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Reframing the Possibilities in Healthcare using Blue Brain Technology

A. Darwin Jose Raju[1], A. S. Karthika[2], Kavyashree Prakashan[2] and R. Ankayarkanni[3]

[1]*Department of Electrical and Electronics Engineering, St. Xavier's Catholic College of Engineering, Nagercoil, India*
[2]*Department of Computer Science and Engineering, St. Xavier's Catholic College of Engineering, Nagercoil, India*
[3]*Department of Electronics and Communication Engineering, St. Xavier's Catholic College of Engineering, Nagercoil, India*
E-mail: darwinraju@ieee.org; karthika_as@ieee.org; ponnu.praks@gmail.com; ankayarkannir@ieee.org

Abstract. The main intention of this paper is to reframe the possibilities in healthcare with the aid of Blue Brain technology. In general, blue brain is usually associated with the preservation of the intelligence of individuals for future. This paper has stepped ahead by describing the other possible solutions that can be provided by implementing the blue brain technology in the medical field. The possibilities in decreasing the demise rates that occur due to the complications in brain have been discussed. The blue brain can be used for monitoring the conditions of the brain, based on which the brain diseases can be diagnosed and cured in advance. In this paper, the details about blue brain, its functions, simulations and up gradation of human brain are explored in depth. The future enhancements and predictions in the field of blue brain that can benefit the humanity are also being discussed in this paper.

Keywords: Blue Brain, Virtual Brain, Nano bots.

1 Introduction

Human Brain is a marvelous creation of God. It's the brain which makes a human intelligent and the sixth sense of the man makes him stand different from the animals that also possess a brain. The brain is not actually a single part of the human body. It is a complex organ connecting each and every organ and organ system present in the body. It plays a vital role in the functioning of every organ as it has the overall control of all the parts. It enables a person to think and make decisions. Even the innovative thoughts that had led to countless inventions have their origins in brain. But the sad reality is that the knowledge in the brain is lost along with the destruction of body after death. The Blue Brain has been under development for resolving this particular issue.

2 Blue Brain

Blue Brain is the name given to the first Virtual Brain [2] of the world, which is being developed by IBM. It is actually the artificial brain created by man that could function as if the original human brain. It has been predicted that, within the next 30 years, we human beings will be able to scan ourselves into the computer. As mentioned earlier, it is an artificial brain, which can behave actually like a natural brain. It can perform thinking; decision making based on experience and can respond too. In order to make this possible, all we need is a super computer, a memory with a large amount ofstorage capacity, a processor having a high processing power, a wide network, a program to convert electric impulses into input signal and an interface between the natural brain and artificial brain for upload-

ing data from natural brain to computer. By doing this the intelligence of that particular brain can be stored further use in the future, even after the death of that corresponding person.

The development we have been attaining at each phase of Science and Technology is because of the intelligence possessed by individuals. Being an inborn quality, intelligence cannot be created. Not everyone is blessed with this quality, but the ones who have this are extra ordinary thinkers. It usually begins and ends with the person who has it. The blue brain can provide a solution for preserving this intelligence [5] even after the death. It can also be used for assistance during one's life time for remembering the important days or facts that have higher chances of being forgotten.

3 Steps Involved in Building a Blue Brain

There are three major steps [3] involved in building a Blue Brain. They are given as follows:

1. Data Collection
2. Data Simulation
3. Visualization

1. Data Collection:

In this phase, the different portions of brain is collected, made to undergo examination through microscope and the shape and electrical behaviour of individual neurons is measured. On the basis of the gauged shape, electrical and physiological behaviour, site within the cerebral cortex and population density, the neurons are captured. The observations thus made can be translated into algorithms that are capable of describing the process, function and the positioning methods of neurons. Based on these algorithms, biologically-real looking virtual neurons that are ready for simulation can be generated.

2. Data Simulation:

Data Simulation concerns with two major features:

i. Simulation Speed
ii. Simulation Workflow

i. Simulation Speed:

The simulation speed is very less when compared with the natural brain. The simulation of one cortical column [10] i.e., more than 10,000 neurons, run about two hundred times slower than the real time. One second of stimulated time takes about five minutes to complete. The simulation displays are probably uneven. Currently the major seek is biological soundness. After the complete understanding of the biologically significant factors for a specific effect it might be possible to crop the constituents that don't subsidize in order to advance performance.

ii. Simulation Overflow:

This step involves virtual cell production based on the algorithms generated to describe the real neurons. On the basis of age, species and the disease stage of the animal to be simulated, the algorithms are chosen.

a. From all kinds of synthesized neurons, a network skeleton is built.
b. Based on the rules framed through experiments, the cells are joined together.
c. The neurons are functionalized and simulation is brought to the life.

3. Visualization:

For the visualization of neural simulations, the Blue Brain project makes use of RT Neuron(An application) [9]. RT Neuron is coded using C++ and OpenGL and is specifically used for neural simulations. It takes input as neuron and displays the output in 3D form. This has been very interactive.

4 Functioning of Human Brain

Almost every sense of a human being is being controlled by the nervous system. None can see the actual functioning of it, but it does its responsibility very smoothly through the electric pulses. It is the most complicatedly organized electron mechanism in the world. In order to understand this complex system, one should have the knowledge about the three basic functions [8] performed by this system:

1. Sensory Input
2. Integration
3. Motor Output

1. Sensory Input:

Whenever we sense something, i.e., if we see, hear or taste something, the sensory cells i.e., neurons, belonging to our eyes, skin and tongue is responsible to send those messages to the brain. This process of receiving information from the surroundings is known as sensory input.

2. Integration:

This function involves interpretation of things that we have felt and this process happens within the brain. For example, if you have touched a hot pan, the sensory input will be given to the brain. The brain identifies that it is a hot pan and responses.

3. Motor Output:

This includes the responses given by brain to those sensory nerves. In case of touching the hot pan, the brain sends message impulse to the hands commanding to take of it from the pan, in order to avoid injuries.

5 Brain Simulation

In Natural Brain, the input is received through the natural neurons, interpreted through the various neurons present in the brain and is delivered as output through the same natural neurons. Here, the processing is done by the arithmetic and logical calculations and the result obtained is stored in the permanent states of neurons.

In Simulated Brain, the reception of input is through the silicon chips or artificial neurons. The interpretation is done by a set of bits in the set of registers and the output obtained is transported through the silicon chips. The results of processing done using arithmetic and logical calculation and artificial intelligence are stored in the Secondary memory.

6 Upgrading Human Brain to Blue Brain

The data present in the human brain can be uploaded to the computer with the help of small robots, commonly known as Nanobots [7]. These bots are nano sized and hence it can travel throughout the human circulatory system. The activities and structure of our nervous system can be monitored by these bots by its frequent travel towards the brain and the spine. These can also act as an interface between human brain and the computer. The bots are capable of scanning our brain and its structure, thus recording the complete connection. When one enters these recorded details into a computer, it starts functioning as human. In this way, the entire data stored in the Human Brain can be uploaded to a computer.

IBM, along with the scientists of Ecole Polytechnique Federale de Lausanne's (EPFL) Brain and Mind Institute, Switzerland is undertaking a research to simulate the biological systems of the brain and to deliver the output in the form of a working Three Dimensional model [6] which could recreate the high-speed electro-chemical interactions taking place within the interior parts of the brain. These interactions include to brain malfunction such as psychiatric disorders like depression and autism and cognitive functions such as language, learning, perception and memory. From there, the modeling will expand to other regions of the brain and, if successful, shed light on the relationships between genetic, molecular and cognitive functions of the brain.

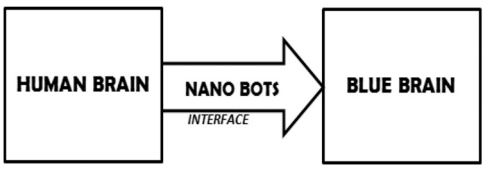

Figure 1. Upgrading human brain to blue brain.

7 Innovative Approach

Blue Brain being a replacement for the real human brain, it can be used to overcome certain disorders happening in the brain. The very first case which we take into consideration is the death rates due to Brain tumors. In most cases, the tumor is identified only in the worst stage. Even among those, the lives of a good percent get expired because of the delay in the identification. Such mortal rates can be decreased by using this blue brain technique. As the nano bots will be continuously monitoring the brain and spine, any minor change in its behavior will be recorded. Based on the recordings, one can identify the issues with the brain and its functions. If the change is the initial stage of tumor, diagnosis can be done and proper treatment can be provided. This will lead to the increase in chances for the survival of the affected person.

The next case we consider is the brain deaths. As we know, brain is the functional unit and control unit of human body, brain death is indeed the person's death. The blue brain can be a solution for this too. The brain which is dead can be replaced by the virtual brain, thus helping the life of the person sustain.

8 Advantages and Disadvantages

Like the other fields of Science, there are both pros and cons in case of Blue Brain too. Blue Brain technology facilitates a person to remember everything without any effort. The activities of human beings and other animals can be understood and can be used for advanced research purposes. This can also help in decision making without the presence of a person. It reduces the illness related to brain to a greater extent. The deaf can be made to hear using the direct connection towards the nerves [4]. Most importantly, it can be used to save the intelligence of individuals even after their deaths.

On the other hand, it can make humans lazier and dependent on machines [11]. Anti-Socialists can use technology against it and can involve in human cloning with wrong intensions. If in future locums for human beings are developed then, there will be no human interaction and the world will run on computers only.

9 Discussion

Being a technology under research, it is a difficult task to predict the exact implementation techniques and methodology for it. The blue brain to be used for the replacement

of dead brains should be more enhanced. The blue brain in a computer will be vain in this case. In short, the blue brain can be a chip or a bot functioning from the interior of the human body in near future. This can enable the quick replacement of the damaged or dead brain. As the intelligence of the person is already recorded within the blue brain, he/she can live a comfortable life even after the brain death. This can also reduce the death rates occurring in the reason of brain deaths can also be considerably brought down to a much lower level.

10 Conclusion

The advancements in Science and Technology have been considered as a bane by the public sometimes. The technologies like Blue Brain have been serving as an evidence for the boon part of advancements thus leading the world towards a sustainable development [1]. The day, we will transform into computers is not so far. At some point, this transformation happens and may lead to immortal life of humans, thus proving that it can bring both benefits and harm to human society. Whatever may be, this technology will be highly accepted whole over the world sooner as a part of promoting sustainable development.

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