

A LOGICAL CALCULUS OF THE IDEAS IMMANENT IN NERVOUS ACTIVITY- ANALYSIS

1. Analysis of the paper:

The paper is motivated by brain, it describes the behavior and functioning of the neurons and their net. This behavior is then simplified to define a logical system that resembles brain with the fundamental unit as neuron.

The paper states that the nervous activity follows “all or none” character which means that the strength of a response of a neuron is not dependent upon the strength of the stimulus. If a stimulus is above a certain threshold, a neuron will fire. Either there will either be a complete response or there will be no response at all.

Some neurons in a net are classified as “peripheral afferents” these do not get any signals from other neurons in the net (i.e. no axons synapsing upon them) and the remaining neurons (The neurons that have input from many neurons, what matters is how many inputs it receives) that are in two possible state firing and not firing.

Corresponding to any description of state, a single neuron is constructible whose firing is a necessary and sufficient condition for the validity of that description that means for each neuron a predicate is true if the neuron is firing at that time and the solution of its net is a set of sentences. These sentences basically describe what the net computes.

A class of logical expressions called as *temporal propositional expressions* (TPE). These TPE’S include predicates that have a single free variable which will be identified as discrete time. These predicates are recursively defined such that: (From the research paper)

- (a) Any predicate of one argument is a TPE.
- (b) the logical AND, OR and NAND of any two TPEs with the same variable is a TPE.
- (c) TPE in which the value of the time variable is substituted by its predecessor (time delay) is a TPE and nothing else is a TPE.

The main result is that any TPE is realizable by a non-recurrent neural net, that is, there is always a net, whose synapses or connections do not form cycles, which can compute any given.

2. What I like about this paper: This paper had a lot of insights and learnings to offer, there are a lot of things that I was not aware of and I had to look things up on the internet. But this small exploring task helped me learn new topics.

3. What I dislike in this paper: The paper is somewhat difficult to decipher, I needed to research topics or instances on the internet and read additional resources to get an idea of what has been described. For ex., the paper starts with “all or none” character of nervous activity and there are many instances that describes this characteristic of neuron, but the paper does not describe what this characteristic is.

If I would not have attended all the lectures till now, I would have struggled to grasp most of the things in the paper.

- 4. Inspirations in the paper:** After reading this paper, I feel that there is a broader aspect in almost everything that exists. This paper was written in 1943 almost 80 years ago and this paper, as per my understanding maps the neurons into a logical model and this model represents reality of the brain. They also mention tinnitus, paresthesia, hallucinations, delusions and disorientations so they were keen to move on the applicability of their network theory. Thus, thinking of modeling a brain 80 years ago definitely inspires me.

(The content was hard to put in one page also adding spaces after paragraphs makes the analysis readable.)