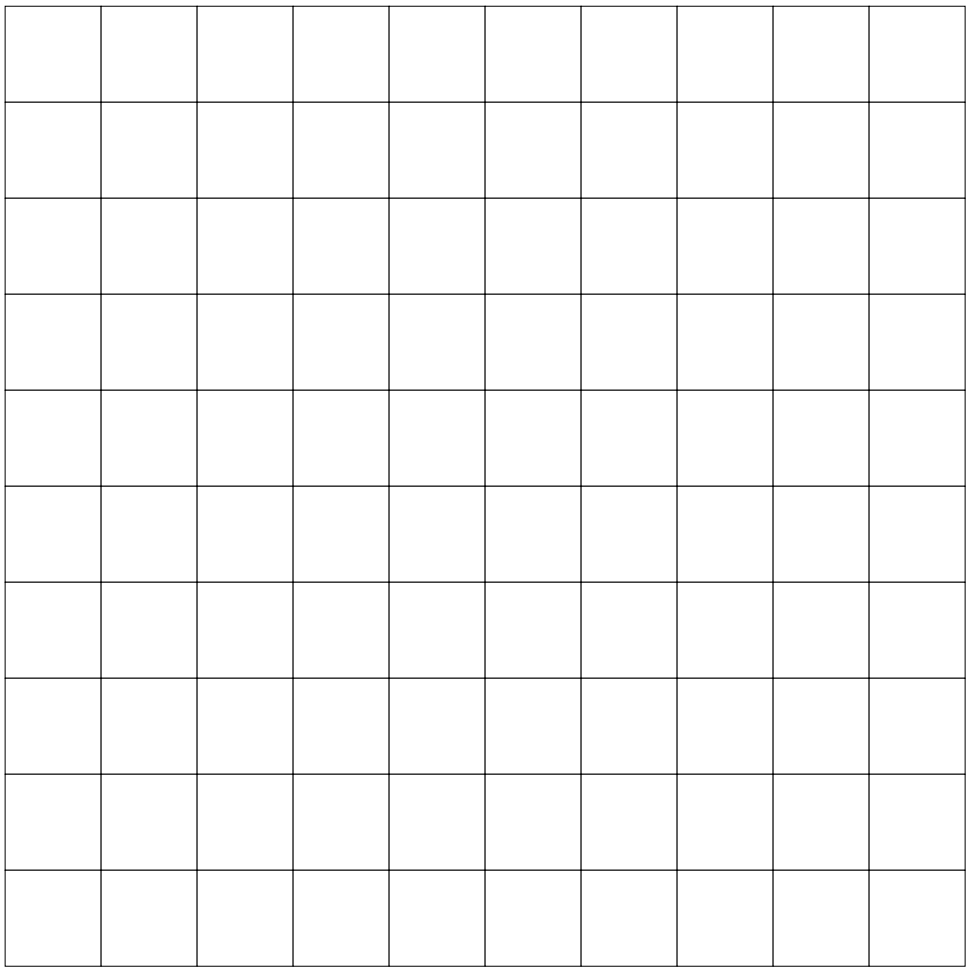
Neuromorphic DBSCAN

Just seeing if I understand.

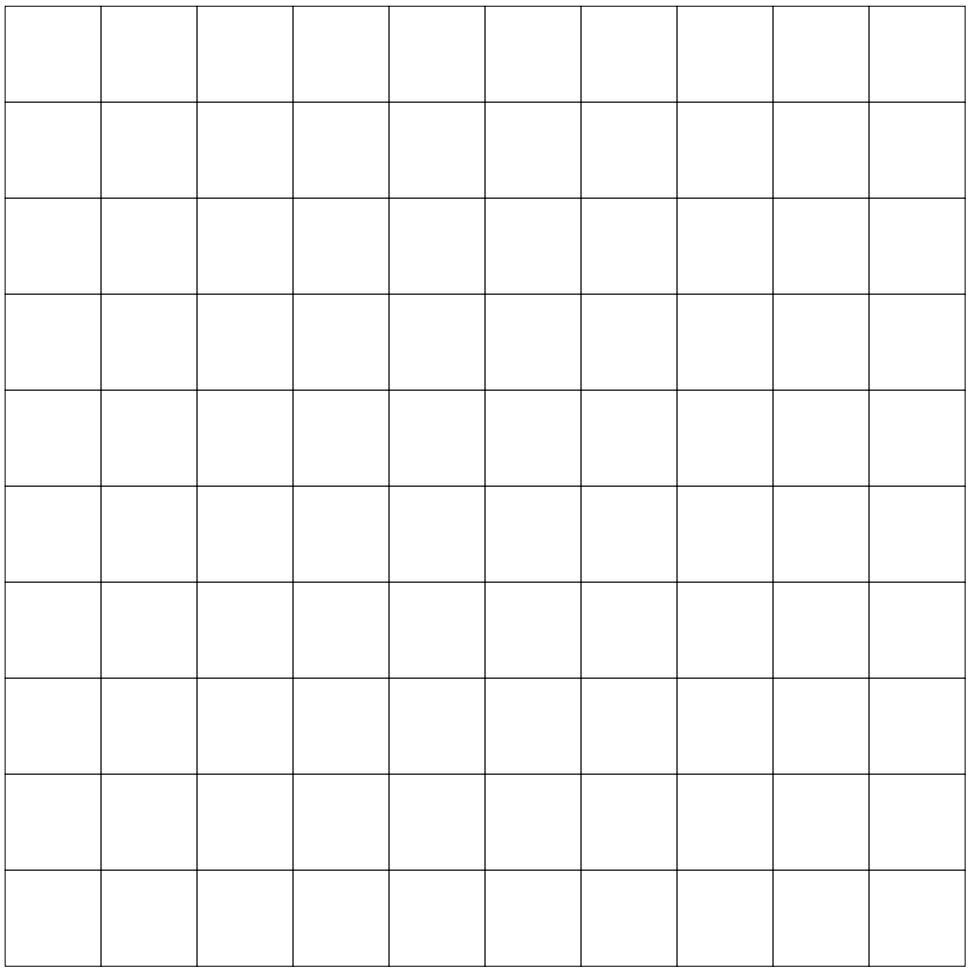
Neuromorphic DBSCAN

Let's do epsilon = 1, m = 7



Neuromorphic DBSCAN

Let's do epsilon = 1, m = 7

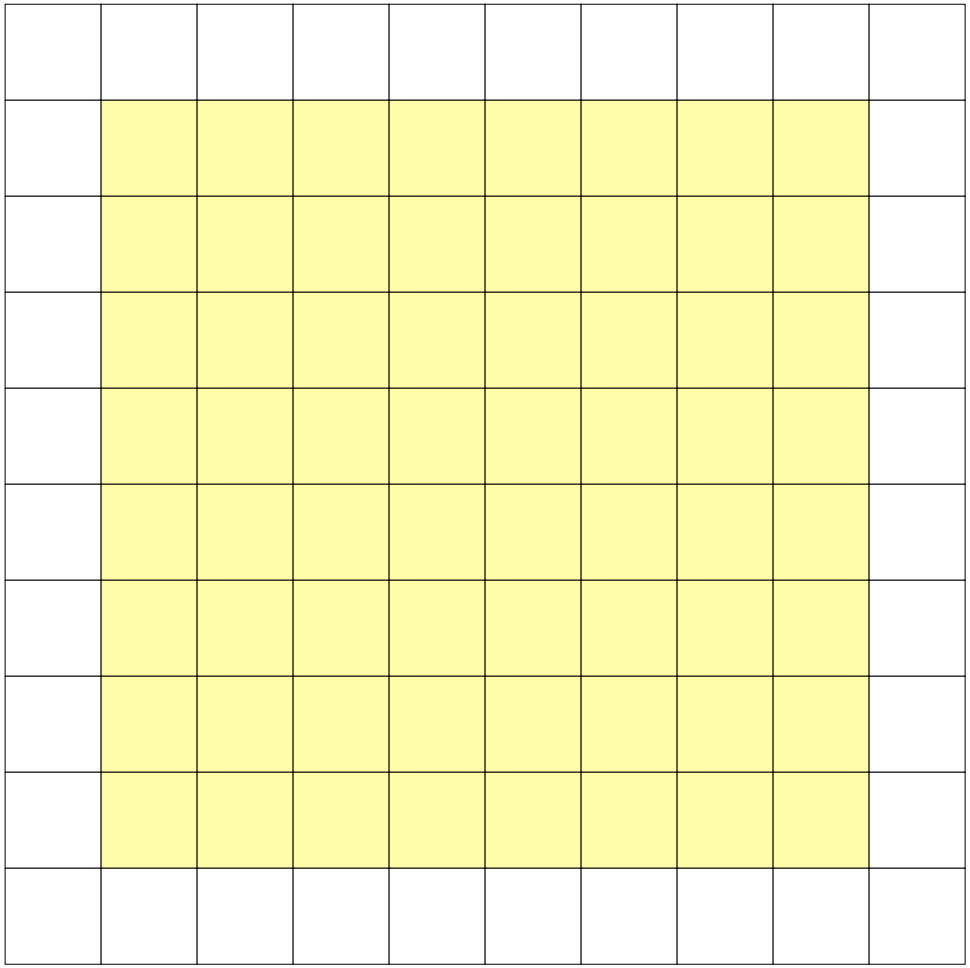


<u>Timestep 0:</u>
Spike in all 100 events.
Each event i,j has an input neuron $I_{i,j}$.

Each event spikes its input neuron at time 0.

Neuromorphic DBSCAN

Let's do epsilon = 1, m = 7



Timestep 1:

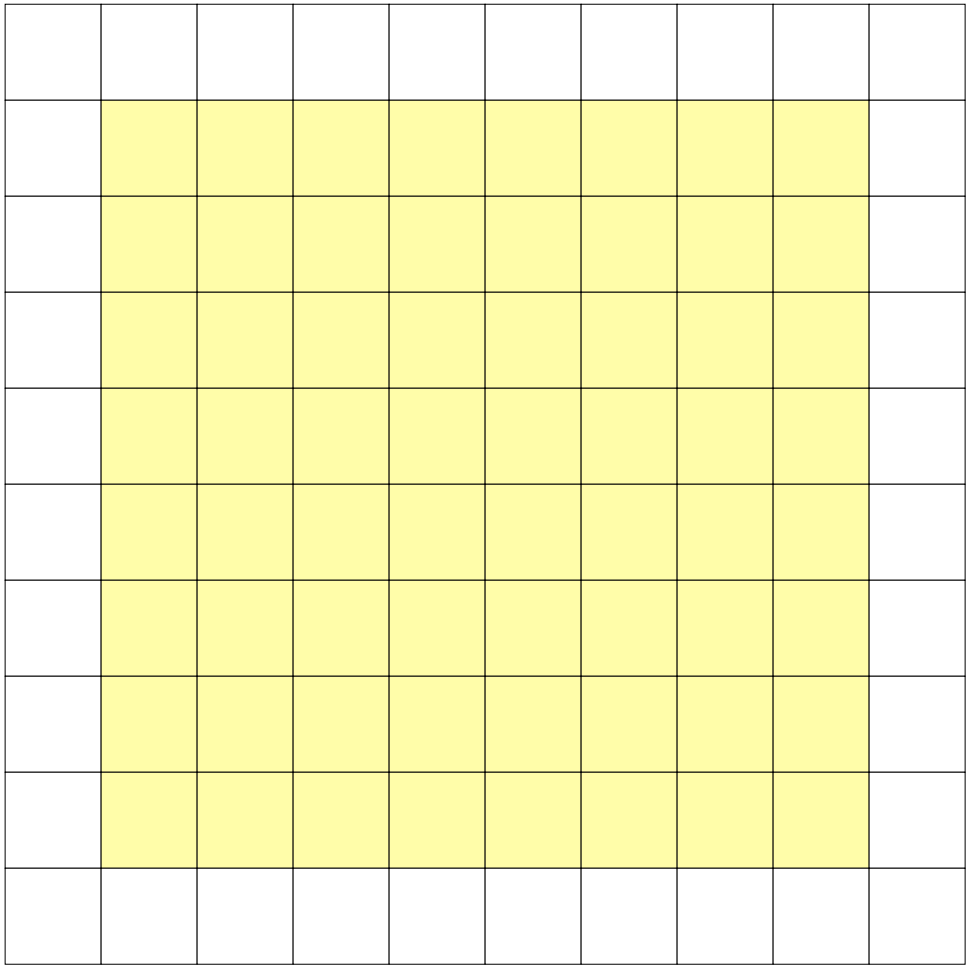
Each of the yellow inputs has a corresponding counting network. Call it $C_{i,j}$. It has synapses from each of its bordering I neurons, but not from its own.

The threshold is 6 (i.e. m-1).

Therefore, it fires if 6 of its 8 bordering neurons fire.

Neuromorphic DBSCAN

Let's do epsilon = 1, m = 7



Timestep 2:

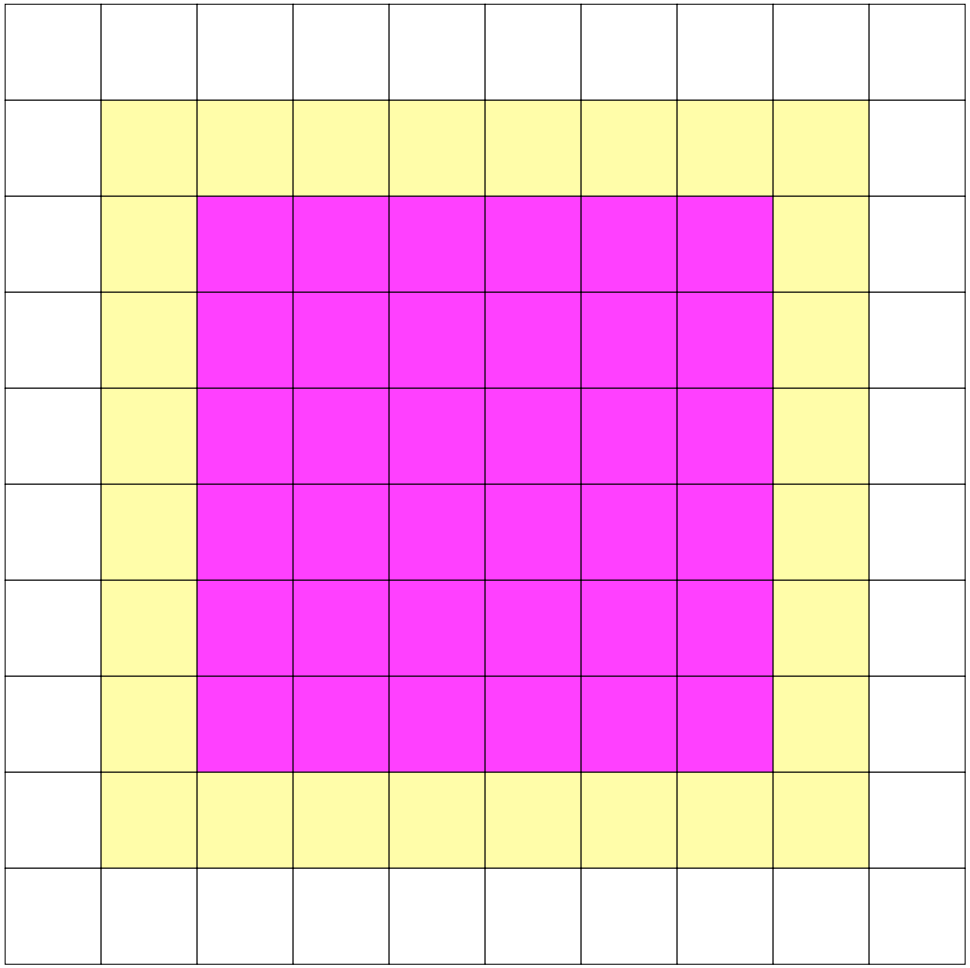
Each of the yellow inputs has a corresponding "core" neuron. Call it $Core_{i,j}$. It has a synapse from Ci,j, weight 1, delay 1, and a synapse from Ii,j with weight 1, delay 2. Its threshold is 2.

Therefore, it fires if it is a core event.

In other words, if its input fires and at least 6 of its neighbors fire, then it is a core event.

Neuromorphic DBSCAN

Let's do epsilon = 1, m = 7



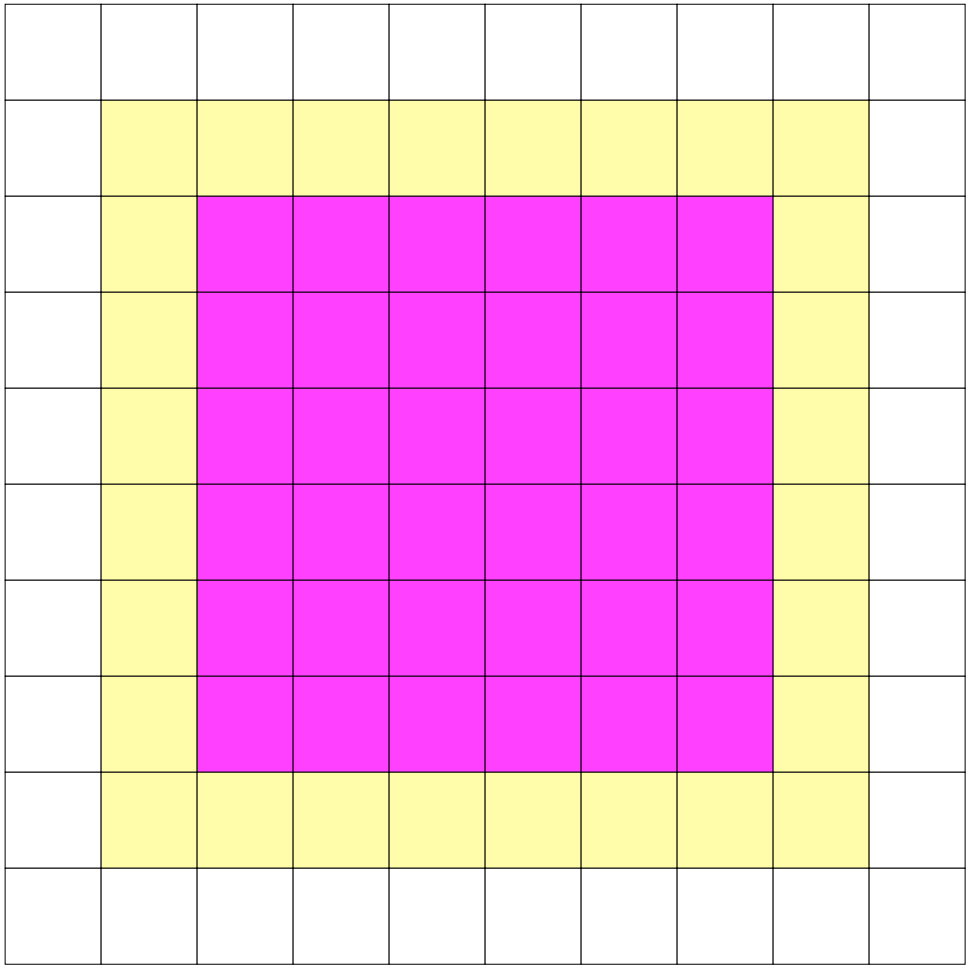
Timestep 3:

Each of the magenta neurons has a corresponding neuron to help with border determination. Call it $Border_{i,j}$.It has a synapse of weight 1 and delay 1 from its bordering Core neurons.

Its threshold is 1, so it fires if any of its neighbors are core neurons.

Neuromorphic DBSCAN

Let's do epsilon = 1, m = 7



Timestep 4:

Each of the magenta neurons has a corresponding “border” neuron. This will spike if the event is a border event. It has three incoming synapses:

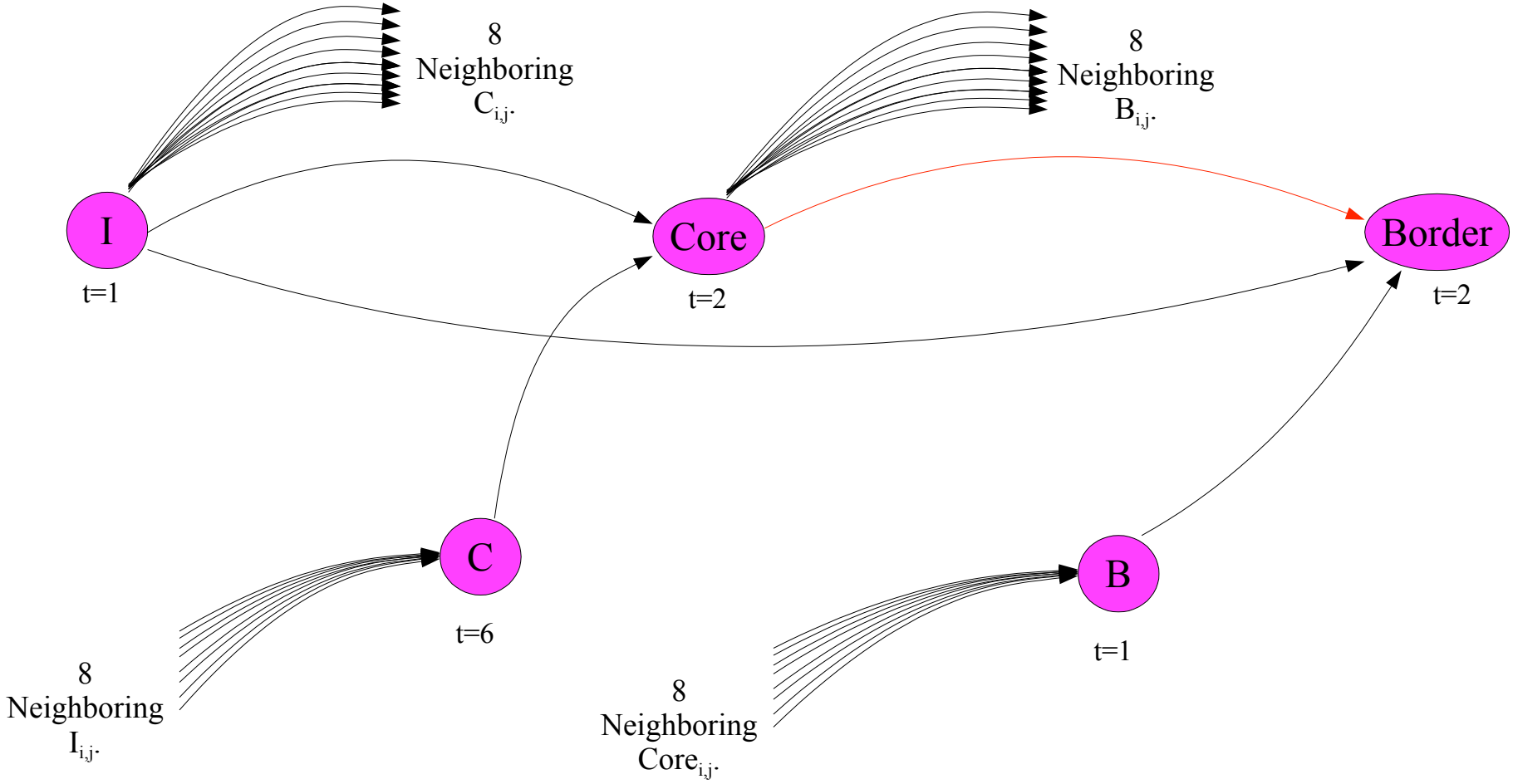
One from Bi,j, weight 1 delay 1.
One from Ii,j, weight 1, delay 4.
One from Corei,j, weight -1, delay 2.

Threshold = 2.

Therefore it spikes if and only if the event is a border event.

Neuromorphic DBSCAN

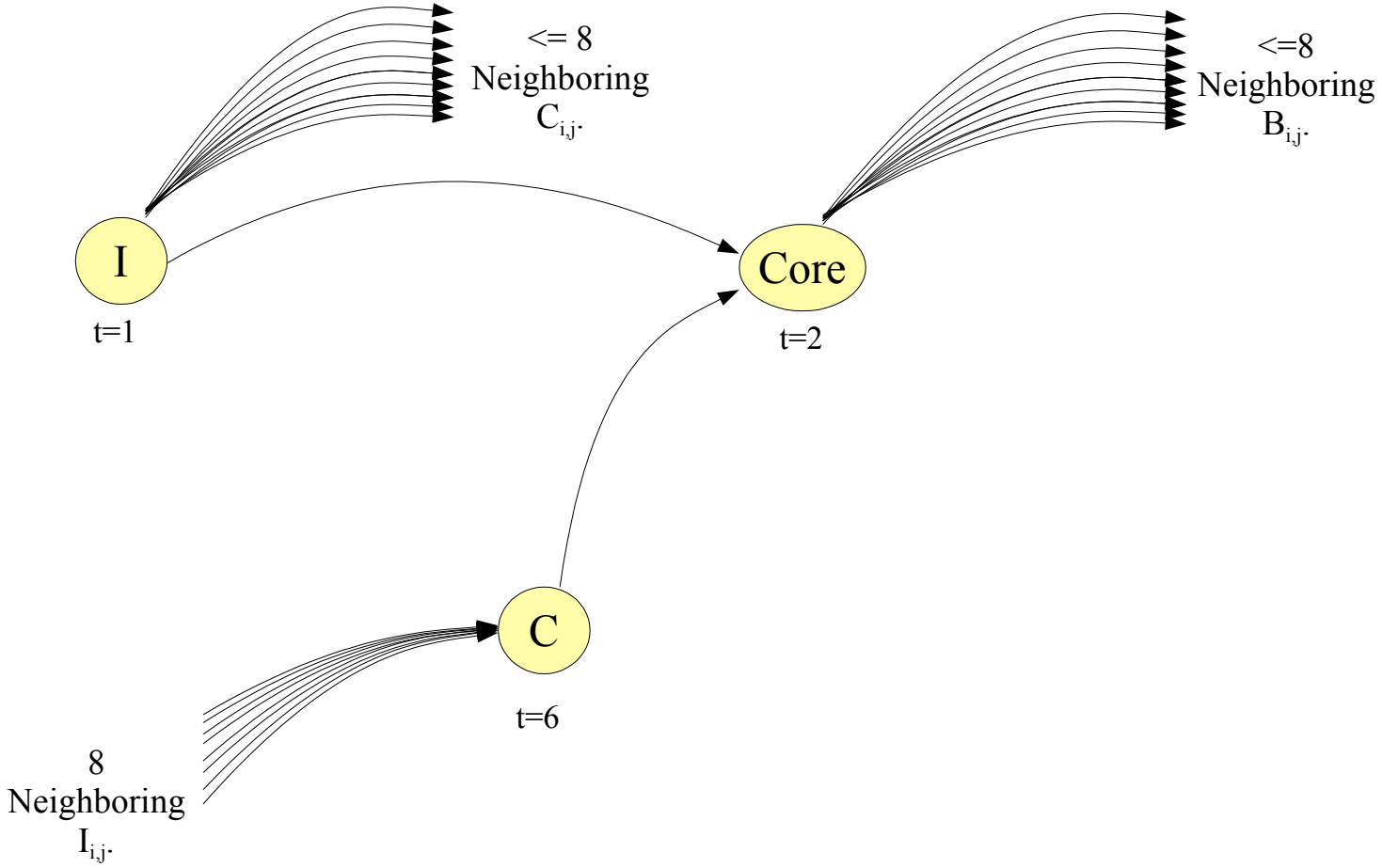
Let's characterize the neurons/synapses for events of each color.
In the determination here and on the next two pages, I'm only counting *incoming* synapses.
If there are m magenta pixels, then that makes 5m neurons and 5+8+8 = 21m synapses.



Timestep 0	Timestep 1	Timestep 2	Timestep 3	Timestep 4

Neuromorphic DBSCAN

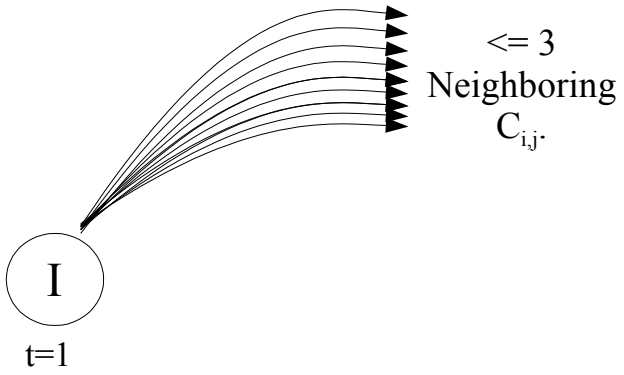
If there are y yellow pixels, then that makes 3y neurons and 2+8 = 10y synapses.



Timestep 0	Timestep 1	Timestep 2	Timestep 3	Timestep 4

Neuromorphic DBSCAN

If there are w white pixels, then that makes w neurons and 0 synapses.



Timestep 0	Timestep 1	Timestep 2	Timestep 3	Timestep 4