3/19/2020

Note Title 3/19/2020

Self organizing maps (SOM)

Self organizing feature maps (SOFM)

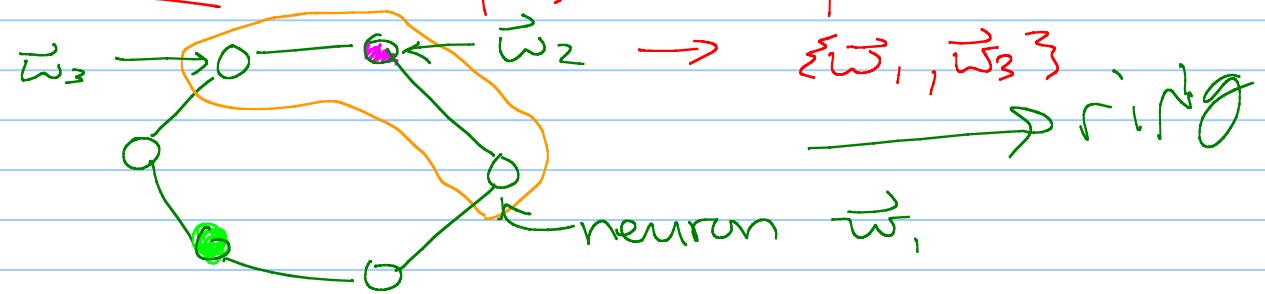
Unsupervised learning

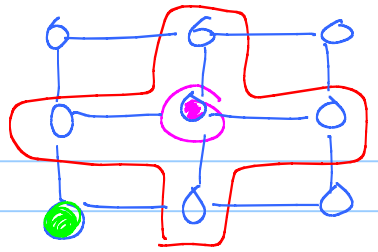
Based on competitive learning

(Winner takes all)

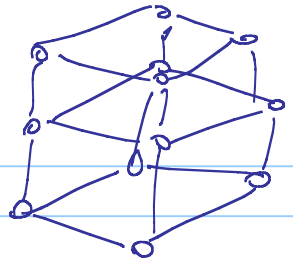
1980's Kohonen network map

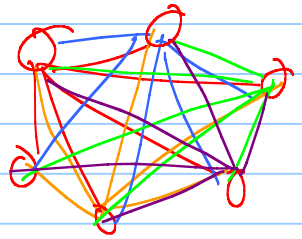
Lattice (topological map)





Von Neuman





Fully connected

$W_j = [w_{j1}, w_{j2}, \ldots, w_{jm}]^T$ ← neuron

$X_i = [x_1, \ldots, x_m]^T$

Winner: $i(x) = \arg\min_j \| x - w_j \|$ $\quad j = 1, 2, \ldots, l$

* Knowledge of the neighborhood

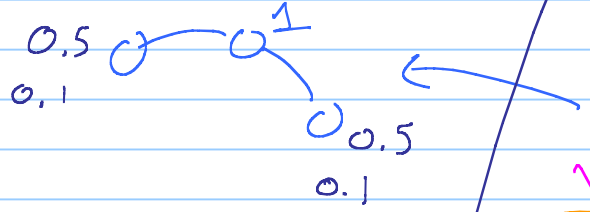
$$N_j = \{ w_k \mid w_k \text{ is "connected" to } w_j \}$$
$$w_k \neq w_j$$

$i_s(x) \leftarrow x_s$

* Kohonen

$$w_j(n+1) = w_j(n) + \eta(n)\, h_{j,i(x)}(n)\,(x - w_j(n))$$

$h_{j,i(x)}(n) \in [0,1]$




ring $\in \{0,1\}$

von Neuman $\in \{0,1\}$

$$\eta(n) = \eta_0 \exp\left(-\frac{n}{\tau_2}\right)$$

SOM

- init the map
- DO until done

✓ ✱ pick a new sample $x_s$

✓ pick the closest neuron

✓ ✱ Neighborhood update

Euclidean

random

sequential

adaptive

## Extensions

✱ how to sample the data

✱ adapting $\eta(n)$

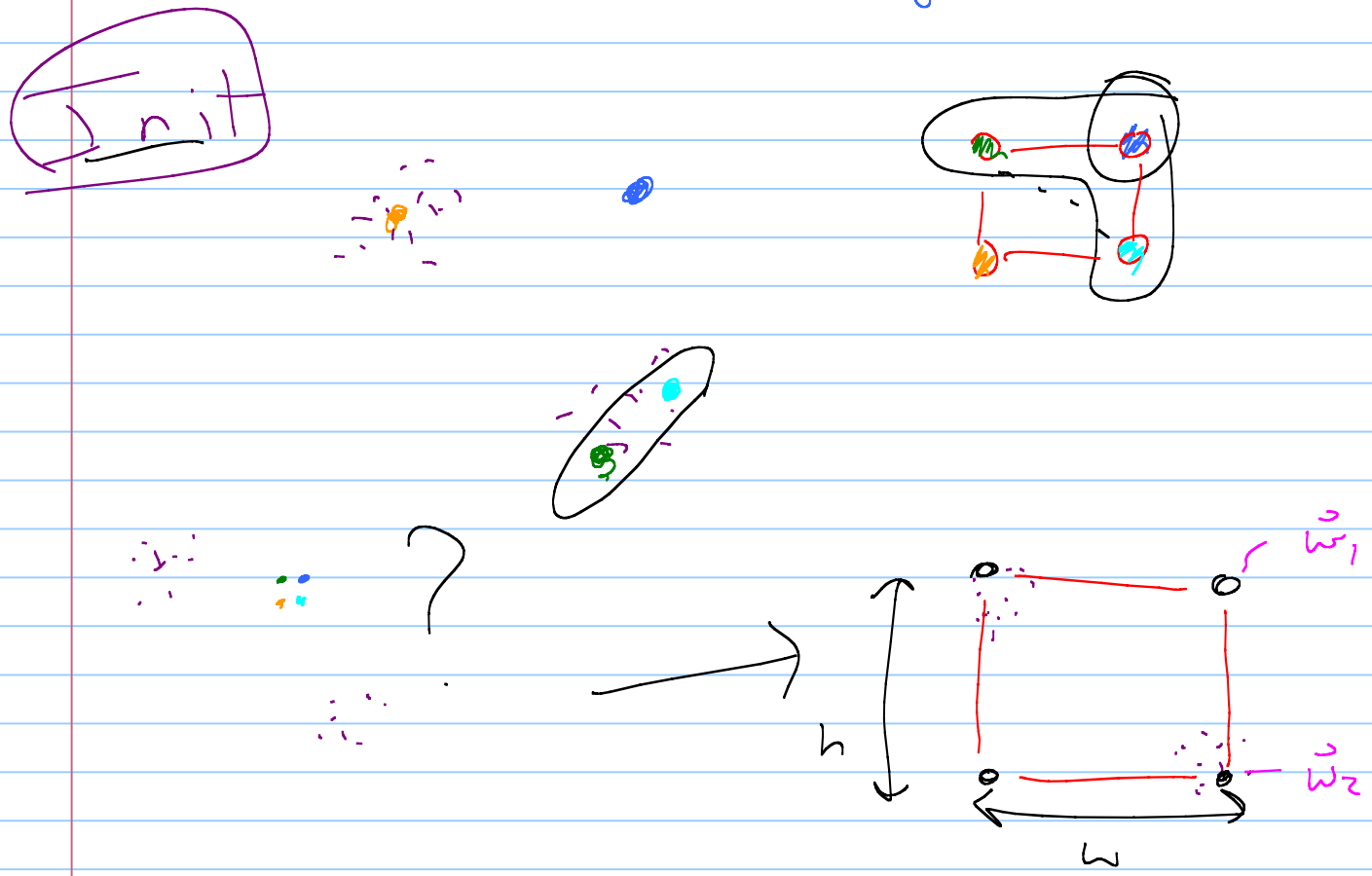
} discussion board

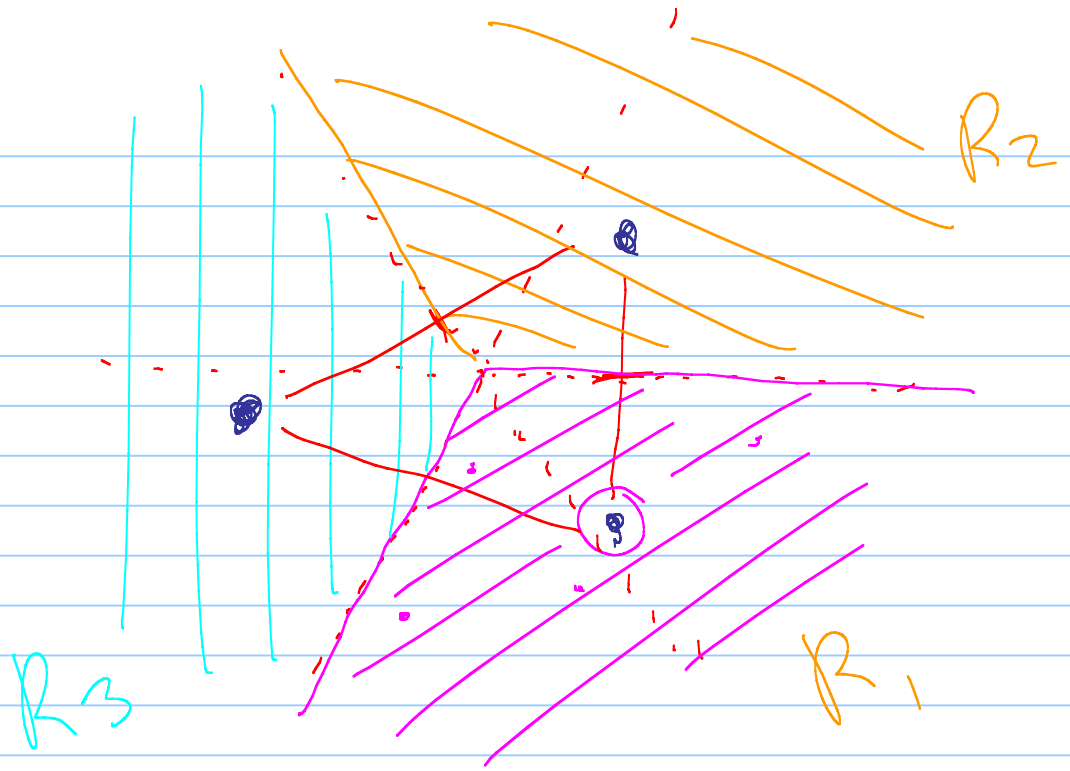
heads up: neural gas → adaptive topology

neural gas → adaptive parameters

heads-up$^2$: SOM (neural gas) changing over time. Other methods like clustering, must are "fixed".

"stream clustering"
"online learning"




R2
R3
R1