

1. 1
  - b. As the learning rate is constant, the colors change with high value at the end. And if classes are near each other too much and neighborhood radius is high enough, it can cause the conflict and update other classes clusters which shouldn't change them at the end of training, or it should be low if any changes happens not high as the beginning of the training.
  - c. As the neighborhood radius stays constant, the learning at the end when the clusters found maybe can be conflicted with other classes in update and if learning rate is high enough maybe can affect the other classes and made change in clusters of other classes.
2. In part B I used k-mean algorithm to find the centers positions, then set the radius of radial based functions as:

$$\sigma = \frac{d_{max}}{\sqrt{2S}}$$

Where  $d_{max}$  is the maximum distance between centroids and S is the number of centroids.

And for values of w I used SGD method with Mean Squared Loss. The formulas used in algorithm are:

$$F(x) = \sum_{i=1}^S w_i \phi_i(x)$$

$$\phi_i(x) = e^{-\frac{\|x - \mu_i\|^2}{2\sigma_i^2}}$$

$$E = \frac{1}{2} (y_k - F(x_k))^2$$

And parameters are  $w_i$ 's. So:

$$\frac{\partial E}{\partial w_i} = -(y - F) \frac{\partial F}{\partial w_i} = -(y - F) \phi_i(x)$$

$$w_i = w_i - \eta \frac{\partial E}{\partial w_i}$$