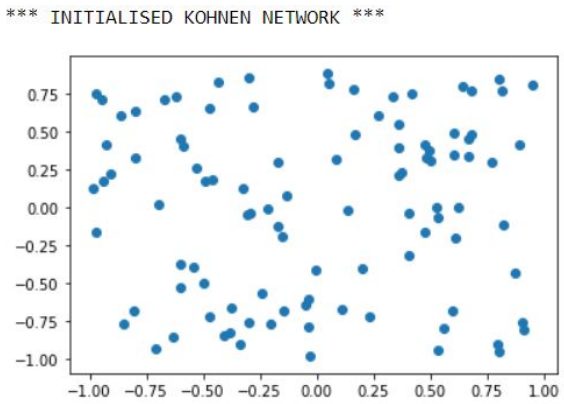
Self Organizing Neural Network

Question:

Consider a Kohonen network with 100 neurons arranged in the form of a two- dimensional lattice with 10 rows and 10 columns. The network is required to classify two-dimensional input vectors such that each neuron in the network should respond only to the input vectors occurring in its Region. Train the network with 1500 two-dimensional input vectors generated randomly in a square region in the interval between -1 and +1. Select initial synaptic weights randomly in the same interval (-1 and +1)and take the learning rate parameter α is equal to 0.1.
Test the performance of the self organizing neurons using the following
Input vectors:
X 1 =[0.1 0.8] T , X 2 =[0.5 -0.2] T , X 3 =[-0.8 -0.9] T , X 4 =[-0.0.6 0.9] T

Procedure:

Here below is the initialised network with 10x10. Now this is to be trained based on the randomly generated 1500 input samples.



Algo : ref (https://towardsdatascience.com/self-organizing-maps-ff5853a118d4)

- Each node's weights are initialized.
- A vector is chosen at random from the set of training data.
- Every node is examined to calculate which one's weights are most like the input vector. The winning node is commonly known as the Best Matching Unit (BMU).
- Then the neighbourhood of the BMU is calculated. The amount of neighbors decreases over time.
- The winning weight is rewarded with becoming more like the sample vector. The neighbours also become more like the sample vector.
- The closer a node is to the BMU, the more its weights get altered and the farther away the neighbor is from the BMU, the less it learns.

Here are the snapshots of network after few iterations
After 300 iterations

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**************THE NETWORK AFTER  300 iterations**************
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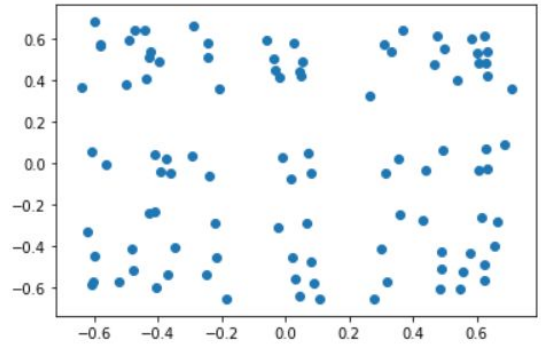

After 500 iterations

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**************THE NETWORK AFTER  500 iterations**************
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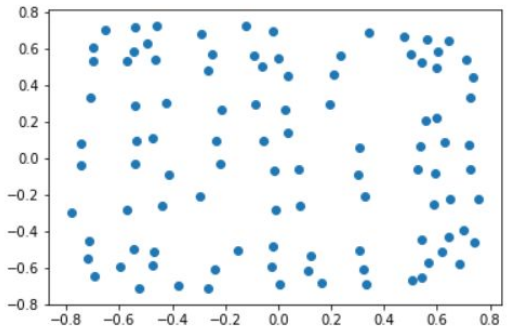

After 700 iterations

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**************THE NETWORK AFTER  700 iterations**************
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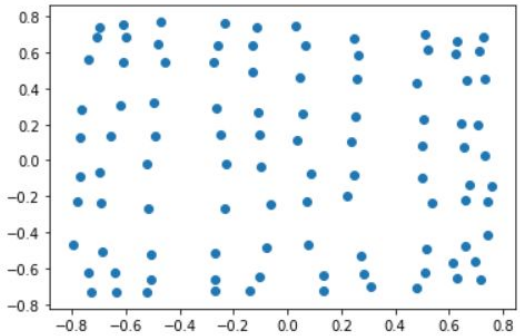
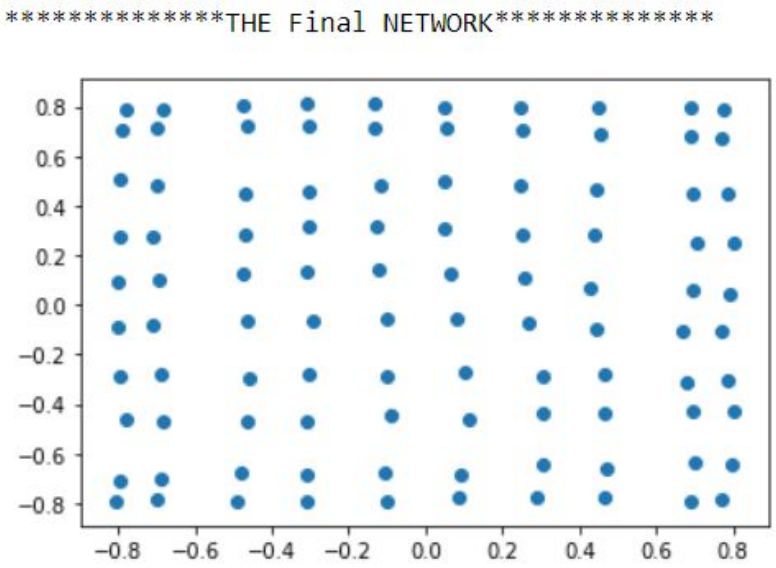


After 1000 iterations/ convergence



Here in the above image we could see how nicely all the neurons of the kohnen network are aligned.

The neurons activated for various test input are shown below.

The nearest neuron is in red colour and its position can be verified based on the input.