effectively. However, key distinction is assignment method used for a point.
 - K-means uses hard clustering assignment; point is assigned to one cluster.
 - GMM applies soft clustering, each point has non zero probability of belonging to a cluster.
 - As a result calculation of means for each cluster differs for two.
 - In K-means, clusters are determined by all points assigned to specific cluster.
 - GMM calculates cluster based on differently weighted average of all points. This discrepancy has notable effect.
 - Center of left cluster is skewed to right and center of right cluster is skewed to left.
 - Some may view this as drawback of EM algorithm but skewing is not entirely unjustified.

Q2

1. Speech recognition

- HMM are widely used in speech recognition systems to model the varying characteristics of spoken language.
- They can be used to identify and predict sequence of phonemes of words to given audio signal, enabling conversion of speech to text.
- Real time speech recognition found in Siri, Alexa

2. Bioinformatics :

- HMM is used to model and predict secondary structure of proteins or functional elements in DNA sequence. They
- They help in detecting genes, protein folds and homologous sequences.
- Real time application personalized medicine.

3. Finance

- HMM can be applied to finance series data such as stock prices or currency exchange rates, to model and predict market trends or hidden states (eg: bullish bearish range).
- Real time trading algorithm

4. Gesture recognition.

- HMM can model temporal dynamics of human gestures, making them suitable for gesture

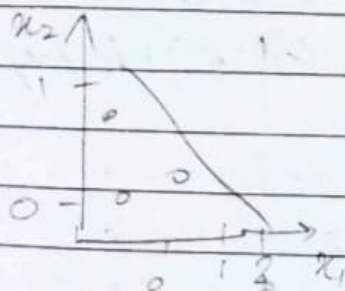
recognition in real time applications.

- Eg : VR, games, HMI.

5. NLP

- HMM is used in NLP part of speech tagging, assigning grammatical category.
- Chatbots, machine translation.

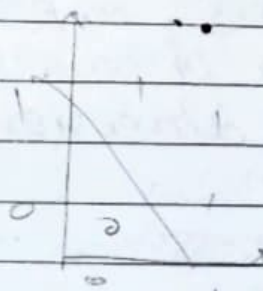
Q3.



AND Func



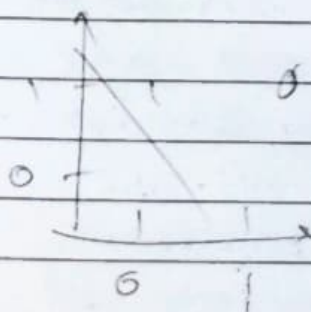
Linearly separable



OR Func



Linearly Separable



← XOR

non linearly separable

- Radial basis function performs linear transformation over IP vectors before the IP vectors are feed for classification.
- Using such non linear transformation, it is possible to convert a non linearly separable data into linearly separable data.

• PCA also increase the dimensionality of p feature vectors to convert them to non linearly separable problem in d under 3 phase

case 1] convert by applying transformation function

• PCA increase dimensionality of p vectors since, a problem in lower dimension is non linear becomes linear in higher dimension.