Memory Association Machine:

A Site-Specific Responsive Autonomous Installation

Ben Bogart 2008

Outline

- Where did the idea come from?
- What is it?
- The system
  - Perception
  - Memory System
  - Free-Association System
- Video Documentation

Where did the idea come from?

- Is it possible to make a machine that relates *itself* to its context without the *artist predetermining* that relation?
  - An artwork that can respond to *any* context
  - *Change* as the context changes
  - It *acts beyond* the intentions of the artist

What is it?

PTZ Camera

Free-Association System

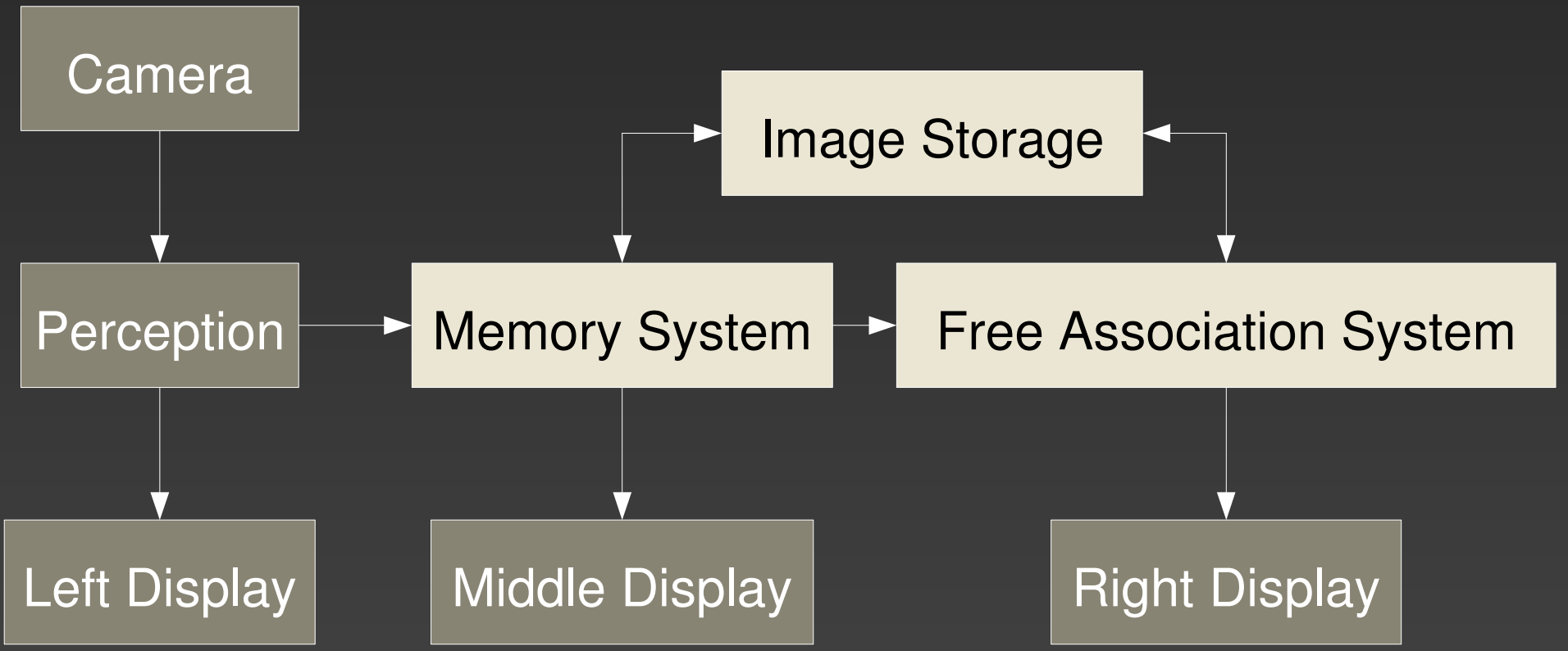
Perception

Memory System

What does it do?

- A camera randomly pans tilts and zooms, looking in a new direction each 12 seconds, to *explore* its visual context.
- The system *integrates* those images into a *continuously evolving* field of experience.
- The machine *free associates through its experience* creating a cinematic montage.

System


Camera
Image Storage
Perception
Memory System
Free Association System
Left Display
Middle Display
Right Display

Perception

From Camera

640 x 480

To Memory System

100 x 75 = 7500

7500 x RGBA = 30,000

Memory System

Memory System (SOM)

What are the input patterns?

- Each image is a vector of 30,000 floating point elements between 0 and 1.
- Each of the elements of the vector can be considered a dimension in an high-dimensional space.
- Then each image is a single point in a space with 30,000 dimensions.

Memory System (SOM)

What are the input patterns?

- Since they are points in space, the distance between them can be calculated.
- This distance is the similarity between the images, the closer the points, the more similar the images are (on a pixel by pixel basis).
- This space of inputs is called the “input space”.

Memory System (SOM)

What does a SOM do?

- A SOM can be considered a projection from a high-dimensional space, to a low dimensional feature space where topology is preserved.
- A SOM is then a mapping from one space to another. A point in input space (an image) ends up being mapped a point in output space (a 2D map of categories of inputs)
- The final mapping (after training) is a “feature map”

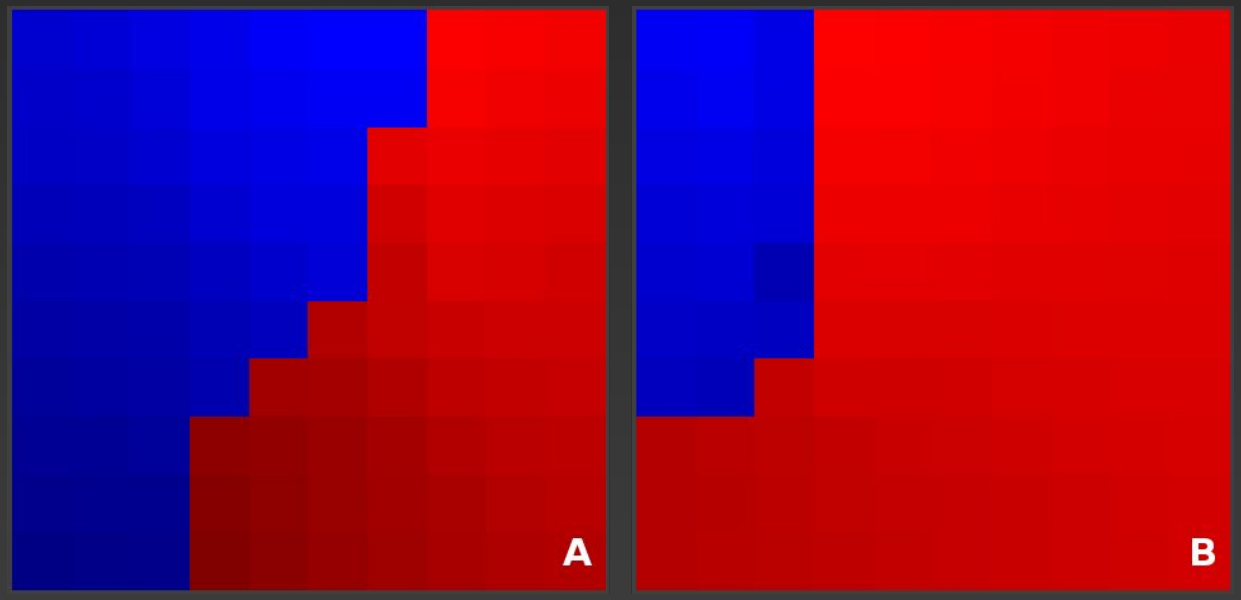
Memory System (SOM)

Feature Maps

- The feature map resulting from a SOM has a few key attributes:
  - Similar inputs are usually placed nearby one and other.
  - Dissimilar inputs are usually placed apart from one and other.
  - The frequency of similar inputs (number of points in a cluster) is proportional to the size of the the area those points are mapped to.

Memory System (SOM)

Folds / Borders



- “Folds” happen where dissimilar inputs end up being associated with nearby categories.
- The larger the difference between the dimensions of the input and output space the more folds are likely to be in the feature map.

Memory System (SOM)

How is the SOM used in MAM different?

- The SOM in MAM is *not meant* to entirely converge as the assumption is that its *environment is constantly changing* in a way that could *never converge* to a finite number of categories.
- Rather than monotonically decreasing the learning rate is a cosine equation.
- The input data is not from a finite set, but each *iteration* is, practically speaking, a *new stimulus* from the environment.
- The ann_som external does not use a Gaussian or linear fall off neighborhood function, but a hard limit.

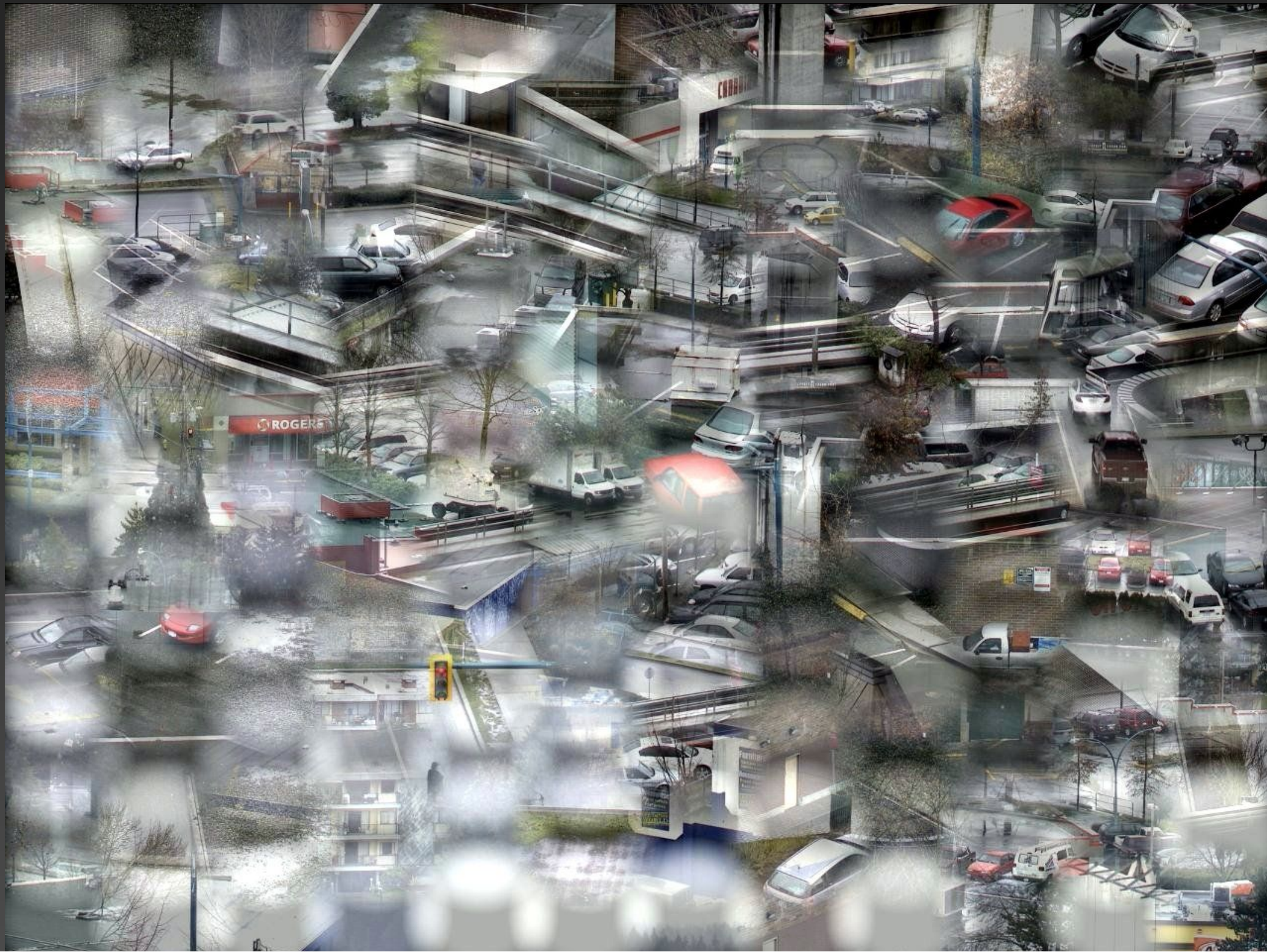
Memory System (SOM)

- Since the input space has 30,000 dimensions, and the output space a mere 144 nodes, the resulting feature-map is *highly* folded.
- The cyclical learning rate results in the SOM *constantly changing* how converged it is.
- Due to both these factors the structure of the feature-map is highly complex and it can *appear* random.


BURGER KING
ROGERS VIDEO


STOP
CIBC
CIBC Banking Centre
whitespot
Linens
Furniture


RANMORE CENTRE
Budget
Zellers


ROGERS


Scotiaba
Bank
RBC
BANANA
whitespot

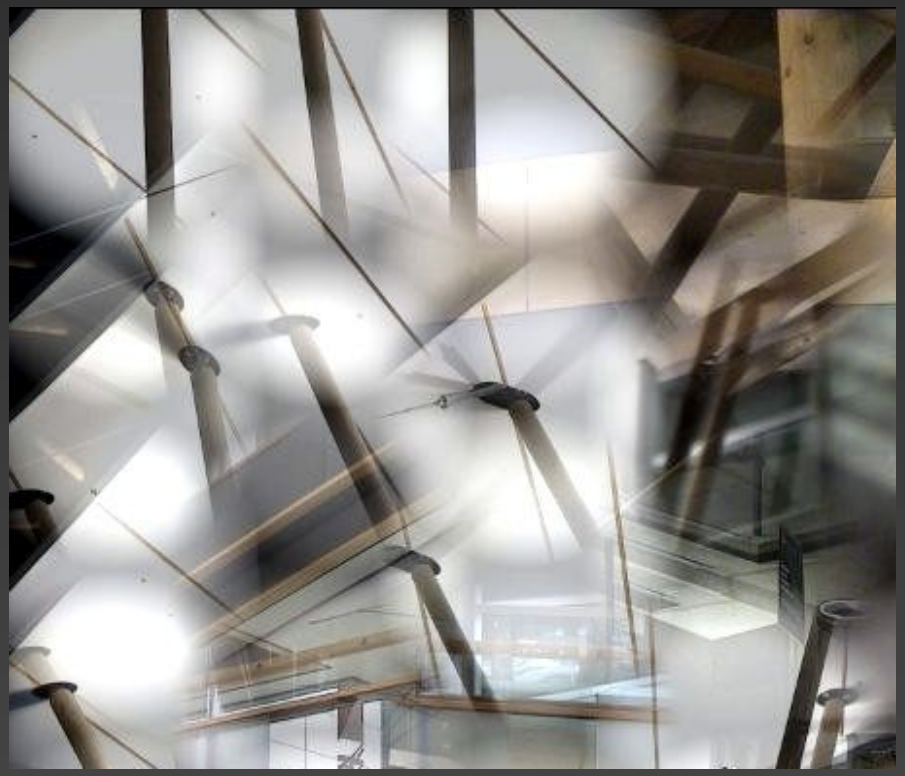
Free Association System

Free-Association System

- Inspired by a model of creativity theorized by Liane Gabora.
- Creativity as a form of free-association through memory.
- Selection of memories through the propagation of a signal through a network of units.
- The initial activation is the BMU (winning neuron)

Free-Association System

Memory

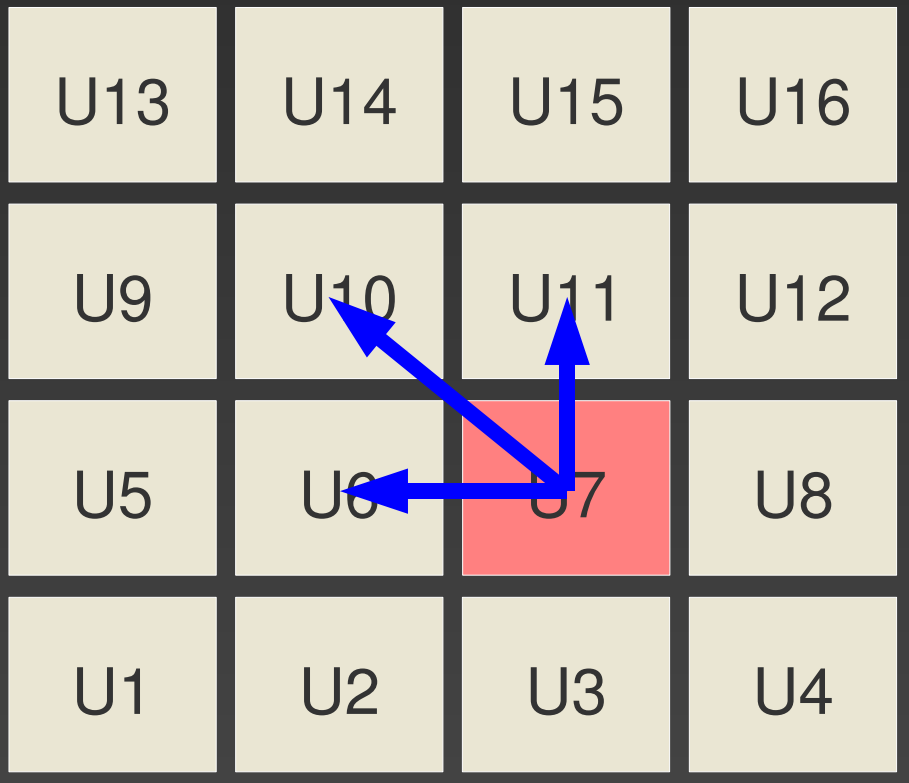


Free-Association

U13	U14	U15	U16
U9	U10	U11	U12
U5	U6	U7	U8
U1	U2	U3	U4

Free-Association System

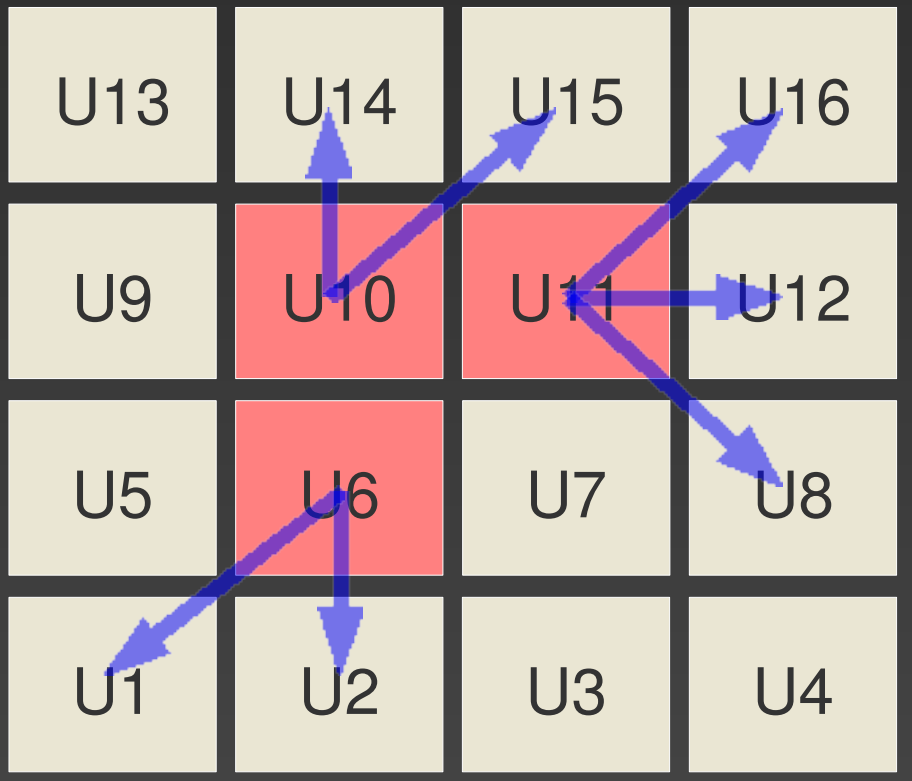
- The camera looks in a direction, which is sent to the SOM and the unit U7 wins.
- U7 then propagates a 20% degraded version of the signal to a random range of neighbours.



{7},{6,10,11}

Free-Association System

- U10,U11 and U6 then propagate onto their neighbours and so on.
- To prevent near simultaneous activations each unit delays the signal a random time before passing it onto neighbors.



{7},{6,10,11},{ {2,1} {14,15} {16,12,8} }

Free-Association System

- To prevent over activation the units have inhibition so they cannot be activated within a temporal delay of being activated.
- Loops and repetitions are possible.

Documentation Video (5min)

http://www.ekran.org/ben