Program for lossy compressing images with implementation of self-organizng map(Kohonen SOM)

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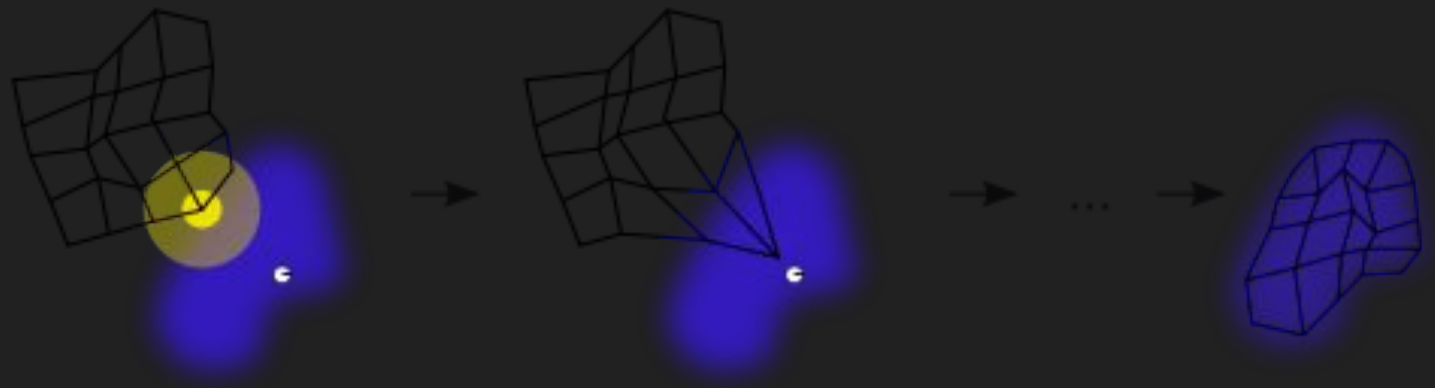
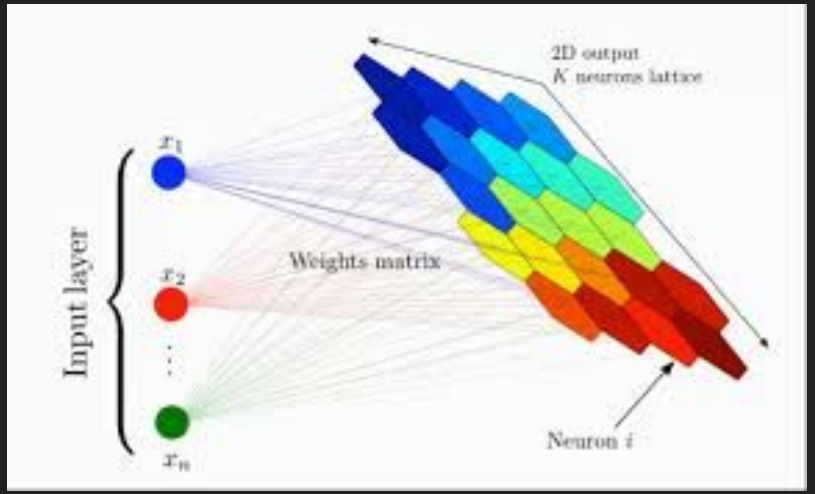
What is self-organizing map?

A self-organizing map (SOM) is a type of artificial neural network that is trained using unsupervised learning to produce a low-dimensional (typically two-dimensional), discretized representation of the input space of the training samples, called a map, and is therefore a method to do dimensionality reduction. Self-organizing maps differ from other artificial neural networks as they apply competitive learning as opposed to error-correction learning, and in the sense that they use a neighborhood function to preserve the topological properties of the input space.[wikipedia]



How does it work?

1. Weight initialization
   The input vector is selected from the dataset and used as an input for the network
2. BMU is calculated
3. The radius of neighbors that will be updated is calculated
4. Each weight of the neurons within the radius are adjusted to make them more like the input vector
5. Steps from 2 to 5 are repeated for each input vector of the dataset



Some math...

$$Distance^2 = \sum_{i=0}^{n} (input_i - weight_i)$$

n - number of weights

And more math

sigma - number of weights
t - iteration
k - number of iterations

$$\sigma(t) = \sigma_0 e^{\frac{t}{\lambda}}$$

$$\lambda = \frac{k}{\sigma_0}$$

It’s almost all

$$weight(t+1) = weight(t) + \Theta(t)L(t)(input(t) - weight(t))$$

L - learning rate

$$L(t) = L_0 e^{-\frac{t}{\lambda}}$$

$$\Theta(t) = e^{-distBMU/2\sigma(t)^2}$$

Thank you for your attention!
Questions?