



A Literature Review on Blue Brain

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Abstract

Human Brain is the most complicated creature on earth that will be demolished after certain decay of years. This research paper is based on the theoretical concept - "How its intelligence can be preserved for future use and what methodology is used for preserving it. It also discussed about its merits, demerits and lots of other things that we can do with it.

Keywords: Blue Brain, nanobots, central nervous system, virtual brain, artificial intelligence, blue gene, neural networks, axons, dendrites and sensory cells.

1. Introduction

This literature gives an immense power to the world to create a duplicate human brain as "Virtual Brain or Blue Brain". It is defined as a generation of such complex machine that works exactly same or in advance as the human brain performs. Our main objective is to enhance our super computer to perform all the activities that human brain can do.

This is to be done because after decaying of human brain, we must preserve its power and its intelligence for a million of years. The Blue Brain is the latest discovery that may be used in many fields. One such field is in the area of the neural networks, where artificial intelligence and artificial neurons are widely used to enhance and control the neural network. This technology provides the simulation between the cerebral part of human brain and with the artificial intelligence network.

The neuron's that present in human brain being a part of cortex. The IBM company had already developed such type of Virtual Brain that do the same thing as the natural Human Brain can do.

This made a long path or a long journey in improving, enhancing, our existing super computers that reveals the drastic change being occurred in the super computer era. It transforms the existing super computer into the "X-Super Computer", to become highly impactful, which is supported by the IBM. This technology rapidly gets a lot of fame and recognition over the world wide web. Most of the favourable comments, reviews and blogs are seen by many of experts of different fields like from Physics, Biology, Neurology, Software Developers from the IT industries, all of them has decided to join their hands and do the work jointly to develop, enhance and implement this technology for the beneficiary of our society.

2. A review on literature

2.1. The future generation- the blue brain (by priya babel)

The neurons information are being modelled in the biology field and their networks into cerebral cortex. The model or simulator that is already created by the IBM company and named it as "Blue Gene Super Computer". Now, we are going to discuss about its methodology used in it-

2.1.1. Input:

Neurons is nothing but acts like an input for the users that communicate directly with cerebrum. Therefore, it is named as sensory inputs.

2.1.2. Integration:

It deals with the neurons that generates the response that our body perceives. This mechanism is performed in the brain, where neurons persists.

2.1.3. Output:

The communication that performed by the neurons, to effect or to interact with other parts of our body like with cells, muscles, different organs for example what we see, what we smell, what we feel, what we listen and what choice to be taken.

2.2. Blue Brain

According to the Henry Markan at TED conference said that "It is impossible to make human brain but we can do it in 10 years". It is noticed that the first stage for the development of blue brain was completed in 2007 and neocortical column of 10,000 cells was completed in 2008 and 100 columns built in 2011 and fully virtual

brain may come into existence by the year 2023 which is equivalent to 1000 rat brains.

2.2.1. Neurocortical column modelling:-

The rat neocortical column was started in Dec 2006, it is very smallest functioning unit of neocortex, whose length is about 2mm and its diameter is about 0.5mm. It has 10,000 approximately neurons in rat, whereas in the humans its number is about 60,000 neurons.

2.2.2. Functioning of blue brain

It is quite complex process, how the brain is transformed into a computer machine. A very famous scientist named Raymond Kurgweil announces a very fruitful theory about a little robots and nanobots. These nanobots has a capacity that gives the view of our sensory system on the computer screen. It also provides the error free data of association of neurons that helps in determining the exact status of mind of human beings. We uploaded this data into the supercomputer for data processing, For this, we need excessive amount of memory space into the computer and also require rapid processing power.

2.3. Blue Brain by Nakul Ghimire and Fahad Iqbal

According to Mr. Nakul Ghimire and Mr. Fahad Iqbal, the brain transferring technology is performed by two the techniques-

- i) firstly, Copy and transfer and
- ii) secondly, slow and relentless substitution of neurons

In the past decay, it is accomplished by doing with the following 3 steps

Firstly

- i) examining
- ii) controlling
- iii) and differentiating the components of cerebrum.

And secondly

- i) duplicating
- ii) moving
- iii) storing of data into computer or into other registered machine.

Now human brain is transformed into the humanoid robots or in an organic body. This research paper has two models-

- i) First Neuron Anatomical Model.
- ii) Simple Artificial Network Model.

2.3.1. Neuron Anatomical Model

This model deals the neuron is the smallest functional unit that size varies from the range of 4 to 100 micrometers, that are responsible to do various activities performed in various parts of sensory system.

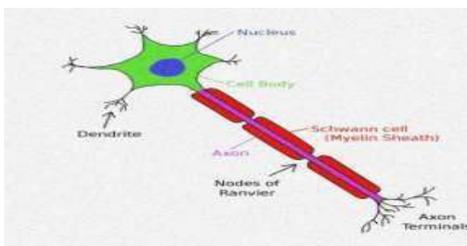


Figure 2.3.1: Neuron Anatomical Model
[Source: Adapted from [3]]

2.3.2. Simple Artificial Network(ANN)

ANNs is a type of model which is regulated by the biological network system which is used to assess the capacities that depends upon the number of inputs. ANNs are based on three things-

- i) Architecture
- ii) Activity Rule
- iii) Learning rule

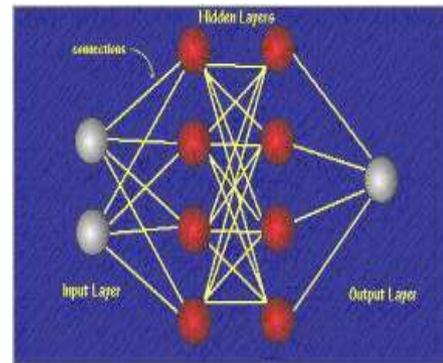


Figure 2.3.2: Simple Artificial Neural Network
[Source: Adapted from [3]]

From a scientific study, it is noticed that about approximately 85 billions of nerve cells called neurons that comprises a human brain.

Each neurons is connected with axons and dendrites and signals are transmitted through them by discharging and recognizing the chemicals called neurotransmitters.

Based on these chemicals activities, most of the neuroscientists noticed and recorded these chargeable activities (like learning, memory and awareness). According to theories given by the renowned neuroscientists, "any fully modified computing machine" must have these proven thoughts and achieve some level of awareness, then only it acts as a virtual brain. In addition to this, it also has a vital computational transferring power and excessive storage to be there in.

2.4. Artificial Intelligence- A survey of Blue Brain(Mrs Shanmugapriya, K. Kaveri et al)

According to them, it is a reverse engineering, recreation of facts and data at the cell level inside a computation machine[4]. In this research paper, they are trying to achieve a goal of brain simulation and the steps to frame the blue brain that are as follows-

2.4.1 Data Collection

Inputs are collected and measured into the forms of electrical signals movements of each individual neurons. Each neurons are diagnosed according to their shape and size, this branch of science is known as morphology. This perception is converted into different algorithms that declares the different data structures used, capacities, sizes and positions. On this basis, a mathematical calculations is performed that creates the virtual neurons.

On studying of electrophysiological conduct of neurons, the instruments that we require is of 12 patch brace that permits 12 living neurons to be fixed simultaneously.

2.4.2. Simulation

It creates a model that measures more accurately and efficiently the different outcomes that are observed during the different electro chemical activities. The main objective is to develop a virtual brain or an x-brain. The steps involved in this is, first to create a virtual neuron and secondly, a software that named NEURON developed by Michael Hines and John Morey in 1990 written in C, C++ and Fortran Languages. The recent version of NEURON software is 7.2 used for building the blue brain.

A list of two factors that influences the simulation are as follows-

2.4.2.1. Speed

It shows linear scaling for

- i) numerical integration that needs 0.025 milliseconds
- ii) for writing the data to the disk that needs 0.1 milliseconds

2.4.2.2. Workflow

It involves manufacturing of virtual cells.

2.4.3. Output Visualisation

The different compiled results written in C++ and OpenGL are stored in computer machine. The BBP team built a software named RT Neuron that takes the output from Hodgkin- Huxley simulation in NEURON and rendered into 3D. It has a facility of stopping, starting and zooming of animation as shown in fig given below.



Figure 2.4: RT NEURON
[Source: Adapted from [4]]

2.5. Blue Brain- The future Generation by Shiva Kumar Avula, Vedrucha S. Pakale and Sheetal V Kashid.

It involves microscopic study of tissue and electrodes. It collects the data on the different types of neurons and carried the simulation on Blue Gene Super Computer built by the IBM. In August 2012, one of the observatory results noted and experimented on microcircuits that has about 100 cortical column, 1 million neurons and 1 billion synapses that matches to honey bee brain.

2.5.1. Blue Gene(P)

The IBM Blue Gene Super Computer is used for Blue Brain Project. The IBM Press release agreed to support Ecole Polytechnic Federal De Lausanne's (EPFL). In a week, excluding Thursday, it is used for preparing simulation and analyzing the data. It is publicly opened by the name "C-BPP".



Figure 2.5.1: Blue Gene(P)
[Source: Adapted from [5]]

2.5.2. JuQUEEN

It is a supercomputer made by the IBM in Julich Research Centre, Germany in May 2012. It performs 1.6 peta flops and attained 8th Position in speedest supercomputers utilized by BBP. The JuQUEEN machine is utilized for exploration activity that builds three dimensional model of human brain.



Figure 2.5.2: JuQUEEN
[Source: Adapted from [5]]

3. Methodology

3.1. Wetware

The term wetware consists of two words, the prefix word "wet" refers to the water found in all living animals that based on computer related thoughts of programs. It is used in the area of fictions. The hardware required for wetware relates with a bioelectric and biochemical proportions of Central Nervous System(CNS), especially designed and used for the mind.

3.2. Fuzzy Logic

It works on value and key(answer) pair. It is used to operate the evaluations on humans and animals for eg. fuzzy is used to determine what output values of forces, directions, angles are responsible for making a feasible toss. The fuzzy logic is also used in many different areas, they are mentioned below-

- i) Fuzzy logic was firstly utilized by Japanese for their practical applications like high speed train in Sendai.
- ii) It is used in Sony Pocket Computers.
- iii) Used in Flights aid for helicopters.
- iv) Used in controlling of subway system to improve the driving comfort.
- v) Used in power economy.
- vi) Used in precision of halting
- vii) Used in improved fuel consumption for automobiles.
- viii) Used in single button control for washing machines.
- ix) Used in automatic motor control for vaccum cleaners.
- x) Used in soil testing.
- xi) Used in early recognition of prediction of earthquakes.

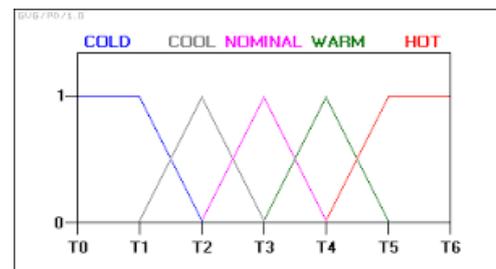


Figure 3 2:Fuzzy Logic
[Source: Adapted from [9]]

3.3 Nanobots Methods

They are the small robots. They travel in our circulatory system. It monitors the activities and structure of CNS (Central Nervous System). It scans the structure of our brain and provide complete detailing between each neurons. It also reads the current status of the brain. All of these data are entered into computer for computing the detailed results.



Figure 3.2: Fuzzy Logic
[Source: Adapted from [7]]

4. Advantages and drawbacks of blue brain

4.1. Advantages of Blue Brain

- i) The power of intelligence is preserved for thousand of years.
- ii) Asking of direct question can be made possible only with the artificial brain.
- iii) To remember the things that does not require any extra efforts as compared with human brain.
- iv) Decision making can be made possible in the absence of human.

4.2. Demerits of Blue Brain

- i) Level of dependability on computer is highly raised.
- ii) A factor of disclosing of information to any of unauthorized person may be increased.
- iii) Crime of giving threats regarding personal data of any human being is highly raised.
- iv) A fear of human cloning is raised in today's world.

5. Conclusion

At last, we are ourself transferring our whole intelligence into a computable machine that would completely be developed by the year 2023. By the usage of nanobots, a drastic change can be occurred in terms of decreasing the development time, increase in efficiency that leads to better performance. Thus, by the enhancement of technology, a begining of new era of blue brain technology is evolved in future with a great impact and high parameters.

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