

Sparse associative memories

L

number of neurons per cluster l
 number of clusters c
 number of erased clusters c_e
 number of messages : m
 number of activities per cluster : a
 density : d
 edge : (i, j)
 probability for i and j to be active in their respective clusters for one message : $\frac{a}{l}$
 probability of the edge not being added in the network for one message : $1 - \left(\frac{a}{l}\right)^2$

$$d = 1 - \left(1 - \left(\frac{a}{l}\right)^2\right)^m$$

gap with density in simulations : under 1 percent
 probability for a vertex v to achieve the maximum score, that is to mean $a(c - c_e)$: $d^{a(c-c_e)}$
 probability for a vertex v not to achieve the maximum : $1 - d^{a(c-c_e)}$
 probability for none of the vertices of one erased cluster, excepting the correct ones, to achieve the maximum : $(1 - d^{a(c-c_e)})^{l-a}$
 probabilities for none of the vertices in any erased cluster, excepting the correct ones, to achieve the maximum in their respective cluster : $(1 - d^{a(c-c_e)})^{c_e(l-a)}$
 Whence error rate is :

$$P_{err} = 1 - \left(1 - d^{a(c-c_e)}\right)^{c_e(l-a)}$$

The simulations agree with the analytical result.

For one iteration (for erasures, not for errors), winner takes all is the same as a -winners take all.

For multiple iterations a -winner take all is an improvement.

" a -Winners take all" better than "winner takes all" with errors instead of erasures.

For errors : only better than only 1 activity per cluster if multiple iterations of the a -winners take all rule.

Spéculations en Français :

Peut-être un intérêt pour cluster based associative memories build from unreliable storage : si une arête porte moins d'info, on peut peut-être en supprimer plus (mais rajout ?!)