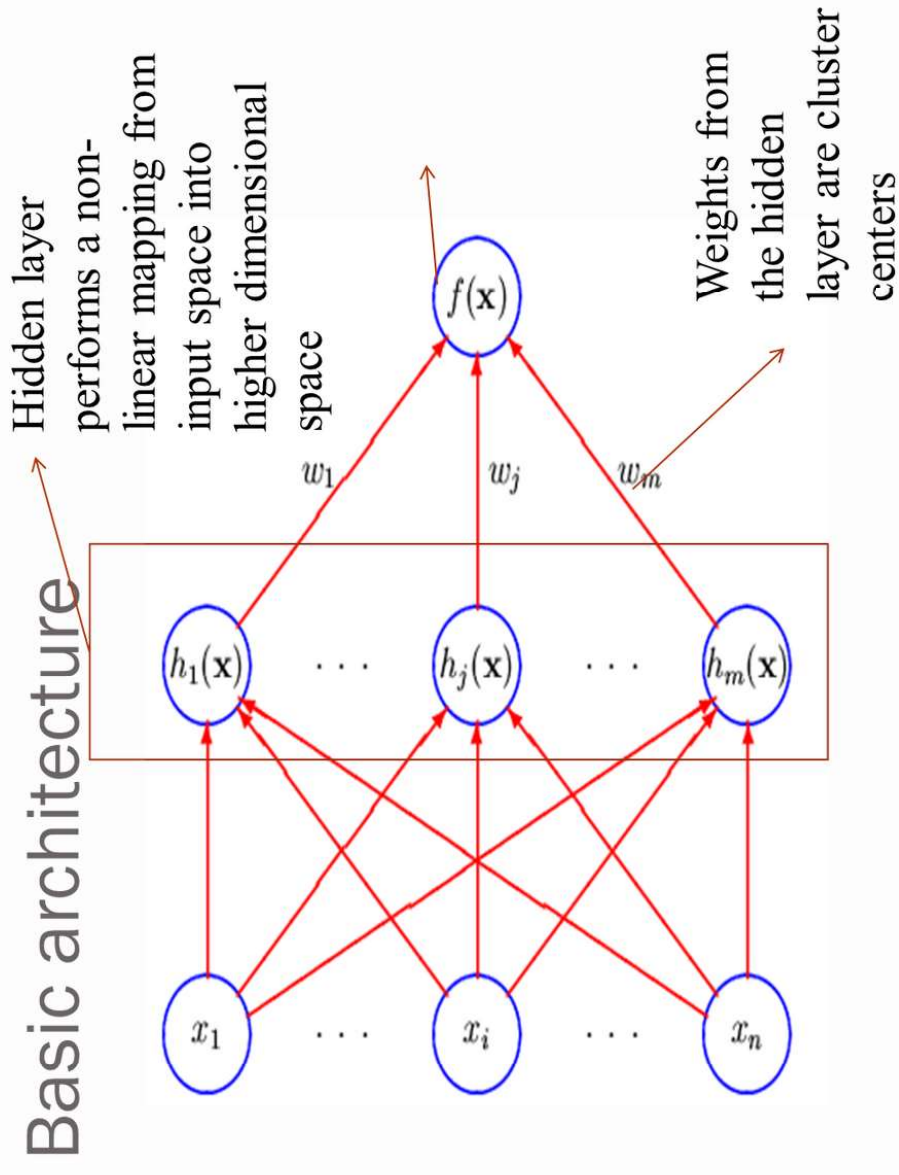
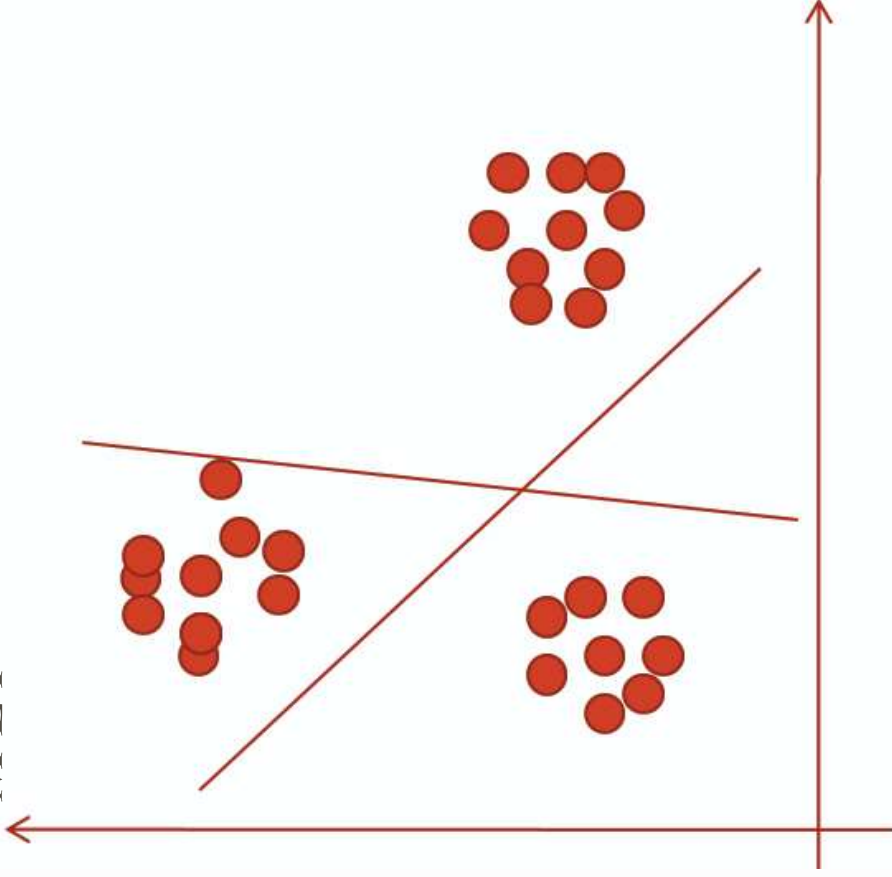


ARCHITECTURE OF RBF

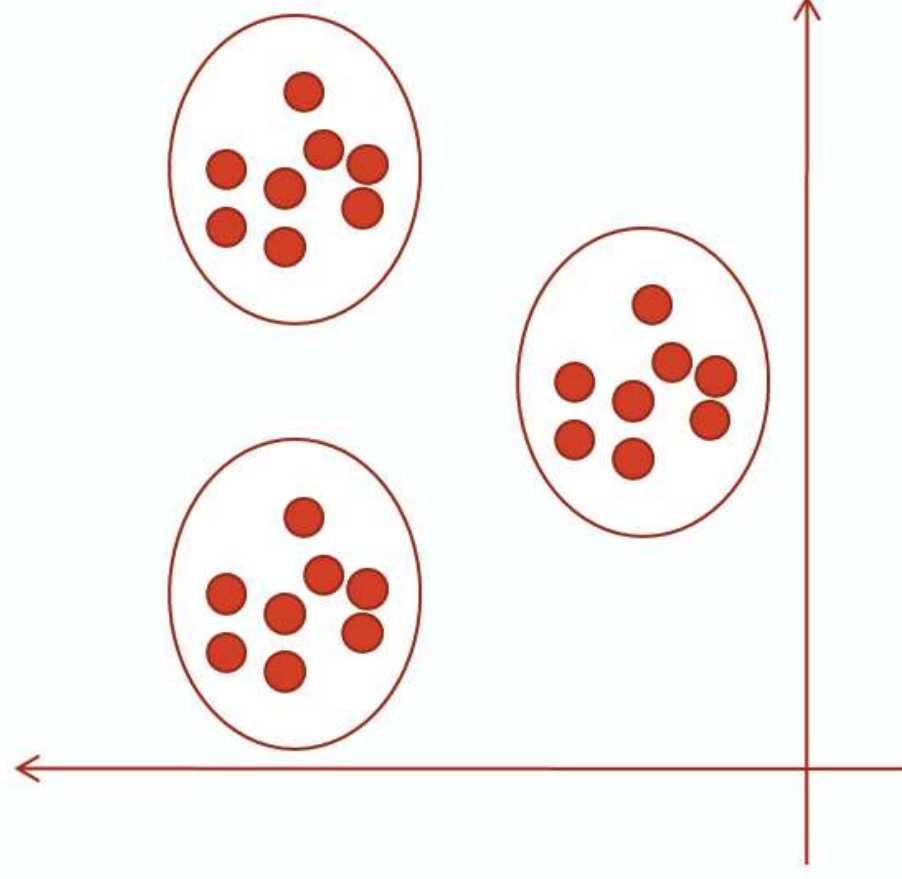


RBF NETWORKS FOR CLASSIFICATION

-MLP



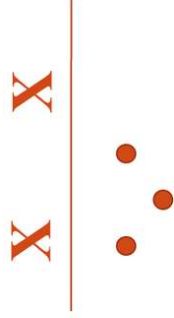
-RBF



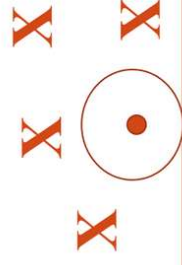
RBF NETWORKS FOR CLASSIFICATION

- An MLP naturally separates the classes with hyperplanes in the Input space
- RBF would be to separate class distributions by localizing radial basis functions
- Types of separating surfaces are
- Hyperplane-linearly separable
- Spherically separable-Hypersphere
- Quadratically separable-Quadratics

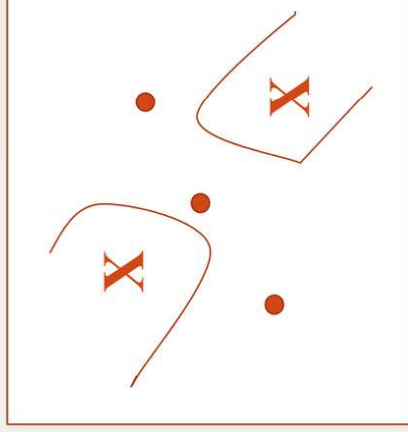
Hyperplane-linearly
separable



Hypersphere-
spherically
separable



Quadratically
separable- Quadrics

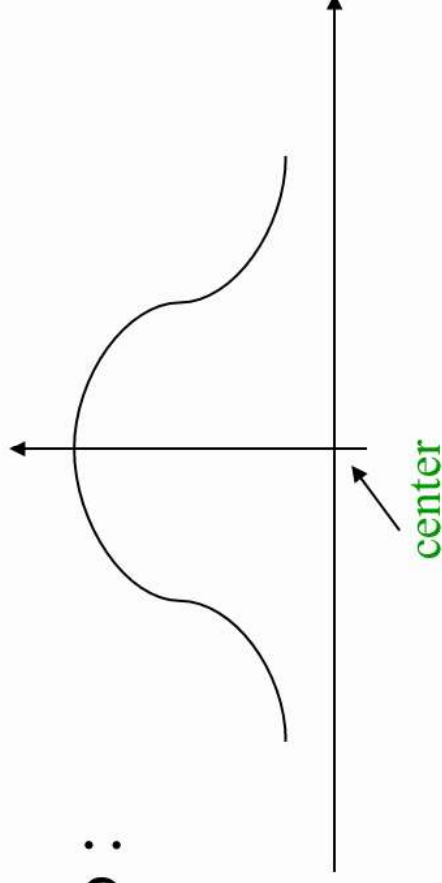


WHAT HAPPENS IN HIDDEN LAYER?

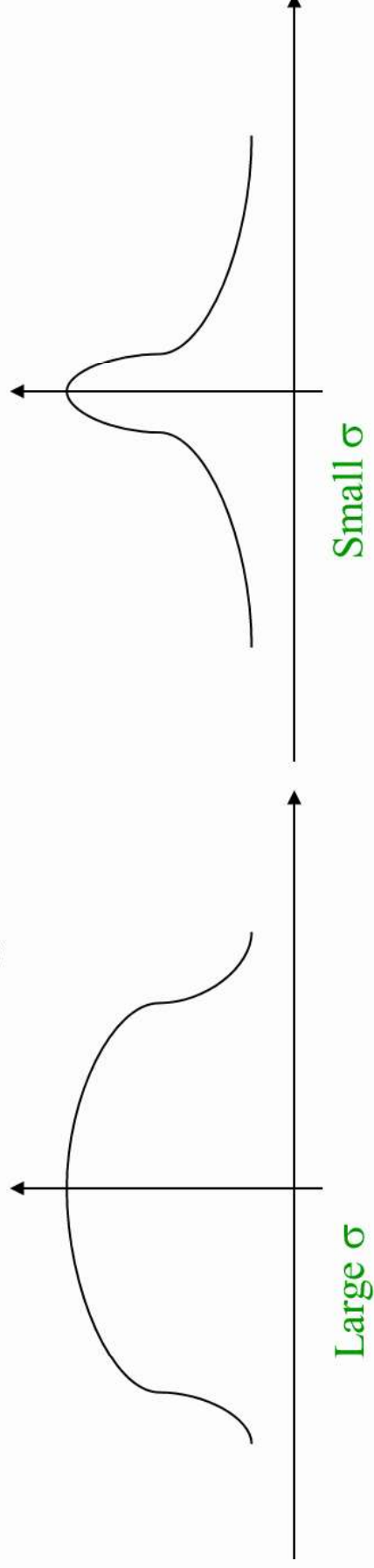
- The patterns in the input space form clusters
- If the centers of these clusters are known then the distance from the cluster center can be measured
- The most commonly used radial basis function is a Gaussian function
- In a RBF network r is the distance from the cluster centre

GAUSSIAN RBF ϕ

ϕ :



σ is a measure of how spread the curve is:



DISTANCE MEASURE

- The distance measured from the cluster centre is usually the Euclidean distance
- For each neuron in the hidden layer, the weights represent the co-ordinates from the centre of the cluster
- When the neuron receives an input pattern X, the distance is found using the equation

$$r_j = \sqrt{\sum_{i=1}^n (x_i - w_{ij})^2}$$

WIDTH OF HIDDEN UNIT

$$\phi_j = \exp\left(-\frac{\sum_{i=1}^n (x_i - \mu_j)^2}{2\sigma^2}\right) \quad 1$$

where $\sigma = \frac{d_{\max}}{\sqrt{2M}} \quad 2$

σ Is the width or radius of the bell shape and has to be determined empirically

M=no. of basis function μ_j =basis function centre

D_{\max} =distance between them

$$\phi_j = \exp\left(-\frac{M}{d_{\max}^2} \sum_{i=1}^n (x_i - \mu_j)^2\right) \quad 3$$

TRAINING OF THE HIDDEN LAYER

- The hidden layer in a RBF network has units which have weights corresponding to the vector representation of the centre of the cluster
 - These weights are found either by k-means clustering algo or kohonen's algorithm
 - Training is unsupervised but the no. of clusters is set in advance.
- The algorithms finds the best fit to these clusters



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ML LAB COMPENSATION