Spektron V1

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# Spektron network V1

## Unit spektron:

### Structure

The unit spektron has

1. Id : identifier
2. Energy: the amount of charge that is held
3. Energy capacity: the firing threshold
4. Pre units: previous nodes that transmit spikes to this unit
5. Post units: posterior nodes that receive spikes from this unit
6. Input: the amount of energy fed to the unit in unit time
7. History: keeps track of when a spike was generated, limited to only 20 clock cycles

Functions:

The unit spektron has the following functions:

1. Constructor: initialize the elements to the default values i.e.
   1. energy = 0
   2. capacity = 10
   3. history = 20
   4. input = 0
   5. pre and post = empty
2. update: according to the input, the nodes will update their energy, if energy is greater than capacity a spike will be generated and the history will be updated
3. act: if there was a spike, the posterior nodes’ inputs will be updated(incremented)
4. toString: prints the energy and history of a unit

### Behavior

The unit spektron acts as a simple leaky integrator. Each time an input comes, the energy is increased by one and each time there is no input the energy is decreased by 0.2. If the spike generation energy threshold is reached, the energy is emptied and the input of post units are updated(incremented) . The update is perfomed in two stages: firstly according to the input the energy is updated. Secondly the according to the energy and the holding capacity a spike is generated and propagated i.e. the inputs of post units are updated.

## Spektron net

### Structure

The network has:

1. Number of input nodes (is kept constant)
2. Number of hidden nodes (is kept constant in v1, can be increased according to data )
3. Number of output nodes (is kept constant in v1, but can be increased according to data)
4. Nodes list: holding the nodes (this can be discarded with a root node with connections to all input nodes)
5. Clock cycles for an input to be propagated through the network (is constant for v1 and equal to 5)

### Functions

The net has the following functions:

1. Constructor: given input, hidden and output number of nodes, adds such nodes to the list
2. Build network: connects the nodes to each other according to the given options
3. Train network: given an input data, the network is fed with the input for a period of given propagationPeriod
4. toString: print the status of the network
5. fired: returns true if the unite fired

### Behavior

A network containing a given number of input, hidden and output number of nodes is generated. The connectivity of the nodes for v1 are input nodes are fully connected to hidden nodes and hidden nodes are fully connected to output nodes.

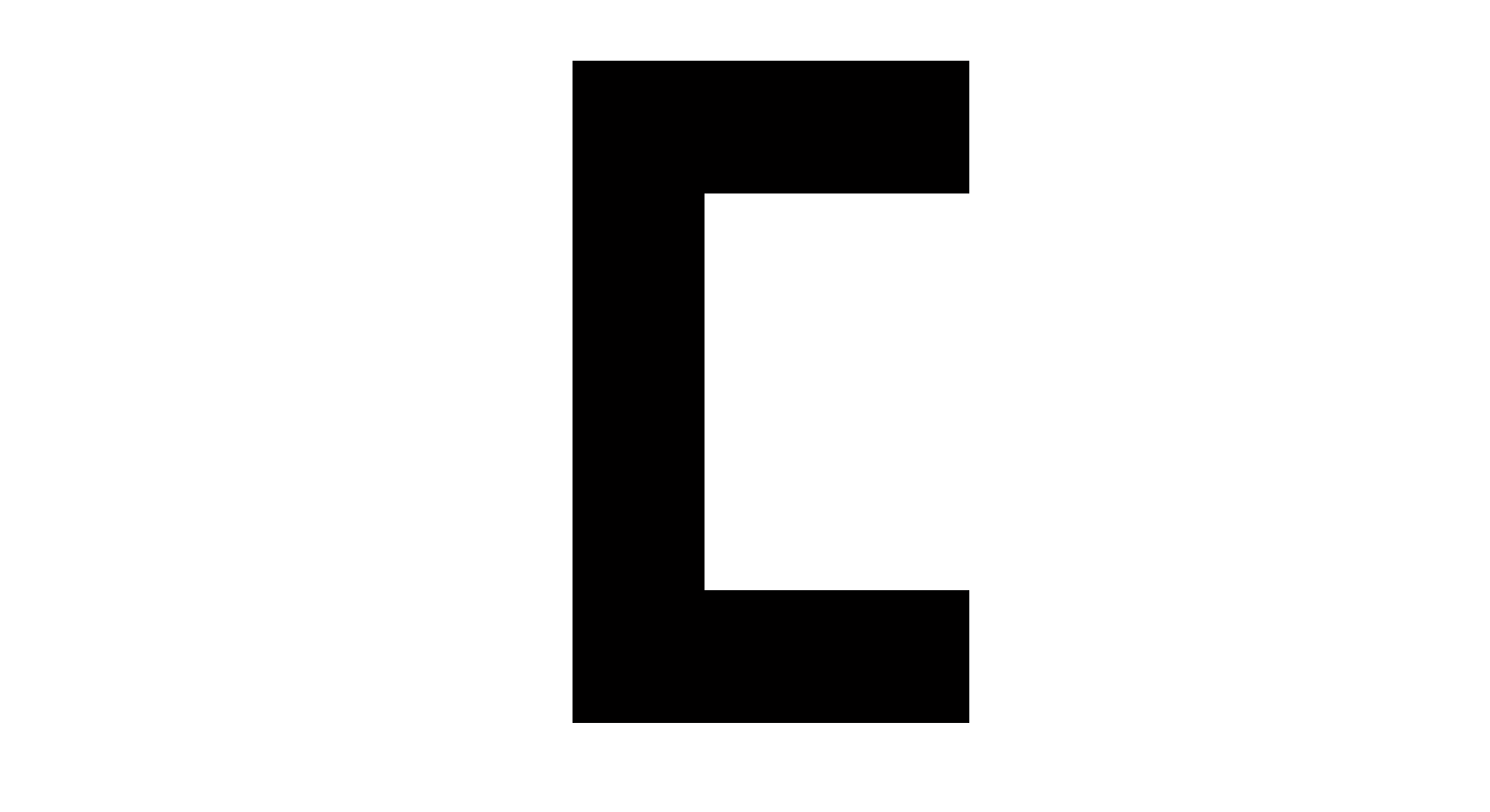
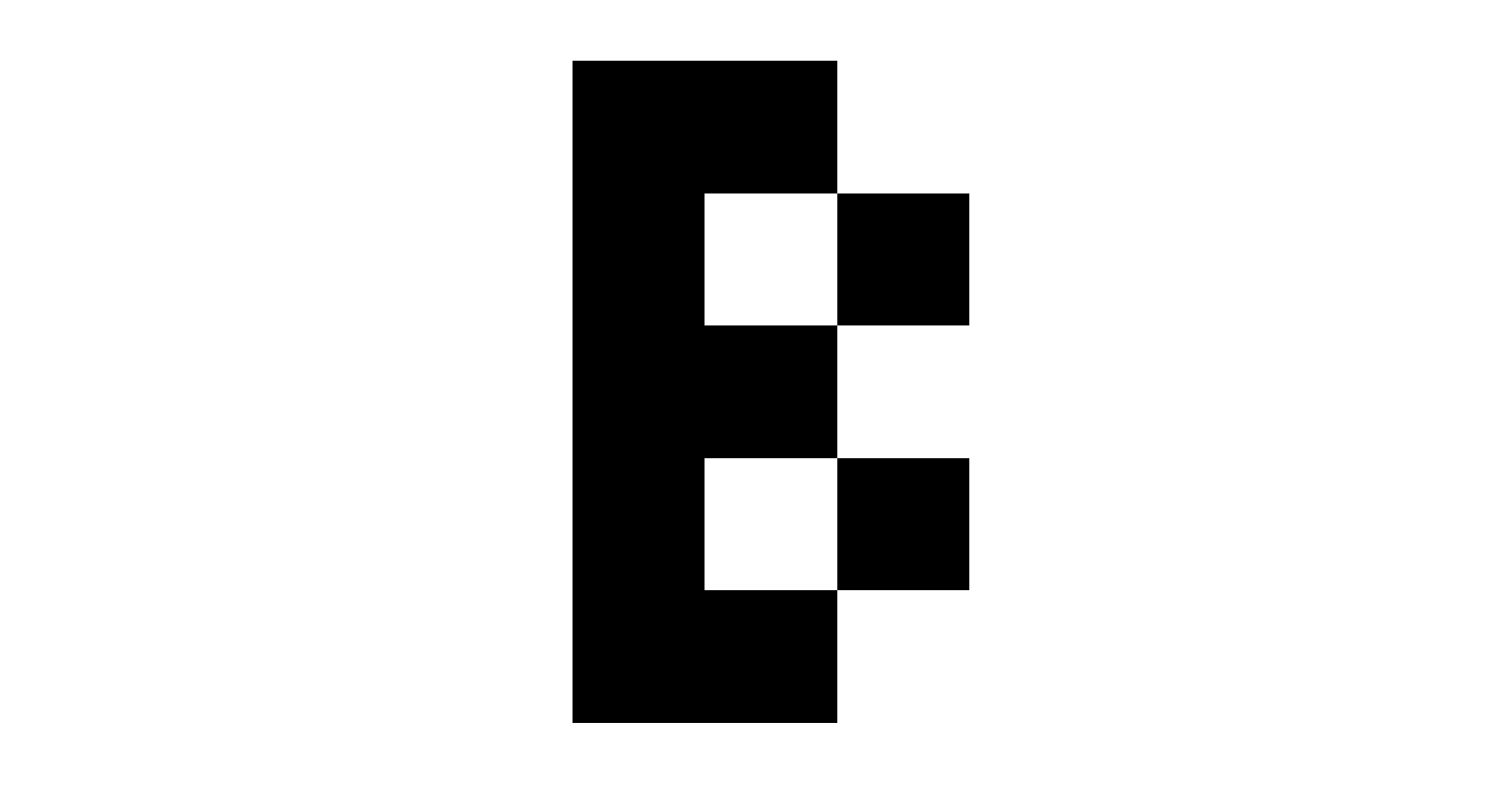
The given input is fed n clock cycles through the net and the output is recorded

The output of the network is printed as a jpg, where the x axis is time( clock cycles) and the y axis is the number of the node. The image is a binary image with blacks corresponding to no spikes and dots representing spikes.

## Results

### Dataset

The data set contains four character images of 5x3 pixels. The probability of each character is set beforehand. The pixels representing the character can be either 0 or 1. So each character is represented by 15 bits.



The network being fully connected, tall the hidden and output nodes are “loaded” the same. There is no differentiation based on the data.

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