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A review on world's first virtual brain

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Abstract

Brain is the indispensable creation of God. If brain fails the entire memories intelligence, emotion and hence everything vanishes out. A question raises here whether it's possible to store a person's memory even a man passed away and the answer is yes, it is possible with the new era of science and technology. On Innovation of technology advancement, we now reconstructed a brain artificially. The first virtual brain has become Imaginable. The First virtual brain named "BLUE BRAIN" which serves as an alternate brain. Its functionality includes storing patterns of a working brain which is similar to a human brain which can think, respond, react like a extraordinary brain. The combination of supercomputers and Artificial Intelligence makes blue brain possible. In 2005, Prof. Henry Markram started the blue brain project, he analyzed the working of brain implemented the operation of neurons using nanobots. The massive storage space of the human brain was recreated using a supercomputer. The permanent states of neurons are stored in secondary memory. Monitoring of central Neurons system is also made possible. This paper implements an advanced of current research in blue brain. It has detailed explanation of how the virtual brain is becoming smarter day by day and solution for the mission.

Keywords: Blue Brain; Nanobots; Neuron Simulation; Neuroscience; Virtual Brain

1 Introduction

The objective of blue brain is to accomplish simulation neuroscience on alignment with Reverse Engineering. It proceeds with experimental, theoretical and clinical neuroscience to well define the brain by establishing the world's first atomically summarized reconstructions and simulations of mouse brain. Blue brain is the gift of artificial Intelligence from the blessing of Prof. Henry Markram which is influencing the world to make smarter. The research was done with the help of IBM [1] (Indian Brain and Mind institute) at EPFL (Ecole Polytechnique Federale De Lausanne), Switzerland. Progress began with the treatment of loss of memory but now provides excellent solutions as a ideal source of preserving information. The Cajal Institute also participates in this collaboration. Nanotechnology in the form of a newly designed brain microscope plays a vital role in research plans. In July 2019, Blue Brain announces it has built the first next generation models of thalamocortical neurons. These digital models of neurons were built using state-of-the art optimization techniques, which directly constrain unknown parameter values with experimental data. IBM's blue gene supercomputer is utilized by the BBP for simulations whose purpose is to upload a human brain into computing device. Uploading is possible using small robots known as the nanobots. These robots are small enough to travel throughout our circulatory system. Traveling into the spine and brain, they will be able to monitor the activity and structure of our central nervous system. They will be able to provide an interface with computer while we still reside in our biological form. A virtual brain is a combination of both hardware and software with cognitive capacity like that of a human brain.

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The endmost goal is to construct a machine reveal human-like parade or Intelligence. The supercomputers-based simulations and restoration built by blue brain gives a proposal to understand about manifold structure and function of the brain. As the brain is loaded to computer the nanobots will continuously monitor the brain and give updates to the registers. The purpose of the nanobots is to study each and everything related to the brain, it includes the interconnection of neurons.

2 Materials-components

The Blue Brain Project has developed a number of software to reconstruct and to simulate the mouse brain. These are the open-source software available for everyone on GitHub.

2.1 Blue brain nexus

Blue Brain Nexus [2],[3],[4] is a data integration platform that allows users to search, store, and organize data using knowledge graphs. Based on FAIR Data principles, it provides flexible data management solutions beyond neuroscience research**.**

2.2 Bluepyopt

BluePyOpt is a tool that is utilized for building electrical models of individual neurons. The parameters are constrained to experimental electrophysiological data using evolutionary algorithms. Attempts to reconstruct single neurons using BluePyOpt are reported by Rosanna Migliore, and Stefano Masori.

2.3 Coreneuron

CoreNEURON is a complementary tool to NEURON that enables large-scale simulations by increasing memory usage and calculation speed

2.4 Neuromorpho vis

NeuroMorphoVis is a tool that enables visualisation of neuromorphology.

2.5 Sonata

Blue Brain Project and Allen Institute for Brain Science have collaborated to create SONATA[5] whose objective is to create a data format standard that allows for a multiplatform working environment with increased computational memory and efficiency.

Figure 1 The IBM Blue Gene/P supercomputer interprid at Argonne National Laboratory runs 164,000 processor cores using normal data center air conditioning, grouped in 40 racks/cabinets connected by a high-speed 3D torus network

3 Methods-evolution of processor

In the beginning of the project, an IBM BlueGene/L supercomputer running on 8192 processors was used. BlueGene/L system is a totally new approach in supercomputer design optimised for bandwidth, scalability and the ability to handle large amounts of data while consuming a fraction of power and floor space required by some of the leading

supercomputing systems. The system needs the floor space of about four large fridges and has a high processing speed of a minimum of 22.8 trillion floating-point operations per second (22.8 teraflops). This means that the supercomputer can theoretically carry out 22.8 trillion calculations per second. By mapping one or two simulated brain neurons to each processor, the computer becomes a silicon replica of 10,000 neurons communicating back and forth.

Recently, the project was powered by a 16,384-core IBM BlueGene/P supercomputer that had a memory about eight times more than the memory of IBM BlueGene/L. This makes IBM BlueGene/P capable of touching pet flops speeds and quadrillions of calculations per second.

Figure 2 Neuron morphology reconstruction in progress (image courtesy: www.artificialbrains.com/blue-brain-project

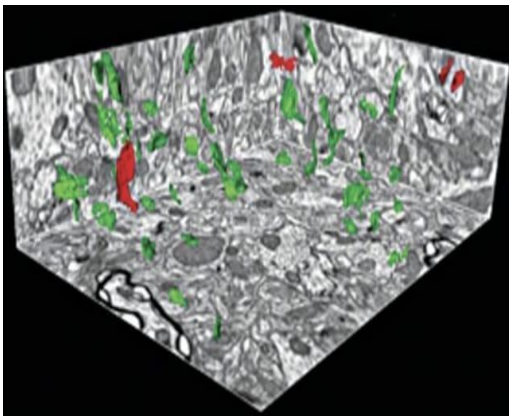

Figure 3 3-dimensional reconstruction of synapses. The colour shows whether the synapses is symmetric(red) or asymmetric(green). (image courtesy: www.upm.es)

3.1. Steps for building blue brain

3.1 Data acquisition

Data acquisition involves taking brain slices, placing them under a microscope and measuring the shape electrical activity of individual neuron. Observations are translated into mathematical algorithms that describes the form, function and positioning of neurons.

3.2 Data simualtion

This step includes two major aspects of simulation speed and workflow. Blue brain simulations use mathematical models of individual neurons and synapses to compute the electrical activity of the network as it evolves over time. Simulation speed of 1 cortical column (more than ten,100 neurons) run concerning 2 hundred times slower than real time [6]. In this simulated area, there was an incredible network of 40 million connections and about 200,000 neurons [7]. The overall simulation setup time is dominated by the recurrent connections, which are about 5 times more numerous than the virtual input connections and take about 5 times longer to set up [8].

3.3 Visualization of result

RT NEURON is the primary application used by the BBP for visualisation of neural simulations. RT NEURON takes the output from HODGIKEN-HUXLEY simulations in neuron and renders them in 3D[9].

3.4 Functionality of blue brain

Of all electronic mechanisms, the nervous system is one of the most intricately organized. There are three simple functions performed; they are:

3.4.1 Sensory input

The sensory cells in our body are called neurons. These neurons are cells that send messages directly to the brain when we touch a warm surface or look at something with our eyes. This process of gathering information from the environment is called sensory input because it uses the senses to add things to the brain.

3.4.2 Integration

Integration is primarily the process of articulating what we feel, taste and touch with our sensory cells into reactions that our bodies perceive. To accomplish this process, many neurons in the brain work together to sense the environment.

3.4.3 Motor power

When the brain interprets what we touch, feel and taste through our sensory cells, muscles or gland cells that can perform the action we request and act accordingly.

3.5 Blue brain storage room features

Intelligence is a major factor in development of society. Intelligence is innate quality that cannot be produced. People with this quality can think and do, even when the person dies, the brain and intelligence continue to live on man. The virtual brain helps people relax by uploading itself to the system[10]. The chatbot's innate intelligence can be created by a programmer. By storing more data, the system can respond more intelligently and accurately. The blue brain is very similar to living brain and has large memory capacity. BB storage space is one such concept based on extended idea of large storage space. BB storage is not a software, but a storage space used to receive data. Audio in text format, data in bit format. BIT is recommended as a storage medium achieve faster execution and more data storage. This happens on three levels, ultimately at this stage, storage is complete. The levels that BB storage passes through are as follows: Input /Output speech recognition which is the transfer of data to and from the BB storage space is done via voice.

The combination of Natural Language Processing (NLP) and speech recognition performs three actions. Accepts voice input. Convert audio to text, text to audio. Generating output. Hidden Markov models (HMMs) are common to statistical models to implement Voice recognition technology. This process involves the conversion of acoustic speech. It is translated into a series of words and executed by a software component. Language accuracy Recognition systems differ in vocabulary size and confusion ability, speaker dependence and independence, speech style (isolated, intermittent or continuous speech, reading or spontaneous speaking), task and language limitations. The voice recognition system is feature extraction and acoustic model database are divided into several blocks.

4 Results and discussions

4.1 Upload data into virtual brain

The uploading is possible using nanobots. Its basic functionality is it will monitor activities of neuron and scans the structure of brain. It defines the data using sensor technology. There is a method called data acquisition whereby using NUROLUCIDA SOFTWARE PACKAGE which runs on windows workstation, we reconstruct the Neuronal 3D morphologies by taking the brain slices from the living being. For the blue brain project a 12-patch clamp instrument was specially developed for it which studies the behaviour of neurons.

4.2 Positive brings

Blue brain accumulates and utilizes human intelligence, and the data remains even after a person dies. Able to make self-determination based on experience generated by computer. Blue brain helps people with hearing loss and enable

people with paralysis to communicate with the world. Research on biological brains can allow us to easily communicate with their brain normal conversation with humans.

4.3 Negative brings

People are becoming more dependent on computers. Since this blue brain project is computer based, Technology is dominated by fear of hacking and viruses. Restoring your computer's RAM is very easy expensive. Requires huge amount of power to start up this machine.

4.4 Applications

Curiosity about conscious and subconscious mind gets a breakthrough. Blue brain serves as a foundation; A physiological model for simulating the whole brain. Hundreds of years' worth of data can be collected checked. Possible neural code cracking. Blue brain is a major brain drug discovery tool. This project has enormous potential applications. Most important application is to collect and test data up to 100 years. This can be achieved by providing a working model. It contains the knowledge of the past 100 years about the microstructure and function of neocortical columns are collected. The blue column job is to access it. All research related to the function and structure of Neocortex creating virtual library for exploration in 3D Microarchitecture of the neocortex. Nerve crackles Code is also an application. The brain's use of electrical patterns is known as neural code. NCC is the primary network used for Computing in the neocortex. To understand the structure of the cerebral neocortex store, process and disclose information. The need to create a correct replica of the NCC that generates electrical dynamics of real microcircuits. One of the noblest applications of this Blue Brain project is that they discovered treatments for human brain diseases. If we understand how the various elements work NCC, very useful for exploring mobile communications. The synaptic basis of much psychiatric neurological disease. Can test the influence of ions, defects in channels, receptors, synapses and cells in simulations. The most suitable experimental test can also be determined. NCC replica allows researchers to explore hypothesis that brain function and disability accelerate the study. Parameters can be determined using simulation. It can be used for experiments and measurements with provides advanced immersive 2D and 3D visualization systems.

4.5 Future scope

In future, if blue brain technology integrated with the robotics, it would be the beginning of a new era that will be able to utilize the intelligence of a person at a completely different level even after the death. BB storage space is a concept focusing on storage where input and output is only provided through voice/speech. As future extension of this concept we can include visual data as input. Visual data can be video's, pictures or even a real time action. Since blue brain technology takes a lot of memory to store the information and the state that will be helpful in remembering the state to take decisions. In future this problem can be solved by the new technology that would take less space and store the large amount of data that will be useful in remembering and taking decisions.

5 Conclusion

The challenges of this blue brain research appear to be simple to overcome. They either lack sophistication or just need more time for technology to advance. The merge of biological and digital technology made these possible. Although there is a long way to go, researchers have already benefited greatly from their model. One million neurons, one billion synapses, and up to 100 cortical columns can all be simulated simultaneously using the Blue Gene supercomputers. The project is expected to be finished by 2024, even though it is a rather complicated undertaking.

Compliance with ethical standards

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All the authors are aware of this publication, and they don't have any conflict of interest.

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