

Blue Brain

Surya Verma, Bhumika Kohli

Student of Department of Electronics & Communication Engineering, SRMSWCET, Bareilly

Abstract- Human brain is the most precious and typical creation of god. The man responds to the things just because of the brain. To preserve this typical thing a project named 'Blue Brain' which is also called the first virtual brain started in 2005. Scientists are in research to develop an artificial brain that can work, respond, contemplate and take decisions without any effort. The effort is to upload a human brain into machine. The aim is to preserve the human brain after death so that the data, intelligence, personalities, feelings, memories of that person should not be lost. This paper includes the complete research work explaining the functioning module of blue brain and the recent developments which are going through it.

Index Terms- Blue Brain, Artificial, Intelligence, Human Brain, Typical.

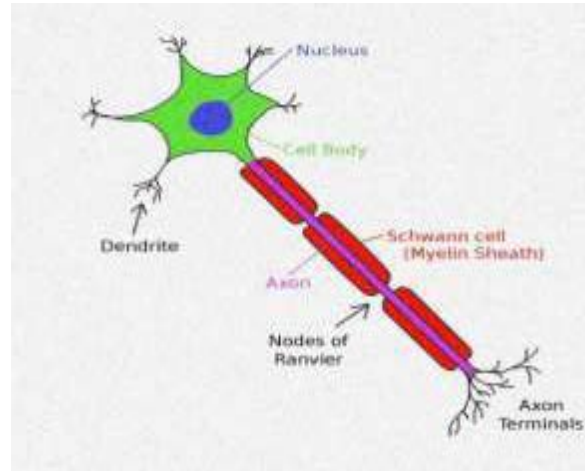


Fig. Neuron anatomical model

I. INTRODUCTION

It is very difficult to understand the complexity of human brain which is the most complex circuit than any other. But now it is possible to create a human brain. The project named Blue Brain is in under process for uploading human brain on computer which resides in the Super Computer. The project was founded in 2005, May by Henry Markram at EPFL in Lausanne Switzerland.

II. HISTORY OF BLUE BRAIN

The main objective of the project was founded in May 2005 by Brain and Mind Institute in Ecole Polytechnique Federal de Lausanne, Switzerland. Its aim is to analyze the brain's architecture and functioning principles. The project is being headed by Henry Markam, the director of the institution. For this they are using the Blue Gene super computer developed by IBM and Michael Hines, neuron software is running on this super computer. The simulation simply does not involve the artificial neural network but the biologically realistic model of neurons.

III. WHAT IS BLUE BRAIN?

Blue Brain is the name of the super computer developed by IBM. If possible, it would be the world's first virtual brain. Within years we would be able to scan our intelligence and knowledge into the computer. By this we can use this knowledge for the development of mankind even after the death of the person. It takes decisions based on the past experiences of the person and apply it to the similar situation occurring in the present. With the help of blue brain we can upload our brain into a computer. Different activities and structure of our central nervous system can also be studied.

IV. NEED OF BLUE BRAIN

Intelligence is the quality through which all of us are different from each other. It is the inborn quality. There are some people having a very high level of intelligency. Sometimes they think upto such extent that other's cannot reach. Examples are Newton etc. But after the death the intelligence is lost. The solution to this is the Virtual Brain. Through this it can be preserved even after death. We all suffer from a problem of remembering history and important days etc. This all can be done by virtual brain.

V. SEVERAL GOALS OF PROJECT

NEUROCORTICAL COLUMN MODELLING

The initial phase completed in December 2006, was the simulation of the rat neocortical column which are the smallest functioning units of neocortex (responsible for conscious thoughts). It is about 2mm tall, having a diameter of 0.5mm and

contains 60,000 neurons in humans but rat neocortical column contain 10,000 neurons.

BRAIN SIMULATION

Henry Markam at TED conference said that, "It is not impossible to make the human brain and we will do it in 10 year". He said that if we would be able to implement it correctly, then it would be able to speak and have the intelligence similar to man.

PROGRESS

The first phase completed in November 2007. The first single cellular model was completed in 2005. The neurocortical column of 10,000 cells completed by 2008. Such 100 columns were built by 2011 human brain predicted to exist by 2023 which will be equivalent to 1000 rat brains.

VI. FUNCTIONING OF BLUE BRAIN

Firstly, it becomes quite important to understand how the person's brain can be uploaded into a computer. Raymond Kurgweil published a paper on this topic and provided that the use of small robots or nanobots is excellent. They are small enough to travel through our circulatory system. They would be able to monitor the activities of the nervous system. They will provide the interface with computer. By scanning our brain it will provide the clear information of the connections of neurons. They would record the current state of brain. All these information when entered into computer, it will work as us. All what is required is the super computer with large space and processing power.

VII. STEPS OF BUILDING A BLUE BRAIN

There are basically three steps of building a blue brain-

1. Collection of Data
2. Simulation of Data
3. Visualization

COLLECTION OF DATA: It involves in the collection of brain portion and analysing them under a microscope and understanding the electrical behaviour individually of the neurons. The observations are transformed into algorithm which are further ready for simulation.

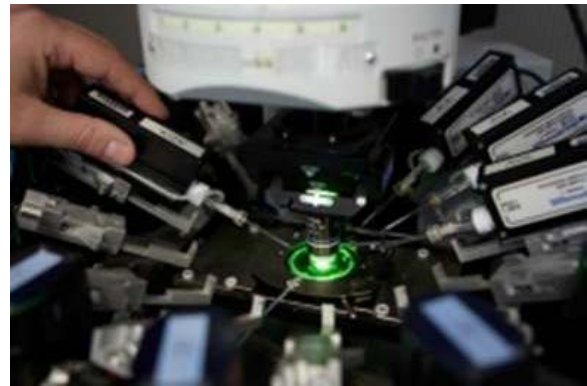


Fig. The 12 patch clamp, close view

SIMULATION OF DATA:

There are 2 aspects of simulation-

1. Speed of simulation
2. Simulation Workflow

Speed of Simulation: The speed of simulation of 1 neocortical column is two hundred times slower than the real one.

BBP-SDK

The software uses C, C++, FORTAN and is an open source software. It was developed in 1990's by Moore and Hines. The Blue Brain Project- SDK is a C++ wrapped in Java and Python.

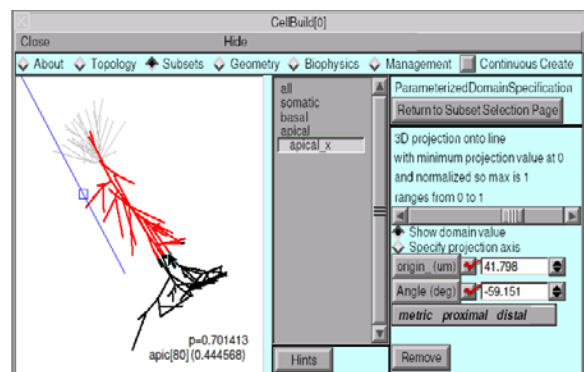


Fig. NEURON cell binder window

VISUALIZATION:

RTNEURON

RTNeuron is generally used for the visualisation of the neural simulations. This software is written in C++ and OpenGL. It is written basically for the neuron simulations. This gives the output in 3D.

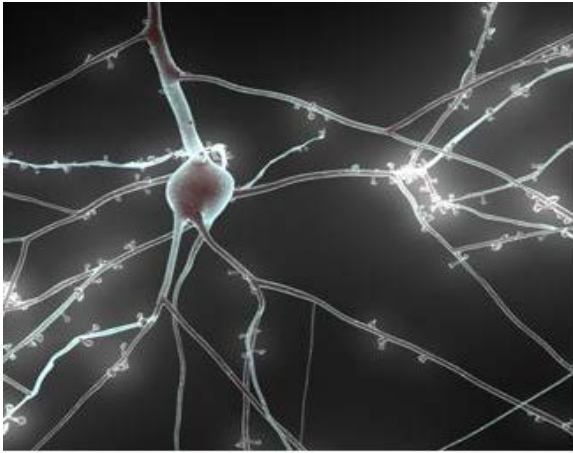


Fig. RTNeuron visualization of a neuron

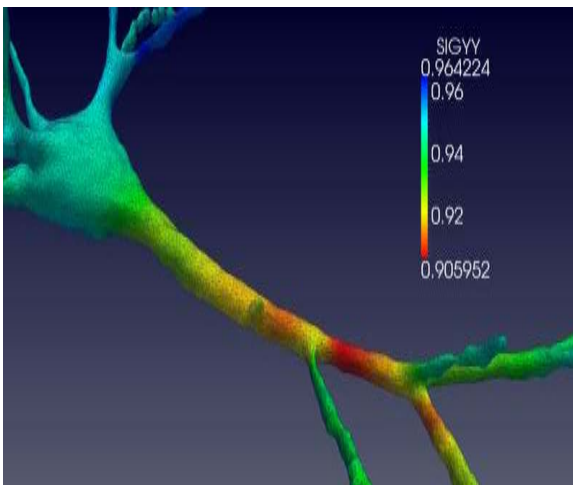


Fig. Visualization of neuron

VIII. HARDWARE/ COMPUTER USED

Blue Gene/P specifications:

1. 4,096 quad-core nodes.
2. Each core is a PowerPC of 4.5, 8.5 GHz
3. It consists of more than 6×10^{13} flops
4. 15 terabytes memory
5. 1 PetaByte of disk space.
6. Operating system used is Linux SuSE SLES 10

This machine marked as 99th fastest supercomputer in the world in November 2009.



Fig. Blue Gene/P's processing system outer view

IX. MERITS

1. It can help deaf people to hear with the help of direct nerve stimulation.
2. The activity and thinking of different animals can be understood by interpretation of electric impulse from their brain.
3. Even after the death of a person his/her intelligence can be used for development of the society.

X. DEMERITS

1. Human will become dependent on machines.
2. Super computers use a large amount of power as much as 1MW.
3. If the neural schema of a particular person is hacked which is uploaded on blue brain can be misused.
4. Since we are providing a brain to machine, so thoughtfully it increases the risk of machine taking over the person.

XI. APPLICATIONS

1. Data of 100 years can be tested.
2. Neural Code can be cracked.
3. Information Processing of Neocortical can be understood.
4. Whole brain simulation can be studied.
5. A drug for the Brain Disorders.

XII. CONCLUSION

Human brain is complex than any circuitry in the world. And we are able to scan ourselves in the computer in near future. The only serious threats raised are also overcome as we note the combination of biological and digital technologies. Despite all the problems and complexity faced in the implementation of this project, it is predicted that the project will be capable by the year 2023. As said by Henry Markam, "As with Deep Blue, Blue Brain will allow us to challenge the foundations of our

understanding of intelligence and generate new theories of consciousness.”

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AUTHORS

First Author – Surya Verma, Student of Department of Electronics & Communication Engineering, SRMSWCET, Bareilly, Email; suryaverma0103@gmail.com
Second Author – Bhumika Kohli, Student of Department of Electronics & Communication Engineering, SRMSWCET, Bareilly, Email; bhumika.kohli24@gmail.com