

Critique on Perceptron: A Probabilistic Model for Information Storage and Organization in the Brain

F. Rosenblatt (1958)

The information about physical attributes are saved in our memory like one-to-one mapping between sensory stimulus and the stored pattern. Whenever a pattern is received from sensors, it is combined with previously stored one to recognize as a previously conducted event. It is like developing a photograph from negatives.

The second approach regarding this is, a pathway from the active regions to sensors' input are constructed. The information is saved as connection or association rather than topographical representation. Then the incoming new pattern is constructed unless it is not one of the previously constructed connection/path.

In contrary to the second approach, perceptron has some assumptions:

- Pathways for interconnection at beginning are random.
- Effect of stimuli on a set of connected cell may get changed after a period of neural activity.
- From a large number of stimuli, similar stimuli will tend to response to the same set of connected cell and vice versa
- The effect of positive and negative stimuli may change the connection of response for a stimulus.

Organization:

- Stimuli on sensory organ respond on an all or nothing basis(binary).
- This impulse is imported to association cells(A-unit), sometimes a Projection area exists in between them. The set of sensory points transmitting impulse to a particular association of cells is called Origin points of that A unit. It may be excitatory or inhibitory in effect. A units fires towards a response when the algebraic sum of inhibitory and excitatory points is greater than threshold value(θ).
- A units responsible for transmitting impulse to a response is called source point for that response. The responses are connected in excitatory feedback to their own source set or inhibitory feedback to the complement of their own source set.

Predominant Phase and Post Dominant Phase:

Predominant phase indicates the state while due to some stimuli some effective A-units are activated. The activated A-units then transfer the impulse to a Response, declared as Post Dominant phase.

$$P_c = \frac{1}{P_a} \sum_{e=\theta}^x \sum_{i=e-\theta}^y \sum_{l_e=0}^e \sum_{l_i=0}^i \sum_{g_e=0}^{x-e} \sum_{g_i=0}^{y-i} P(e, i, l_e, l_i, g_e, g_i) \quad (2)$$
$$(e - i - l_e + l_i + g_e - g_i \geq \theta)$$

In the post dominant state activity is limited to single source set.

μ -system concerns to the response whose input has the greatest mean value response.

Σ -system concerns to the response whose input has the greatest net value gain.

Therefore, the system is trained to learn using reinforcement learning, i.e. on giving correct response the system is given reward signal and on choosing the wrong response the system is given punishment signal by the trainer.

Bivalent System:

A bivalent system includes positive and negative reinforcements, i.e. it can gain or lose value according to its choice of response. If positive reinforcement is provided the source set of 'on' response for a particular A-unit gains value ΔV and the source set of 'off' response gains $-\Delta V$. Also due to negative response the opposite event occurs.

Now if a threshold is designed in a temporal dimension, i.e. it will depend on a previous(t-1) time's event to detect activity of present time(t) then the perceptron will be able to distinguish velocity, sound sequence etc. Momentary stimulus perceptron do not have this quality.