

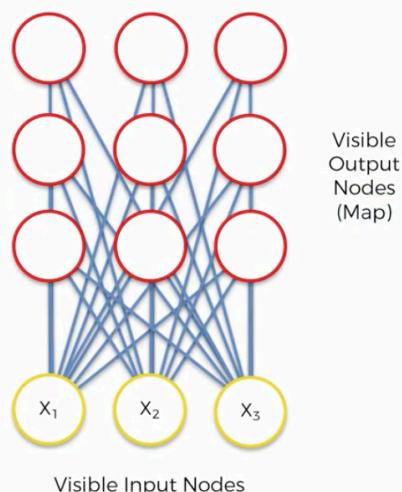
How do SOMs learn?

How Do SOMs Learn?

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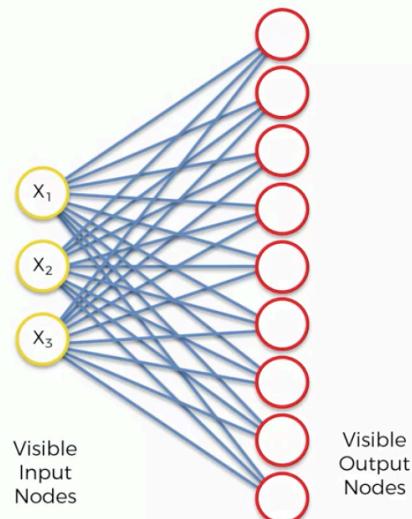


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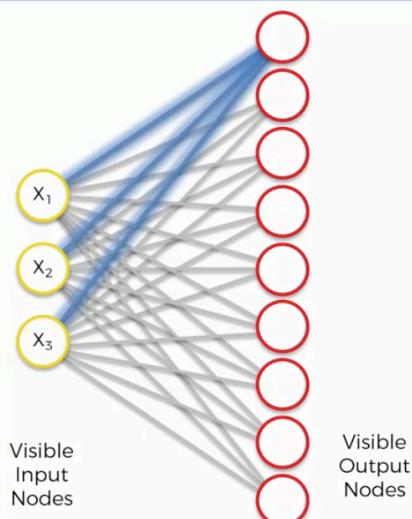
Note: Our input dataset is 3 dimensional it means that we have three columns of nodes in here and our output dataset in SOM is always 2 dimensional. Therefor we are reducing the dimensionality from 3D to 2D.

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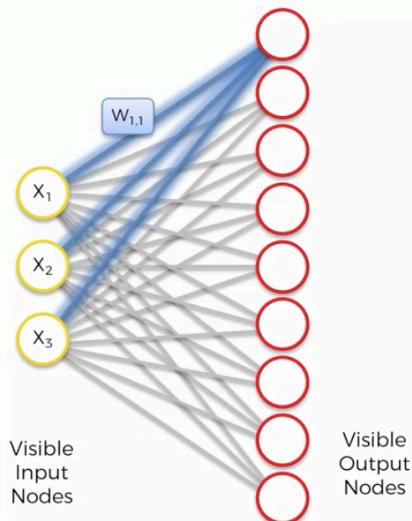
This is same as above, only the positions have been changed. Remember that some expression in SOM have a different meaning than what it has in ANN or in CNN like weights, synapses and so on.

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First, we are looking at the top node and look at the three connections or synapses leading to this node.

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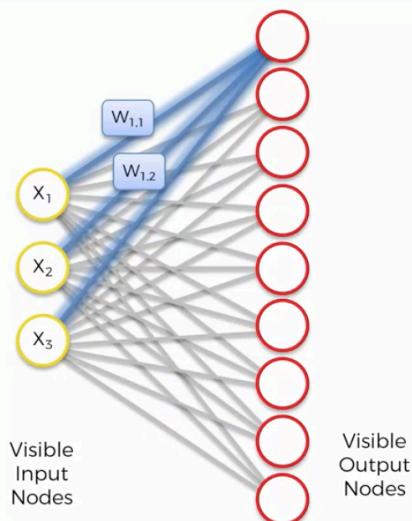


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some weights are assign to each of synapses in here
in $W_{1,2}$, first index means the first node in our output and the second index means where that synapses connected from. Which in here is the second one.

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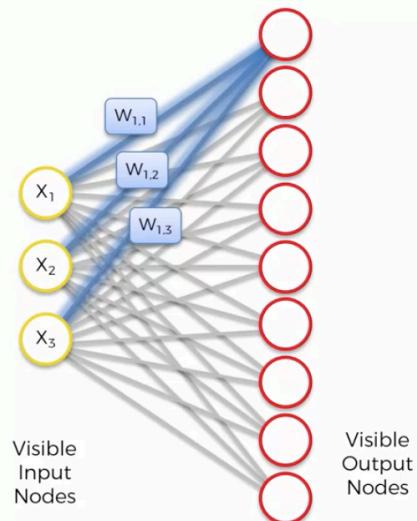


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Note: weights in SOM has a different meaning than ANN. In ANN, weights are used to multiply the input by that weight and then we applied an activation function. But in SOM, there is no activation function so in here weights are characteristic of node itself.

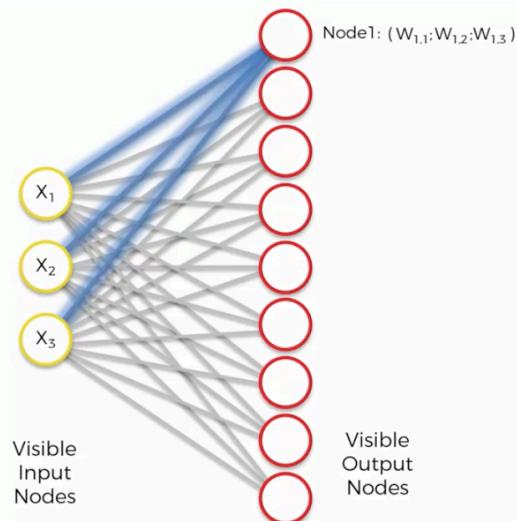
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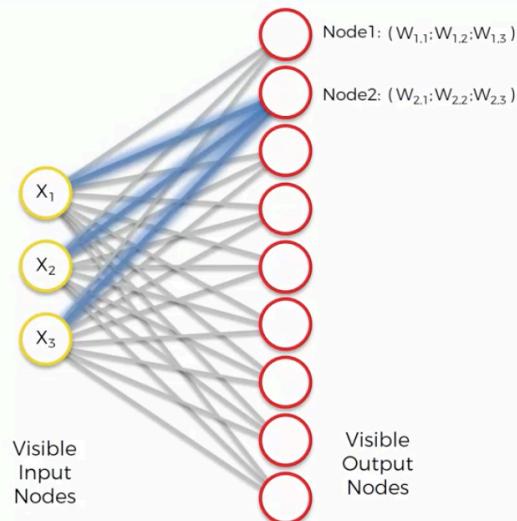


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In SOM, weights are characteristic of node itself.

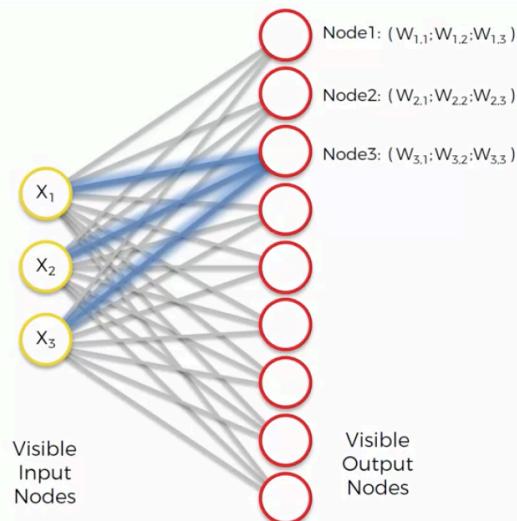
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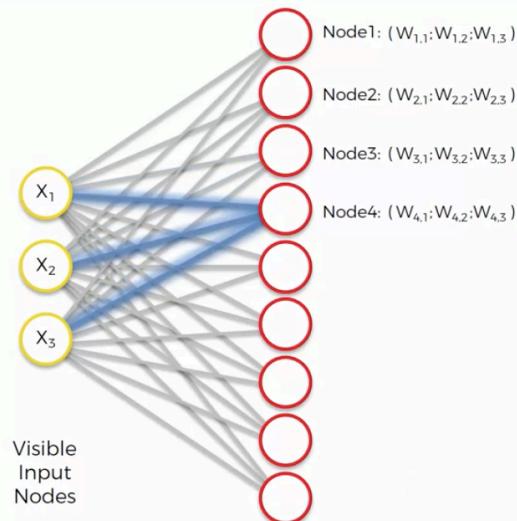
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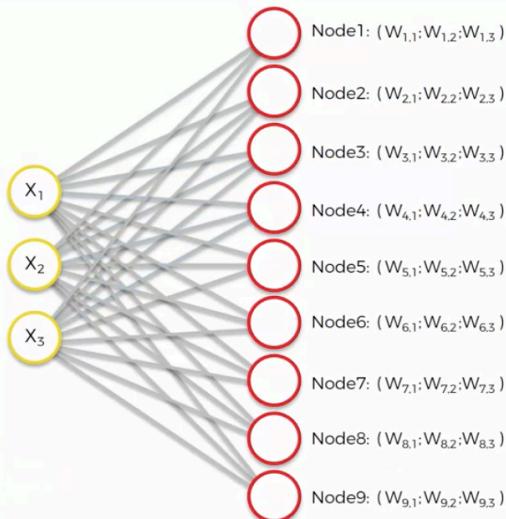
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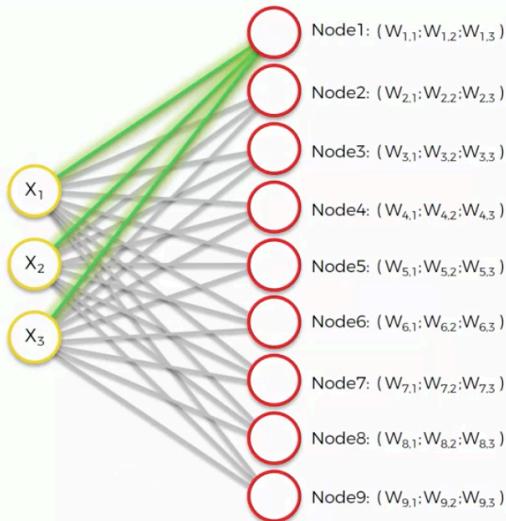
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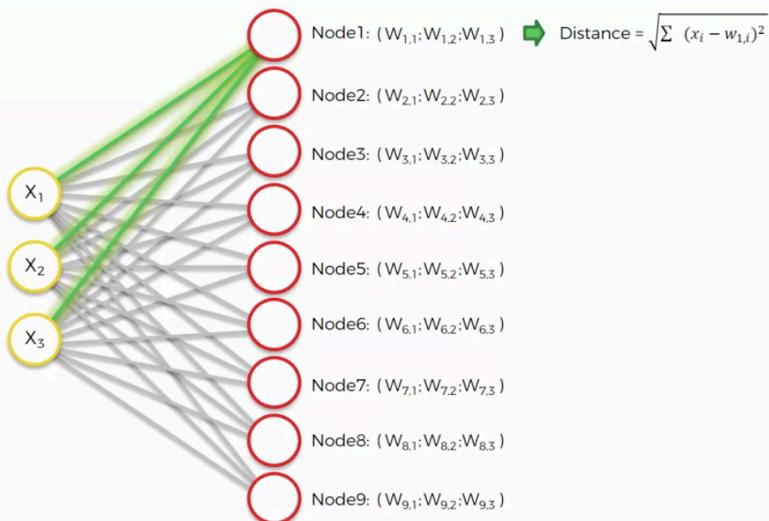


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Now, we are going to have a competition among these nodes to find out which of these nodes is closest to each of the rows in our dataset. (these three shown nodes are one row)

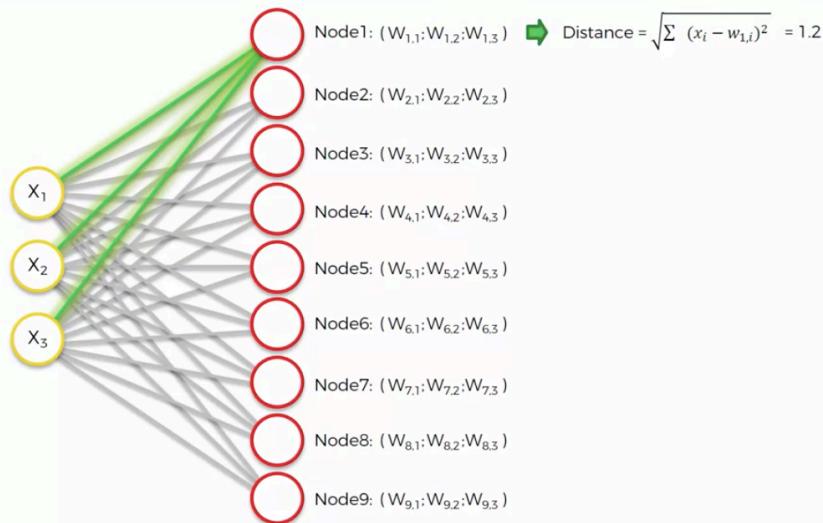
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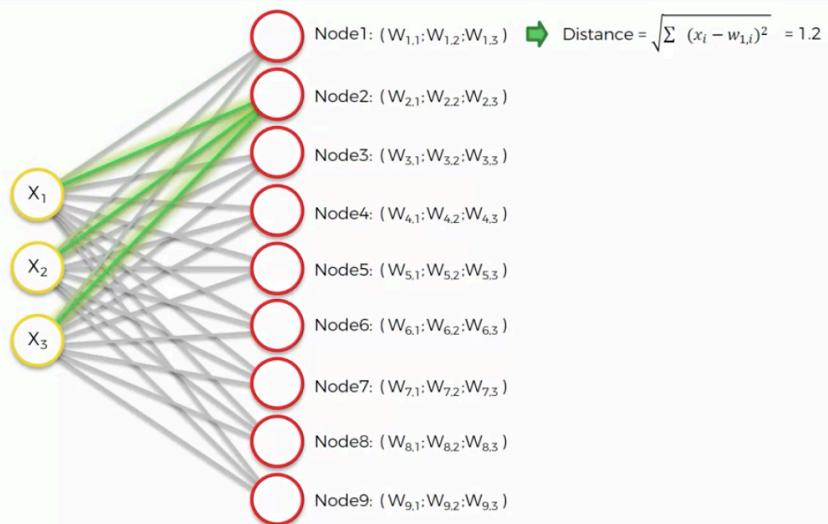


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In here we should get values near to 1 because we should make sure that our inputs are between 0 and 1 for all of these algorithms to work properly. (because of the feature scaling that applied before)

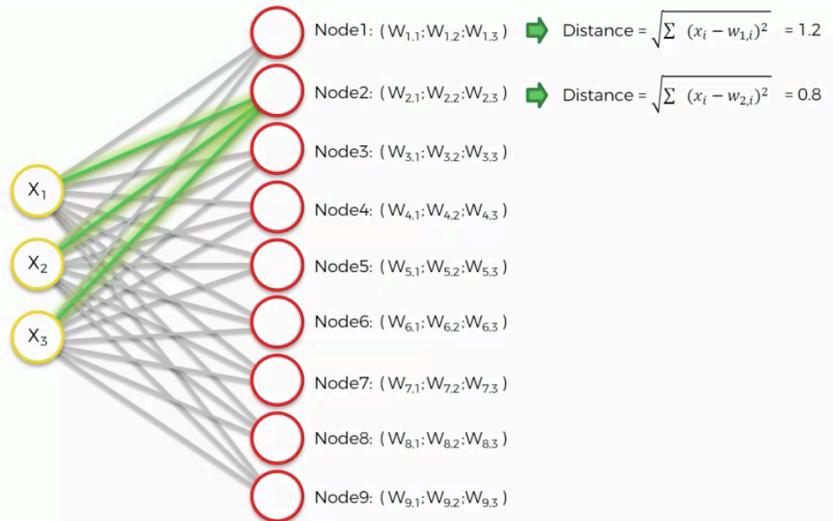
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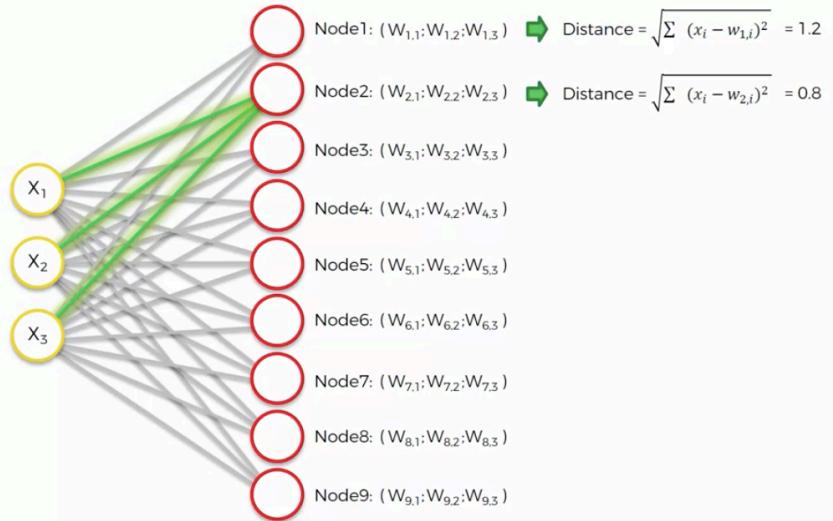
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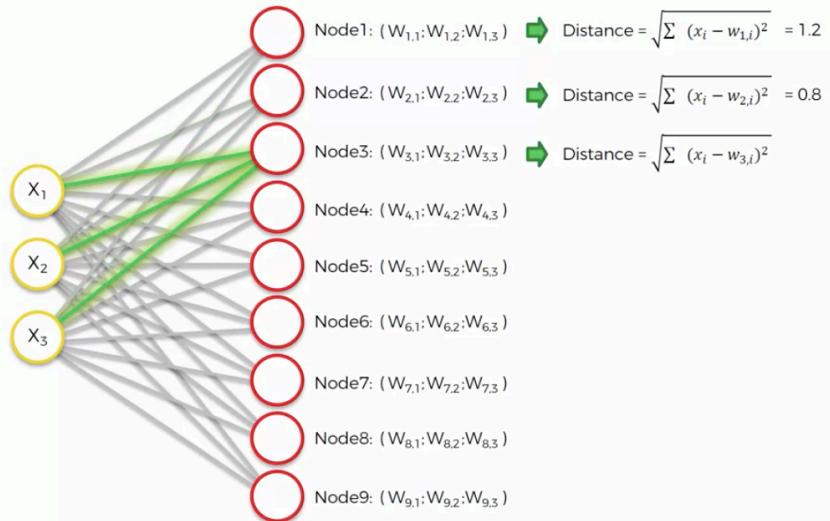
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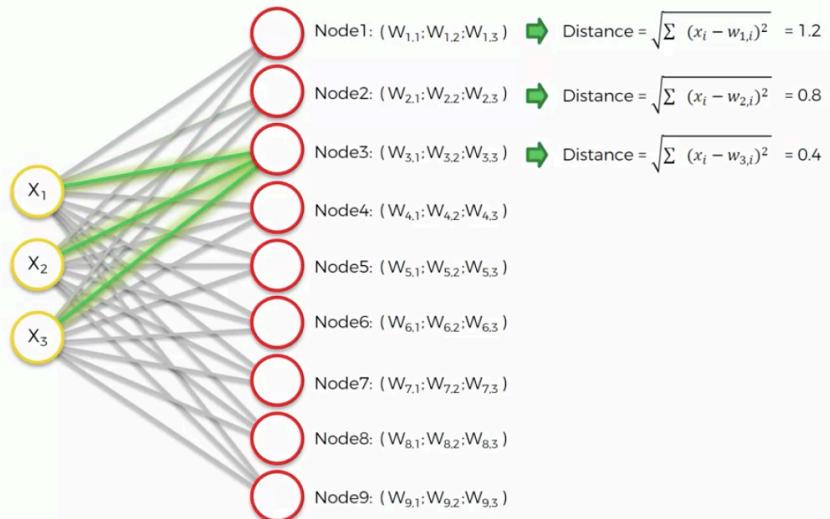
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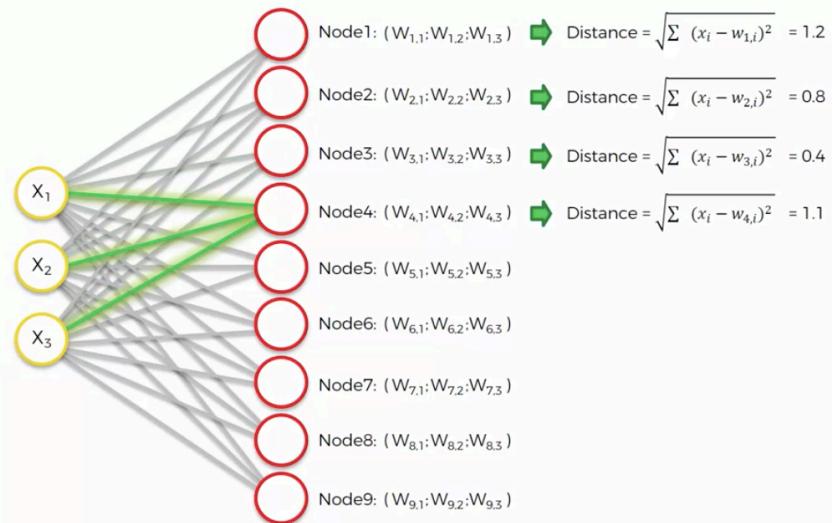
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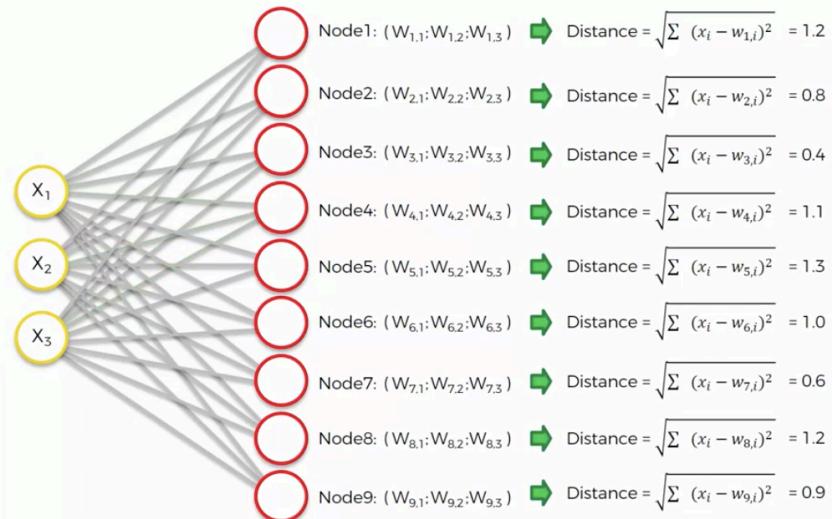
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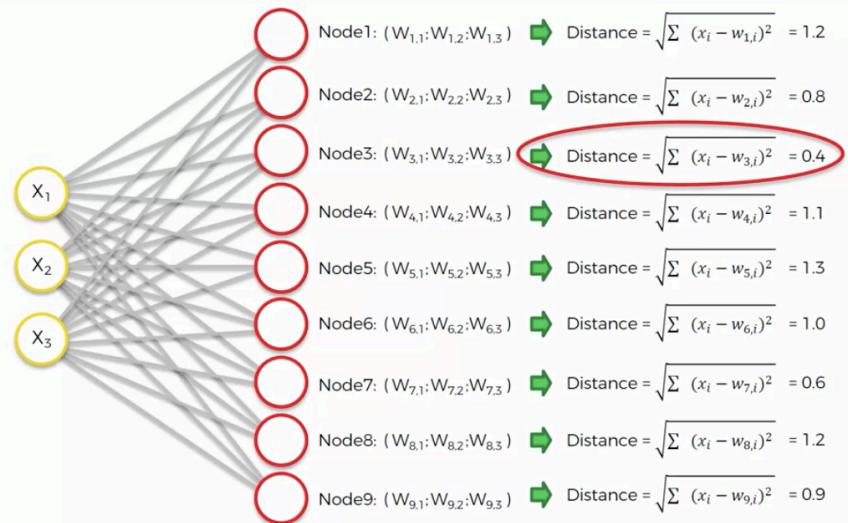
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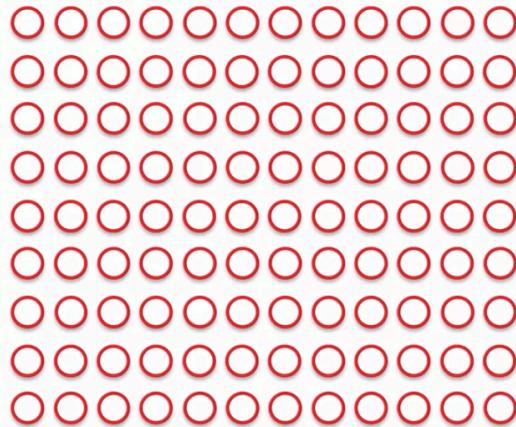


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closest number which we usually call this kind of node BMU or best matching unit.

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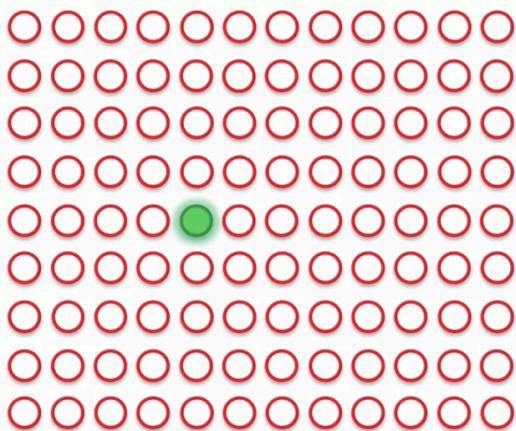


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This is a larger self-organizing map.

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Let's say we find the best matching unit for our number 1.

Afterward the SOM is going to update the weights. (in here weights are the characteristic of that specific node.)

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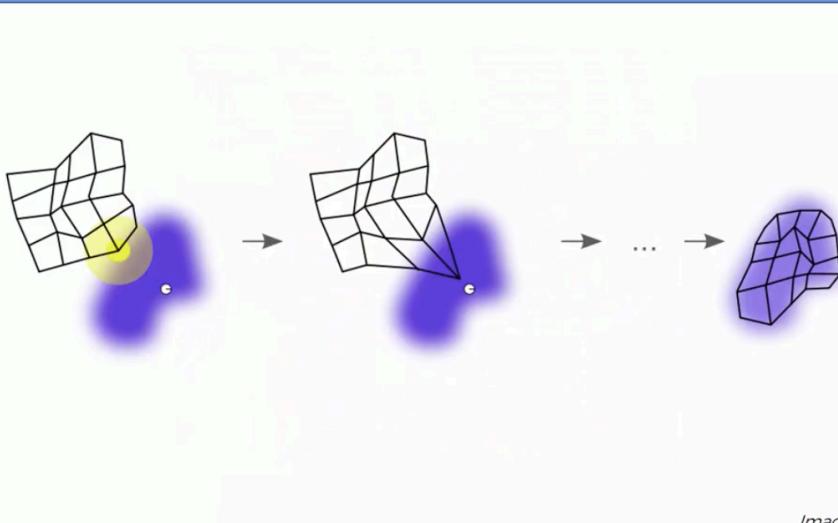


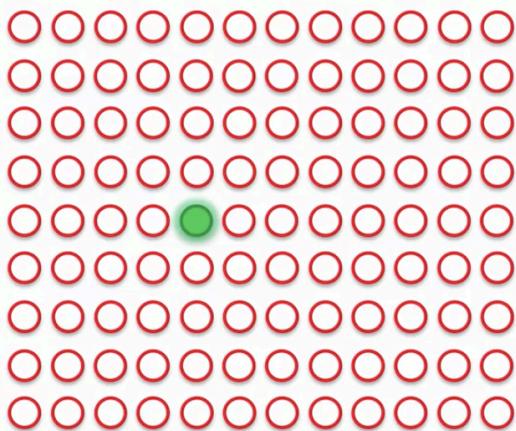
Image Source: Wikipedia

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In visual term, it means that self-organizing map coming closer to that data point. In the second part, only one point totally drag closer into that data point and also some of its near node drag closer into as well

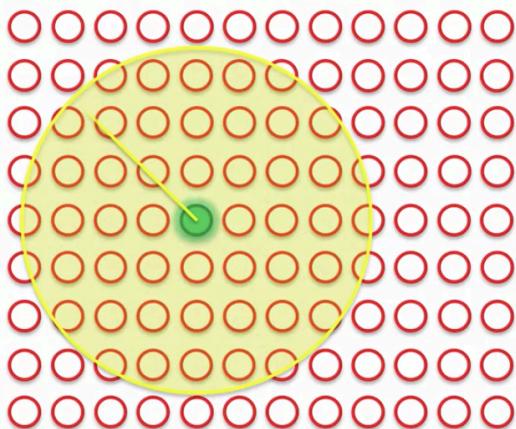
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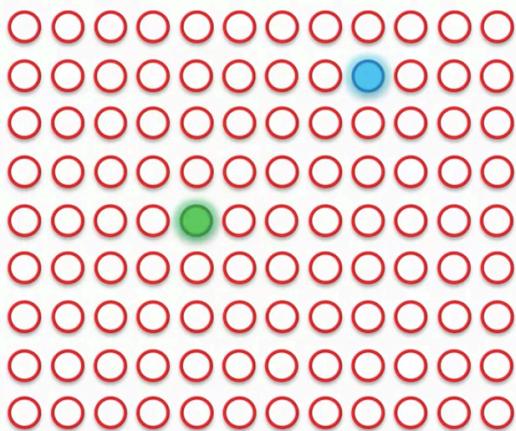


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the next step is a radius around this BMU and every single node that fall into that radius, its weights going to be updated to come closer to that row we matched up with.
Note: inside that radius, the closer our node is to the BMU, the heavier our weights of data going to be.

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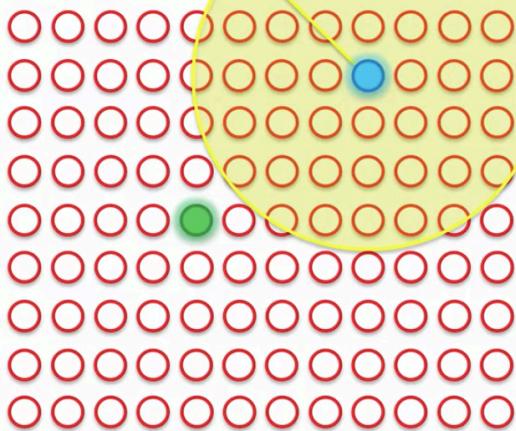


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this is BMU for the row number 2.

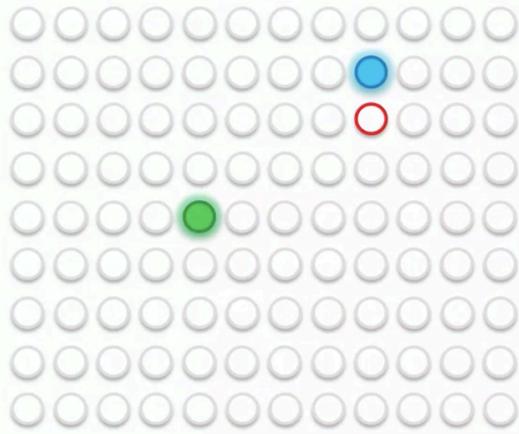
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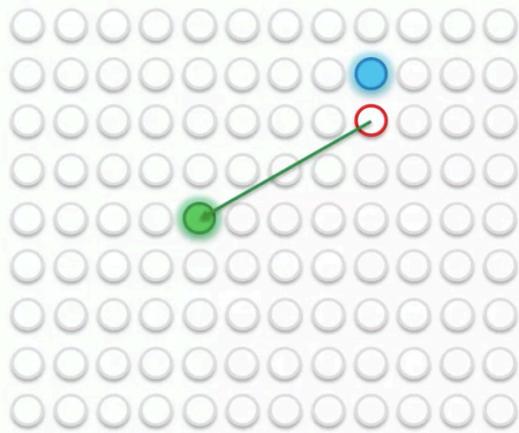


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this red node is closer to the blue BMU so it will pull heavier by the blue node.

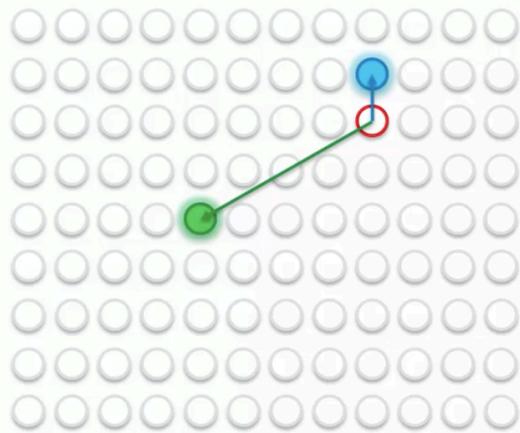
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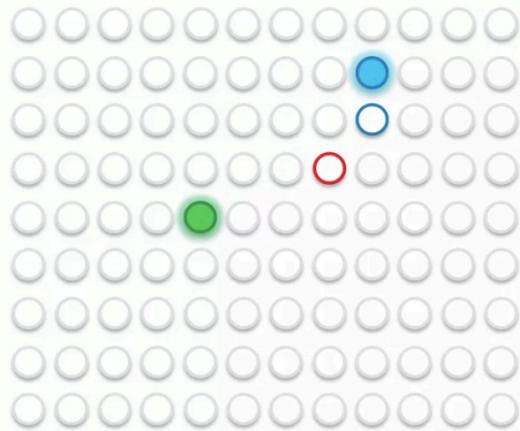
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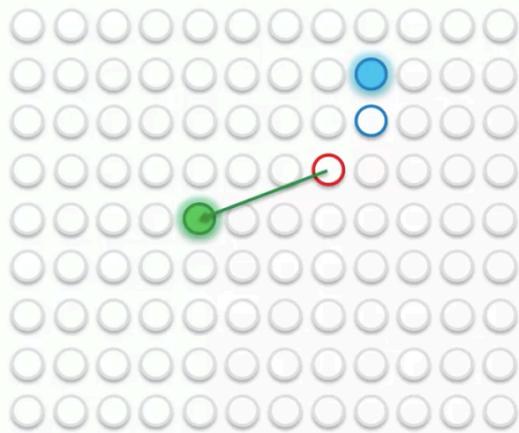


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This red node has the same distance from two BMU so it will be affect equally by the two BMU.

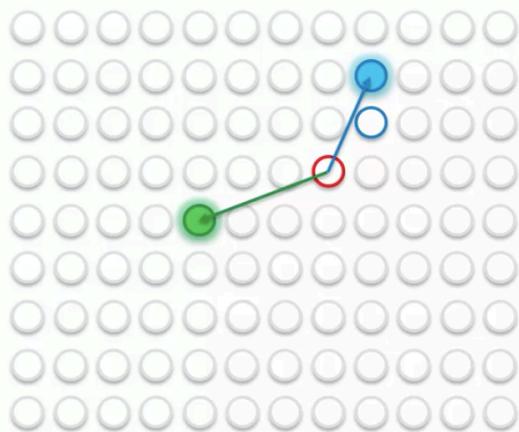
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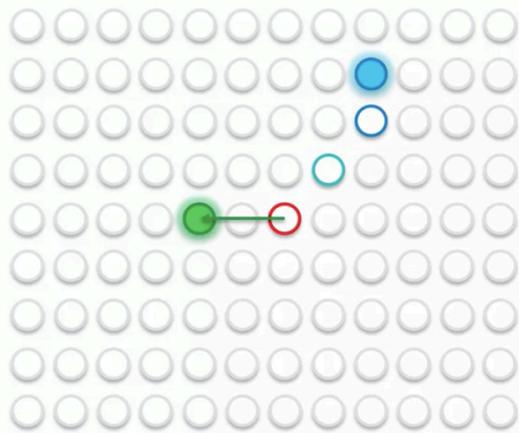
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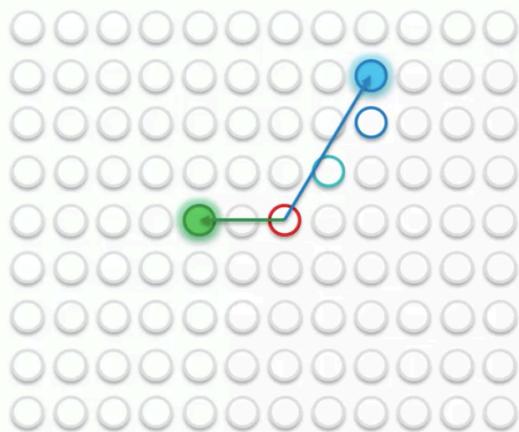
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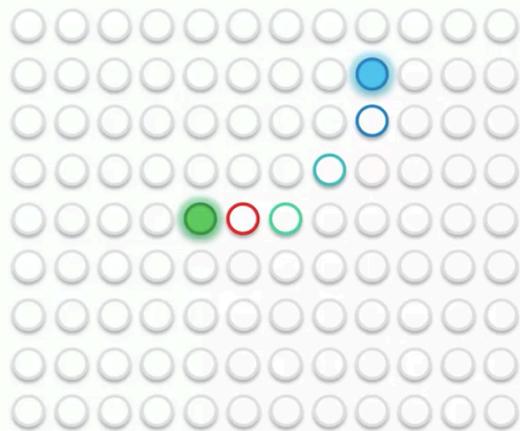
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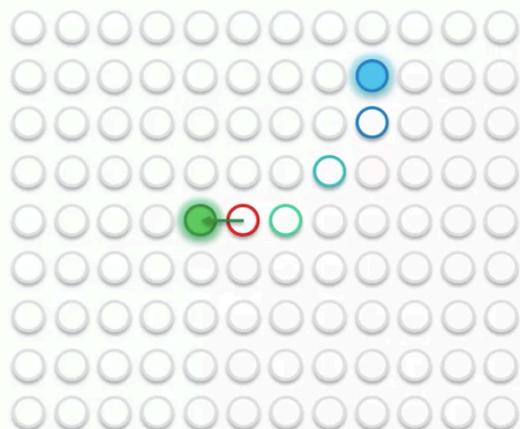
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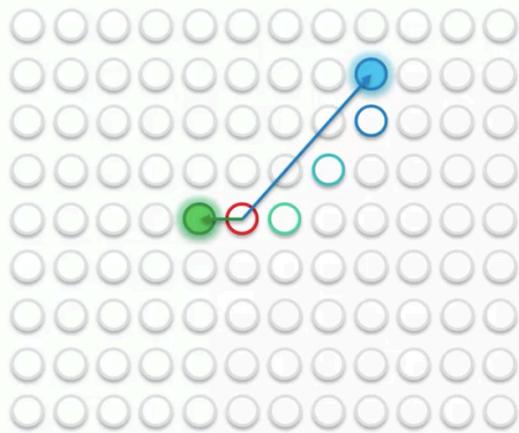
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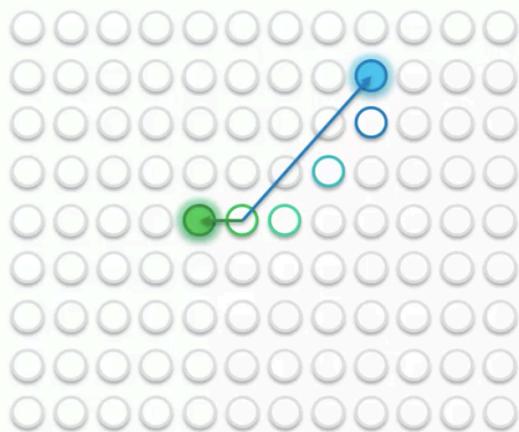
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