

A Study on Blue Brain

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ABSTRACT:-Human brain plays a pivotal role with the help of which the world is developing and considered intelligent. It is not possible to model a brain and to upload the information of the natural brain into it. Think about the achievements that would be back if we will be able to restore the brain of the greatest persons like Einstein or Mahatma Gandhi. Considering this, scientists mentioned the world's first virtual brain as "Blue Brain". The scientists are researching for creating the virtual brain which can response, take decision, think and can keep every data in the memory. The motive of the project is to preserve the brain after the death so the data, feelings, memory and intelligence of that person would not lost. This paper presents the complete research of blue brain including the concepts and functions.

KEYTERMS:- Brain; Neurons sensory Blue brain; artificial system

I. INTRODUCTION

Human brain is contemplated as the biggest gift that God has given to this world. Man is considered to be the most intelligent because of his abilities that brain deliver him. The brain enables a person to respond by converting the information transmitted by impulses. Technology is growing faster and faster. Virtual brain is an artificial brain, which is able to respond, think and act as a real brain. This possibility can be turned into realization by using a super computer, having large storage capacity and an interface between the human brain and the virtual brain. This interface helps to upload the real brain into the virtual one. So the brain of any person along with its intelligence, knowledge and memory can be kept and used even after death. One can also overcome the problems dealt in memorizing things such as important dates, roads and routes, birthdays, history, etc. Even It is very difficult to understand the complexity of human brain. But now it is possible to create a human brain. The project **Blue Brain** is in under process for uploading human brain on supercomputer. Henry Markram founded the project in May 2005 at the EPFL (Ecole Polytechnique Federal De Lausanne) in Lausanne, Switzerland[2]. The Goal of the project is to achieve a complete understanding of the human brain and to enable faster and better development of brain diseases. Data is gathered for about many neuron types which is used to build realistic models of neurons. IBM created a Blue Gene supercomputer named “**Blue Brain**” to carry the simulations.

II. WORKING OF REAL BRAIN

The primary step is to gather information about all wide range of neuron types. This information is utilized to completely study biology practical models of neuron and network of neurons. The simulations are completed by IBM on a Blue Gene supercomputer [5]. Let us begin with the function of normal brain:-

1. Sensory input:

Initially, when our hands touch a warm surface, the neurons, communicate specific straight to the cerebrum. This activity of getting data from environment is called sensory input.

2. Integration:

The understanding of things we have tasted, felt and touched which the body perceives into responses through neurons is called integration

3. Major output:

Once the brain learn, either by touching or tasting, at that point our mind communicates specific through neurons to effector cells, which really work to play out our solicitations with the help of which we see, listen, smell and feel.

III. FUNCTIONING OF BLUEBRAIN

1. Collection of Data:

It actually involves understanding the electrical behaviour of neurons by collecting the brain portion and analysing them under a microscope. The observations obtained are then transformed into algorithm which becomes further ready for the simulation process.

2. Simulation of Data:

There are two aspects of simulation:

1. Speed of simulation
2. Simulation workflow

Speed of simulation: In 2012 simulation of one cortical column which consist of 10000 neurons run approximately 300 times slower than the real time. Accordingly one second of simulated time took about five minutes to complete. Now the speed of simulation of one neocortical column is two hundred times slower than the real time. These simulations show approximately linear scaling, that results in doubling the size of the neural network which doubles the time it takes to simulate[9]. At present the primary goal is to gain biological validity instead of performance.

Simulation workflow: **BBP-SDK (Blue Brain-SDK)** is an open source software which uses C++, C, FORTRAN. Moore and Hines developed it in 1990's. The BBP-SDK is a C++ wrapped in Python and Java[3]. Neural simulation is basically used for building and using computational models of neurons. For blue brain, the current version of neuron which is in use is 7.2.

3. Visualization:

RT Neuron is used for the visualisation of neural

simulations. This software is generally written in C++ and OpenGL[3]. This gives the 3D output. The initial phase was completed in December 2006, which included the simulation of the rat neocortical column which are the small functioning units of neocortex which is usually responsible for conscious thoughts. It is about 2 mm tall, having a diameter of 0.5 mm and contains 10,000 neurons in rats but in human it contains 60,000 neurons[1].

IV. COMPARISON OF REAL BRAIN AND BLUE BRAIN

REAL BRAIN	BLUE BRAIN
1. SENSING PART The neurons help in passing the message. The sensory cell receives the input which produces electric impulses. The impulses are received by neurons then transferred to the brain.	1. SENSING PART In the Blue brain these sensory cell have been replaced by Silicon chip. It has been tested that these neurons can produce electric impulse.
2.INTERPRETATION The electric impulses are illustrated in the brain by means of certain states of many neurons.	2. INTERPRETATION The electric impulses are illustrated in the Blue brain by means of registers. There are different values in the register which represent the different states of brain.
3. RESULT The brain sends the electric impulses representing the responses which are further received by sensory cells to respond neurons in the brain at that time.	3. RESULT Based on the different states of register the brain send the electric impulse representing the responses which are further received by a particular register to respond neurons at that time.
4. MEMORY Certain neurons in the brain represent the states	

permanently. When required, the state is visualized by our brain and we can easily remember the past things.	registers can be stored permanently and when required the information can be received and used.
5.WORKING Whenever we take decisions or make any computation, the computation are done in neural circuitry. The past experiences stored and the inputs received are used for the output.	5. WORKING The decisions in virtual brain are taken by some stored registers and the current inputs received for the output.

V. BLUEBRAIN COMPONENTS

1. Blue Gene Supercomputer:

The primary machine used for the project is a Blue Gene Supercomputer built by IBM.

a) BLUE GENE/L: IBM in June 2005 agreed to supply EPFL a “technology demonstrator” with the help of Blue Gene/L.

b) BLUE GENE/P: This supercomputer was upgraded to a Blue Gene/P in June 2010 in Lausanne with the following specifications:-

1. Total: 16 terabytes of memory, 56 teraflops
2. GPFS parallel file system
3. Operating system: Linux SUSE SLE10
4. 1 PB of disk space
5. Silicon graphics: A 32-processor Silicon graphics Inc. (SGI) system is used for visualization of results with 300 GB of shared memory [10].
6. Commodity PC clusters: Clusters of commodity PC's have been used for visualization tasks with RT Neuron software.

2. Blue Gene/Q:

JUQUEEN is an IBM Blue Gene/Q supercomputer. It was installed in May 2012 at the JULICH Research Centre in Germany that currently performs at 1.6 pet flops and in June

2012 was ranked the world's 8th fastest supercomputer. The goal is to develop a three-dimensional model of the human brain[11].

3. Brain chip:

Brain chip was designed to provide a balance between durability, safety and functionality by Matthew Nagle. The chip had to be small enough to not halt normal brain functions[3]. The chip recorded brain signals using integrated CMOS circuitry, which is an array of recording electrodes[1]. The reliability of recorded data was improved by repeating experiments and using multiple electrodes

VI. ADVANTAGES

1. Interpretation of electric impulse from the brain of animals can be helpful in understanding their thoughts.
2. Even after the death of person his/her intelligence can be used for development.
3. Things can be remembered without any effort.
4. It would be possible to hear deaf people via direct nerve stimulation.
5. The decisions can be conducted without the actual presence of the person.

VII. DISADVANTAGES

1. Supercomputers use a large amount of power.
2. Human will become more dependent on machine.
3. If the neural schema of person is hacked which will be uploaded on blue brain, it could be misused[7].
4. There are threats of malware and viruses.

VIII. APPLICATIONS

1. To discover Drug for brain disorder.
2. Gathering and testing of 100 years of data.
3. Cracking of neural code can be done.
4. Brain simulation can be studied.
5. It can provide aid in relieving from conditions

like depression, anxiety, stress and other genetic disorders[8].

6. Social issues like various crimes, drug abuse can go eradicated.

IX. CONCLUSION

Human brain is a pivotal part of human body and in near future we will be able to scan ourselves in the computer. The Blue brain is the concept of reverse engineering having great benefits for humans. The serious threat is the combination of biological and digital technologies. Despite all the difficulties, the project is aimed to be completed by 2023.

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