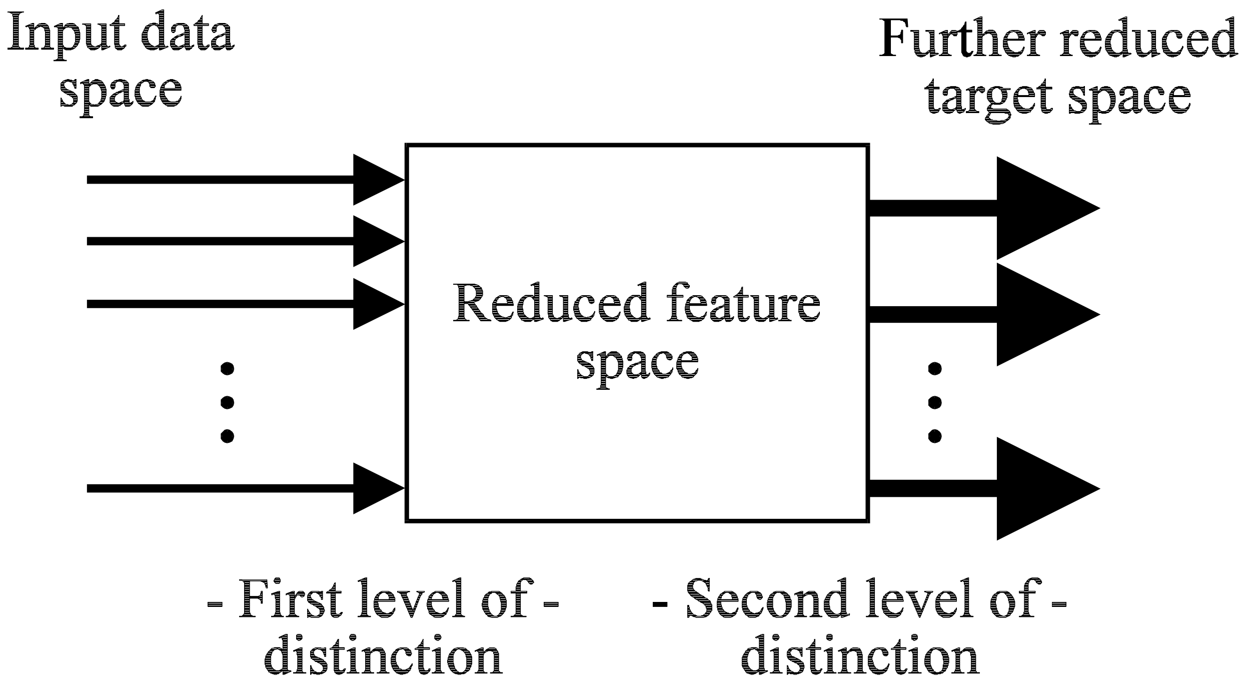
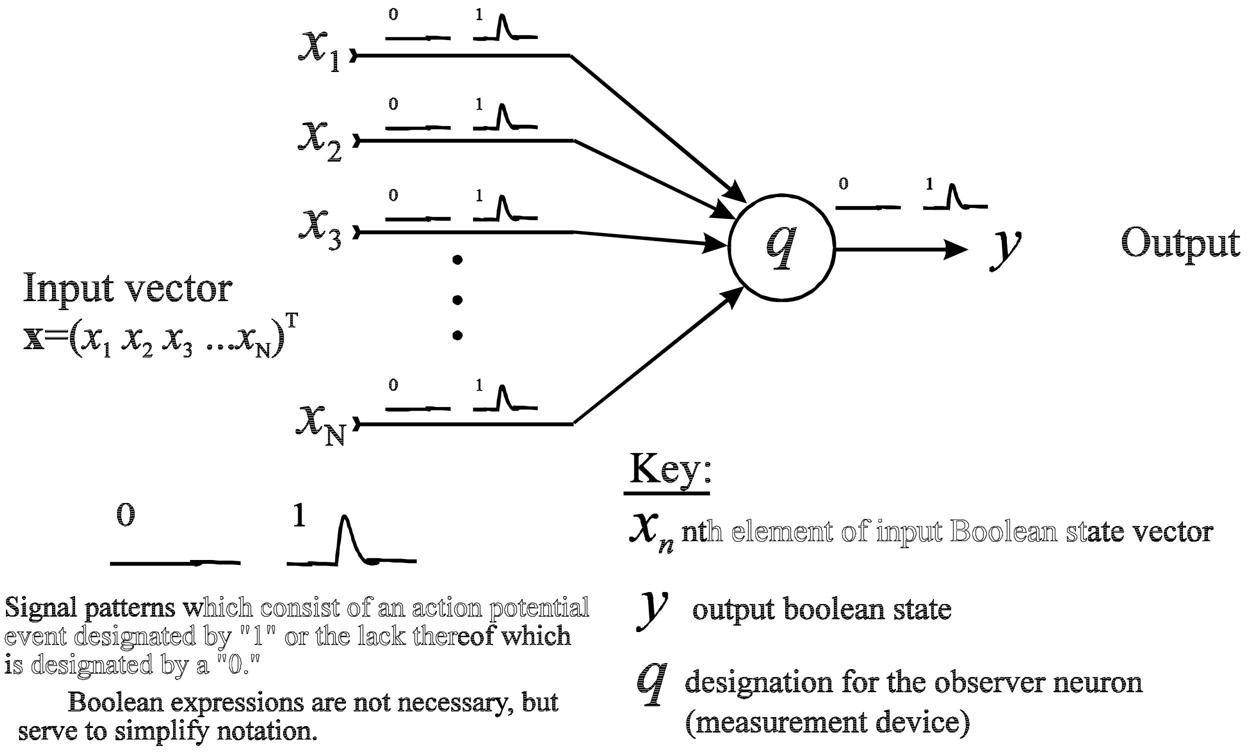

Input data space
Further reduced target space
Reduced feature space
- First level of - distinction
- Second level of - distinction

Figure 1 - Diagram of an associative memory which contains two levels of distinction



x_1
x_2
x_3
x_N
0
1
q
y
Output
Input vector
$\mathbf{x}=(x_1\ x_2\ x_3\ \ldots x_N)^T$

Signal patterns which consist of an action potential event designated by "1" or the lack thereof which is designated by a "0."

Boolean expressions are not necessary, but serve to simplify notation.

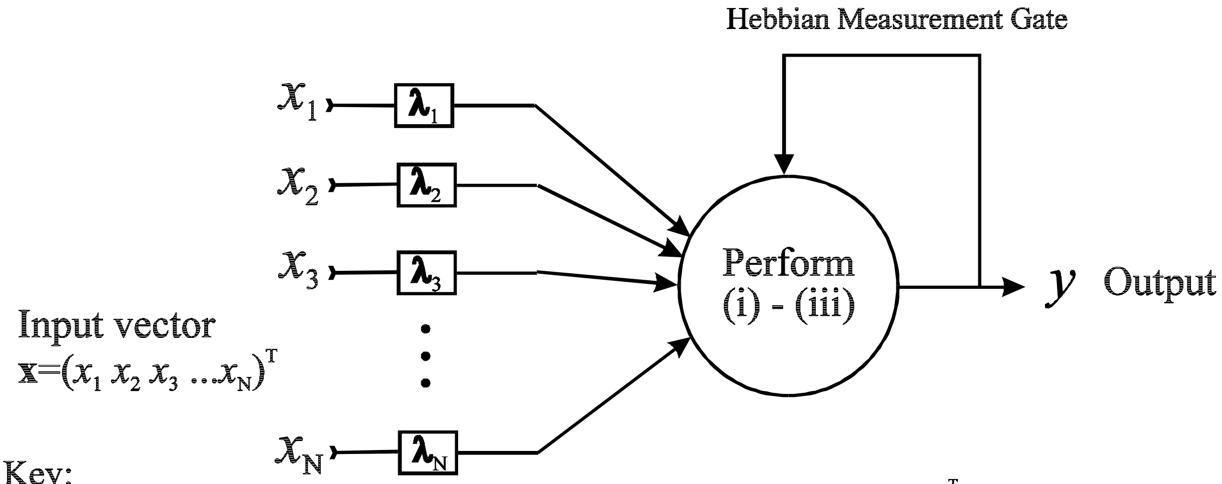
Key:

x_n nth element of input Boolean state vector

y output boolean state

q designation for the observer neuron (measurement device)

Figure 2 - Neuron measurement model


Hebbian Measurement Gate
x_1
λ_1
x_2
λ_2
x_3
λ_3
x_N
λ_N
Perform
(i) - (iii)
y Output
Input vector
$\mathbf{x}=(x_1\ x_2\ x_3\ \ldots x_N)^T$

Key:

x_n nth element of input Boolean state vector

y output boolean state

λ_n nth Lagrangian multiplier for $<x_n y>$

μ Lagrange multipler for $<y>$

(i) Find inner product $\lambda^T x$

(ii) Compute evidence $\zeta(x)=\lambda^T x - \mu$ and make "firing" decision (ML or Sigmoid)

(iii) If action potential occurs (y=1) then update λ and μ

Figure 3 - Neuron model which maximizes the mutual information between input and output

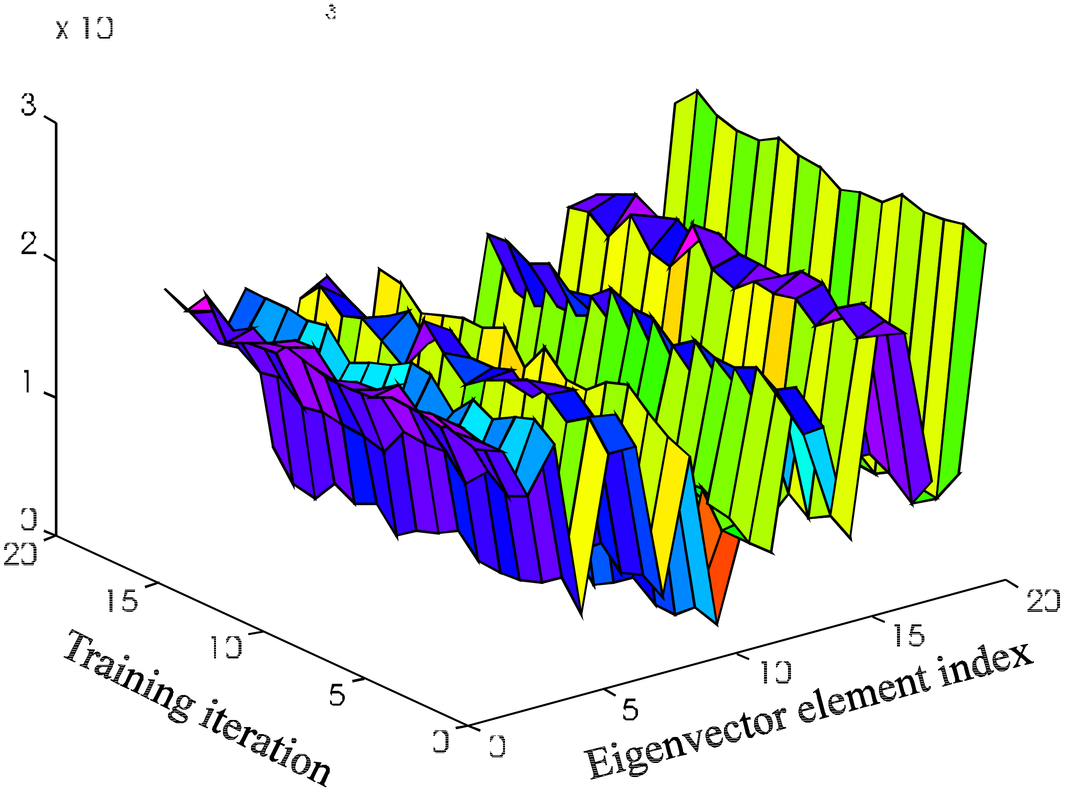


Figure 4 - Eigenvectors resulting from 16 training iterations with random initial conditions

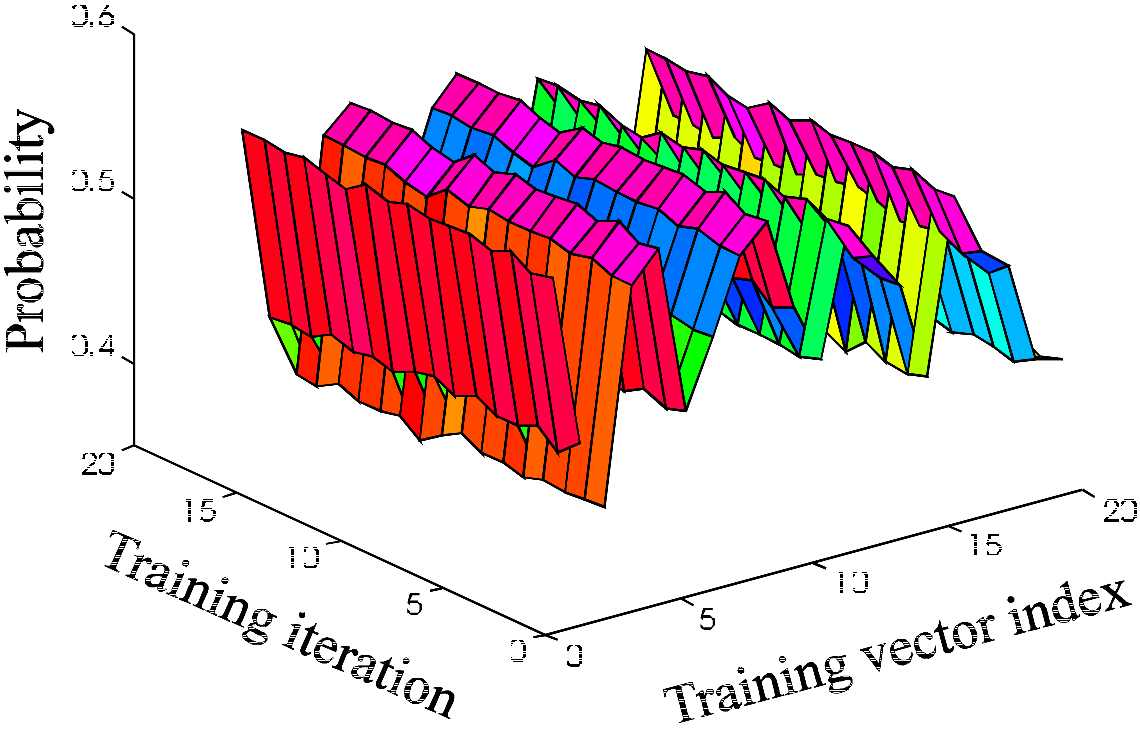
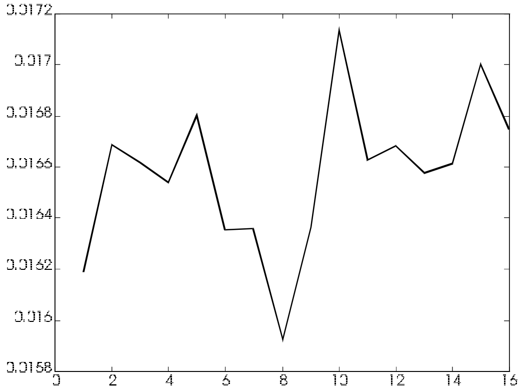
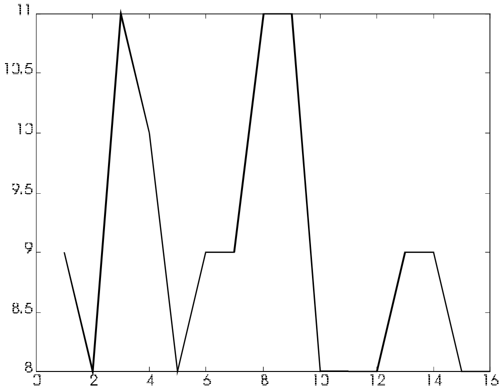


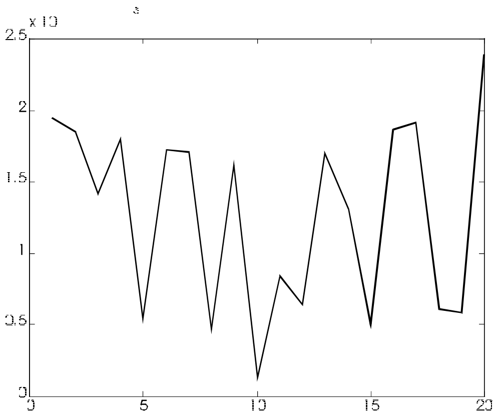
Figure 5 - Probability of action potential for each of 20 training vectors over 16 random trials. A high temperature value is assumed.



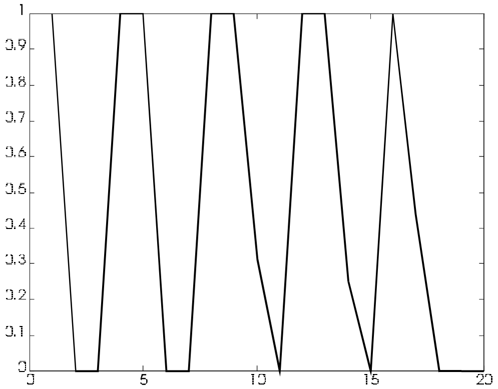
(a)



(b)



(c)



(d)

Figure 6a - Computed decision threshold over 16 random trials

Figure 6b - Number of input training vectors out of 20 distinguished by the neuron

Figure 6c - Averaged of computed eigenvectors over 16 random trials

Figure 6d - Averaged decision of a maximum likelihood decision rule over 16 random trials.