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Blue Brain: Bringing a Virtual brain to Life

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Abstract: Man is intelligent because of the brain. But the brain, all its knowledge, and power are destroyed after the death of the man. BLUE BRAIN, The name of the world's first virtual brain that means a machine that functions like a human brain. It can think. It can take a decision. It can response. It can store things in memory. The research involves studying slices of living brain tissue using microscopes and patch clamp electrodes. Data is collected about all the many different neuron types. This data is used to build biologically realistic models of neurons and networks of neurons in the cerebral cortex. The simulations are carried out on a Blue Gene Supercomputer built by IBM.

In this paper, we concentrate on the application of Blue Brain for "Cracking Neural Code" as well as the use of Blue Brain in "Human memory loss". The neural code refers to how the human brain builds images using electrical patterns and cracking the neural code means finding the patterns and meaning in the noisy activity of the cell ensembles. Human memory loss includes conditions like 'Alzheimer' and 'short-term memory loss'.

Keywords: Blue Brain, Virtual Brain, Brain Tissues, Patch Clamp Electrode, Neuron, Cerebral Cortex, Supercomputer, Neural Code, Alzheimer.

1. INTRODUCTION

The BLUE BRAIN, a Swiss national brain initiative, aims to create a digital reconstruction of the brain by reverse engineering mammalian brain circuitry. The mission of the project is to use biologically detailed reconstructions and simulations of the mammalian brain (brain simulation) to identify fundamental structure and function in health and disease. Neural coding is a neuroscience-related field concerned with the reconstruction of sensory and other stimuli. Therefore, the main goal of neural coding is to characterize how the electrical activity of neurons elicit activity and the responses in the brain. Memory loss could be defined as an unusual forgetness. Problems in remembering new ideas or facts or difficulty in remembering past events.

2. WHAT IS BLUE BRAIN?

The IBM is now developing a virtual brain known as the Blue brain. It would be the world's first virtual brain. Within30 years, we will be able to scan ourselves into the computers. We can say it as Virtual Brain i.e. an artificial brain, which is not actually a natural brain, but can act as a brain. It can think like the brain, take decisions based on the past experience, and respond as a natural brain. It is possible by using a supercomputer, with a huge amount of storage capacity, processing power and an interface between the human brain and artificial one. Through this interface, the data stored in the natural brain can be up loaded into the computer. So the brain and the knowledge, intelligence of anyone can be kept and used for ever, even after the death of the person.

3. NEED OF VIRTUAL BRAIN

Today we are developed because of our intelligence. Intelligence is the inborn quality that cannot be created.Some people have this quality so that they can think up to such an extent where other cannot reach. Human society is always in need of such intelligence and such an intelligent brain to have with. But the intelligence is lost along with the body after the death. The virtual brain is a solution to it. The brain and intelligence will be alive even after the death. We often face difficulties in remembering things such as people names, their birthdays, and the spellings of words, proper grammar, important dates, history facts, and etcetera. In the busy life, everyone wants to be relaxed. Can't we use any machine to assist with all these? The virtual brain may be a better solution for it. What will happen if we upload ourselves into the computer, we were simply aware of a computer, or maybe, what will happen if we lived in a computer as a program?

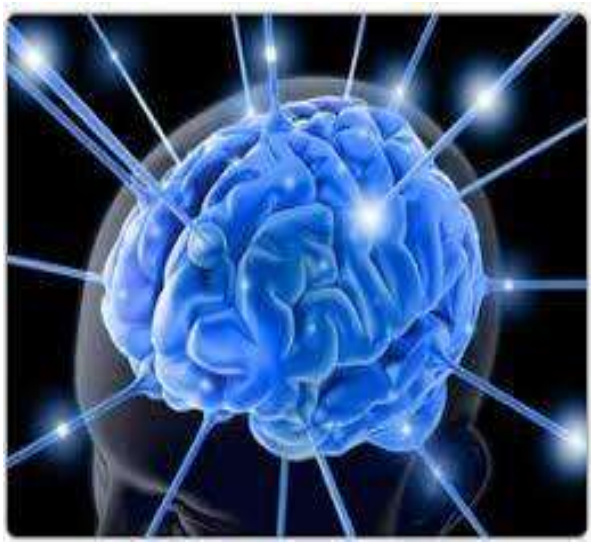
4. FUNCTIONING OF HUMAN BRAIN

The human ability to feel, interpret and even see is controlled, in computer like calculations, by the magical nervous system. Yes, the nervous system is quite like magic because we can't see it, but its working through electric impulses through your body. One of the world's most "intricately organized" electron mechanisms is the nervous system. Not even engineers have come close to making circuit boards and computers as delicate and precise as the nervous system. To understand this system, one has to know the three simple functions that it puts into action: sensory input, integration, motor output.

1. Sensory input: When our eyes see something or our hands touch a warm surface, the sensory cells, also known as Neurons, send a message straight to your brain. This action of getting information from your surrounding environment is called sensory input because we are putting things in your brain by way of your senses.

2. Integration: Integration is best known as the interpretation of things we have felt, tasted, and touched with our sensory cells, also known as neurons, into responses that the body recognizes. This process is all accomplished in the brain where many neurons work together to understand the environment.

3. Motor Output: Once our brain has interpreted all that and act upon the environment. How we see, hear, feel, smell, and take a decision. We have learned, either by touching, tasting, or using any other sense, then our brain sends a message through neurons to effector cells, muscle or gland cells, which actually work to perform our requests.



5. BRAIN SIMULATION

A) Natural Brain

Input

In the nervous system in our body, the neurons are responsible for the message passing. The body receives the input from sensory cells. This sensory cell produces electrical impulses which are received by neurons. The neurons transfer these electric impulses to the brain.

Interpretation

The electric impulses received by the brain from neurons are interpreted in the brain. The interpretation of the brain is accomplished by means of certain states of many neurons.

Output

Based on the states of the neurons the brain sends the electric impulses representing the responses which are further received by a sensory cell of our body to respond neurons in the brain at that time.

Memory
There are certain neurons in our brain which represent certain states permanently. When required, this state is represented by our brain and we can remember the past things. To remember things we force the neurons to represent certain states of the brain permanently or for any interesting or serious matter, this happens implicitly.

Processing
When we take a decision, think about something, or make any computation, logical and arithmetic computations are done in our neural circuitry. The past experience stored and the current inputs received are used and the states of certain neurons are changed to give the output

B) Simulated Brain
Input
In a similar way, the artificial nervous system can be created. The scientist has created artificial neurons by replacing them with the silicon chip. It has also been tested that these neurons can receive the input from the sensory cells. So, the electric impulses from the sensory cells can be received through these artificial neurons.

Interpretation
The interpretation of the electric impulses received by the artificial neuron can be done by means of registers. The different values in these register will represent different states of the brain.

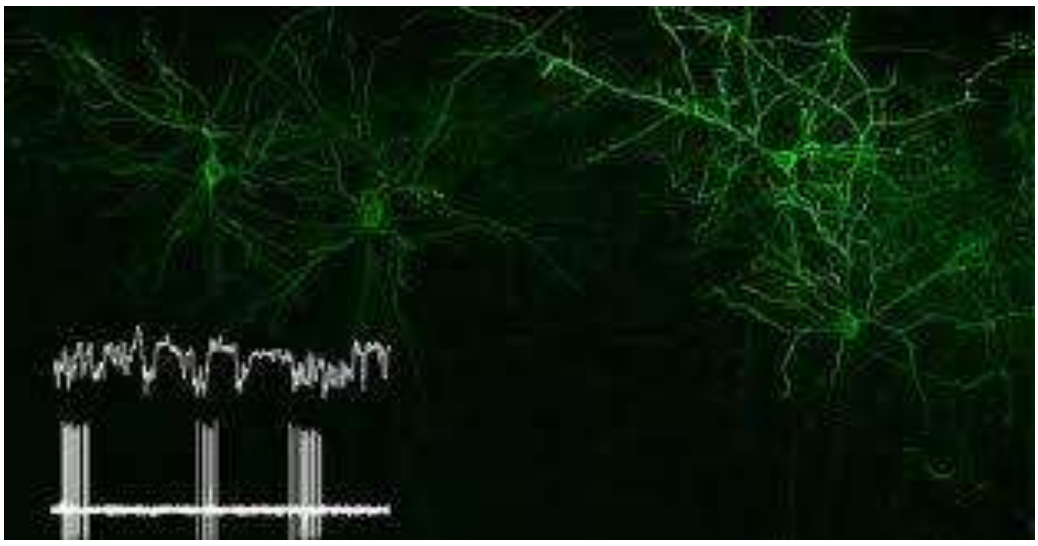
Output
Similarly based on the states of the register the output signal can be given to the artificial neurons in the body which will be received by the sensory cell.

Memory
It is not impossible to store the data permanently by using the secondary memory. In the similar way the required states of the registers can be stored permanently and when required this information can be received and used.

Processing
In a similar way, the decision making can be done by the computer by using some stored states and the received input and the performing some arithmetic and logical calculations.

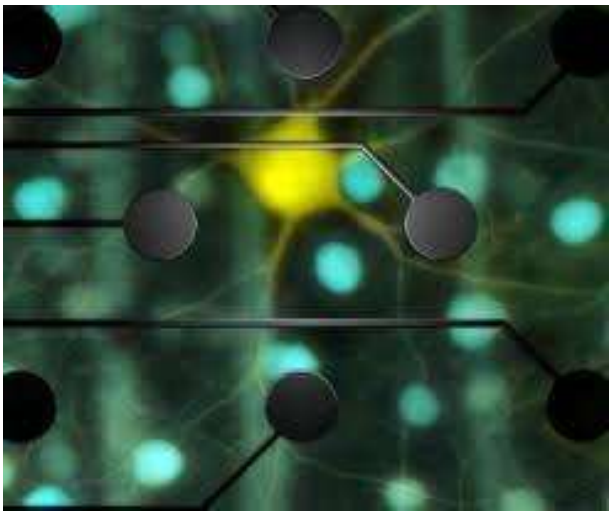
6. WHAT IS NEURAL CODING?

Neural coding is a neuroscience related field concerned with characterizing the relationship between the stimulus and the individual or ensemble neural responses and the relationship along the electrical activity of the neurosin the ensemble. Based on that theory that sensory and other information is represented in the brain by networks of neurons, it is thought that neurons can encode both digital and analog information.



7. CRACKING OF NEURAL CODE

The two basic processes underlying perceptual decisions-hoe neural responses encode stimuli, and how they inform behavioural choices-have mainly been studied separately. To address this issue, we propose a new framework centered on redefining the neural code as the neural features that carry sensory information used by the animal to drive appropriate behaviour; that is, the features that have an intersection between sensory and choice information. We show how this framework leads to a new statistical analysis of neural activity recorded during behaviour that can identify such neural codes. The process of cracking neural code forms a loop with neural encoding. First, the organism must be able to perceive a set of stimuli in the world-say a picture of the hat. After varying the range of stimuli that are presented to the observer, we expect the neurons to adapt to the statistical properties of the signals, cracking those that occur frequently. This may map to the process of thinking and acting, which in turn guide what stimuli we receive, and thus, complete the loop.



8. APPLICATION OF BLUE BRAIN IN MEMORY LOSS

- Alzheimer Disease: It is a chronic neurodegenerative disease that usually starts slowly and worsens over time. It is the cause of 60% to 70% of dementia. The most common early symptom is difficulty in remembering recent events. As a person condition declines, they often withdraw from family and society. Although the speed of progression can vary, the average life expectancy following diagnosis is three to nine years.
- Short-term Memory: It is the capacity for holding, but not manipulating, a small amount of information in mind in an active, readily available state for a short period of time. Short term memory can be distinguished from working memory, which refers to structures and processes used for temporarily storing and manipulating information.
- For the above, we need a blue brain. It is the simple chip that can be installed in the human brain for which the short term memory and volatile memory can be avoided.

CONCLUSION

In conclusion, we will be able to transfer ourselves into computers at some point. Most arguments against this outcome are seemingly easy to circumvent. They are either simple minded or simply require further time for technology to increase. The only serious threats raised are also overcome as we note the combination of biological and digital technologies. While the road ahead is long, already researches have been gaining great insights from their model. Using the Blue Gene supercomputers, up to 100 cortical columns, 1 million neurons, and 1 billion synapses can be simulated at once. This is roughly equivalent to the brain power of a honey bee. Humans, by contrast, have about 2 million columns in their cortices. Despite the sheer complexity of such an endeavor, it is predicted that the project will be capable of this by the year 2023.

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