A Case Study of A Blue Brain Working on the Neural Network Concepts

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***Abstract*:- Human brain is the most valuable creation of God. The man is called intelligent because of the brain. The brain translates the information delivered by the impulses, which then enables the person to react. But we lose the knowledge of a brain when the body is destroyed after the death of man. That knowledge might have been used for the development of the human society. What happens if we create a brain and upload the contents on to the system?. The work presented in this paper is the UG credit seminar work of the undergraduate student that was undertaken by the UG student & just provides a brief review of the applications of the Bluebrain that could be used in the medicine for the curing of the cancer treatement and is just a review paper, which serves as a basis for all the students, faculties as a base for carrying out the research in this exciting field of Bluebrain.**

Keywords:- Brain, blue brain, impulses, knowledge

1. INTRODUCTION

The name of the world's first virtual brain. That means a machine that can function as human brain. Today scientists are in research to create an artificial brain that can think, response, take decision, and keep anything in memory. The main aim is to upload human brain into machine. So that man can think, take decision without any effort. After the death of the body, the virtual brain will act as the man .So, even after the death of a person we will not loose the knowledge, intelligence, personalities, feelings and memories of that man that can be used for the development of the human society. No one has ever understood the complexity of human brain. It is complex than any circuitry in the world.

So, question may arise "Is it really possible to create a human brain?" The answer is "Yes". Because whatever man has created today always he has followed the nature. When man does not have a device called computer, it was a big question for all. Technology is growing faster than everything. IBM is now in research to create a virtual brain, called "Blue brain". If possible, this would be the first virtual brain of the world. With in 30 years, we will be able to scan ourselves into the computers. Is this the beginning of eternal life?

Ease of Use : First, it is helpful to describe the basic manners in which a person may be uploaded into a computer. Raymond Kurzweil recently provided an interesting paper on this topic. In it, he describes both invasive and noninvasive techniques. The most promising is the use of very small robots, or nanobots. These robots will be small enough to travel throughout our circulatory systems. 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 computers that is as close as our mind can be while we still reside in our biological form. Nanobots could also carefully scan the structure of our brain, providing a complete readout of the connections between each neuron. They would also record the current state of the brain. This information, when entered into a computer, could then continue to function as us.

All that is required is a computer with large enough storage space and processing power. Is the pattern and state of neuron connections in our brain truly all that makes up our conscious selves? Many people believe firmly those we posses a soul, while some very technical people believe that quantum forces contribute to our awareness. But we have to now think technically.

Note, however, that we need not know how the brain actually functions, to transfer it to a computer. We need only know the media and contents. The actual mystery of how we achieved consciousness in the first place, or how we maintain it, is a separate discussion. Really this concept appears to be very difficult and complex to us. For this we have to first know how the human brain actually works. important is that the silica is not biodegradable permitting a long-term activity in the body.

2. FUNCTION OF NORMAL BRAIN

The brain essentially serves as the body's information processing centre. It receives signals from sensory neurons (nerve cell bodies and their axons and dendrites) in the central and peripheral nervous systems, and in response it generates and sends new signals that instruct the corresponding parts of the body to move or react in some way. It also integrates signals received from the body with signals from adjacent areas of the brain, giving rise to perception and consciousness. The brain weighs about 1,500 grams (3 pounds) and constitutes about 2 percent of total body weight.

The human ability to feel, interpret and even see is controlled, in computer like calculations, by the magical nervous system. The nervous system is quite like magic because we can't see it, but its working through electric impulses through your body. One of the world's most "intricately organized" electron mechanisms is the nervous system. Not even engineers have come close to making circuit boards and computers as delicate and precise as the nervous system.

To understand this system, one has to know the three simple functions that it puts into action; sensory input, integration & motor output.

3. ARCTITECTURE OF BLUE GENE

Blue Gene/L is built using system-on-a-chip technology in which all functions of a node (except for main memory) are integrated onto a single application-specific integrated circuit (ASIC). This ASIC includes 2 PowerPC 440 cores running at 700 MHz. Associated with each core is a 64-bit "double" floating point unit (FPU) that can operate in single instruction, multiple data (SIMD) mode. Each (single) FPU can execute up to 2 "multiply-adds" per cycle, which means that the peak performance of the chip is 8 floating point operations per cycle (4 under normal conditions, with no use of SIMD mode). This leads to a peak performance of 5.6 billion floating point operations per second (gigaFLOPS or GFLOPS) per chip or node, or 2.8 GFLOPS in non- SIMD mode.
The two CPUs (central processing units) can be used in "co-processor" mode (resulting in one CPU and 512 MB RAM (random access memory) for computation, the other CPU being used for processing the I/O (input/output) of the main CPU) or in "virtual node" mode (in which both CPUs with 256 MB each are used for computation). So, the aggregate performance of a processor card in virtual node mode is: 2 x node = 2 x 2.8 GFLOPS = 5.6 GFLOPS, and its peak performance (optimal use of double FPU) is: 2 x 5.6 GFLOPS = 11.2 GFLOPS. A rack (1,024 nodes = 2,048 CPUs) therefore has 2.8 teraFLOPS or TFLOPS, and a peak of 5.6 TFLOPS. The Blue Brain Projects Blue Gene is a 4-rack system that has 4,096 nodes, equal to 8,192 CPUs, with a peak performance of 22.4 TFLOPS. A 64-rack machine should provide 180 TFLOPS, or 360 TFLOPS at peak performance.

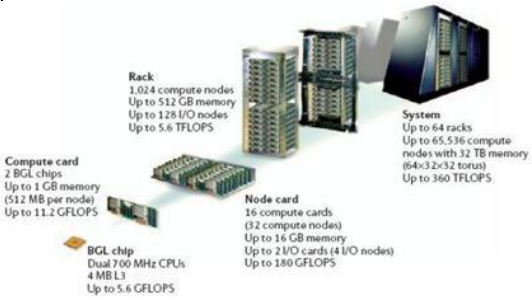

Fig. 1 : System architecture

4. WHOLE BRAIN SIMULATION

The main limitations for digital computers in the simulation of biological processes are the extreme temporal and spatial resolution demanded by some biological processes, and the limitations of the algorithms that are used to model biological processes. If each atomic collision is simulated, the most powerful super-computers still take days to simulate a microsecond of protein folding, so it is, of course, not possible to simulate complex biological systems at the atomic scale. However, models at higher levels, such as the molecular or cellular levels, can capture lower-level processes and allow complex large-scale simulations of biological processes. The Blue Brain Project's Blue Gene can simulate a NCC of up to 100,000 highly complex neurons at the cellular or as many as 100 million simple neurons (about the same number of neurons found in a mouse brain).

However, simulating neurons embedded in microcircuits, microcircuits embedded in brain regions, and brain regions embedded in the whole brain as part of the process of understanding the emergence of complex behaviors of animals is an inevitable progression in understanding brain function and dysfunction, and the question is whether whole-brain simulations are at all possible. Computational power needs to increase about 1-million-fold before we will be able to simulate the human brain, with 100 billion neurons, at the same level of detail as the Blue Column. Algorithmic and simulation efficiency (which ensure that all possible FLOPS are exploited) could reduce this requirement by two to three orders of magnitude.

Simulating the NCC could also act as a test-bed to refine algorithms required to simulate brain function, which can be used to produce field programmable gate array (FPGA)-based chips. FPGAs could increase computational speeds by as much as two orders of magnitude. The FPGAs could, in turn, provide the testing ground for the production of specialized NEURON solver application-specific integrated circuits (ASICs) that could further increase computational speed by another one to two orders of magnitude.

It could therefore be possible, in principle, to simulate the human brain even with current technology. The computer industry is facing what is known as a discontinuity, with increasing processor speed leading to unacceptably high power consumption and heat production. This is pushing a qualita-tively new transition in the types of processor to be used in future computers. These advances in computing should begin to make genetic- and molecular-level simulations possible. Software applications and data manipulation required to model the brain with biological

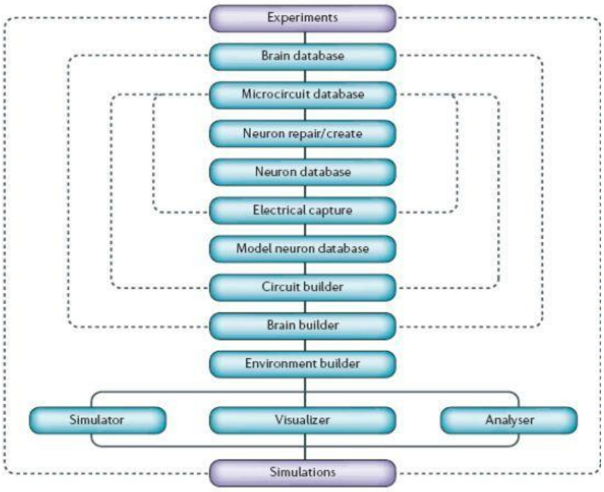

Fig. 2 : Flow-chart of the brain simulation using neural nets

Experimental results that provide the elementary building blocks of the microcircuit are stored in a database. Before three-dimensional neurons are modeled electrically, the morphology is parsed for errors, and for repair of arboriza-tions damaged during slice preparation. The morphological statistics for a class of neurons are used to clone multiple copies of neurons to generate the full morpho-logical diversity and the thousands of neurons required in the simulation.

A spectrum of ion channels is inserted, and conductance's and distributions are altered to fit the neurons electrical properties according to known statistical distributions, to capture the range of electrical classes and the uniqueness of each neurons behaviour (model fitting/electrical capture). A circuit builder is used to place neurons within a three-dimensional column, to perform axo-dendritic collisions and, using structural and functional statistics of synaptic connectivity, to convert a fraction of axo-dendritic touches into synapses.

The circuit configuration is read by NEURON, which calls up each modeled neuron and inserts the several thousand synapses onto appropriate cellular locations. The circuit can be inserted into a brain region using the brain builder. An environment builder is used to set up the stimulus and recording conditions. Neurons are mapped onto processors, with integer numbers of neurons per processor. The output is visualized, analyzed and/or fed into real-time algorithms for feedback stimulation.

5. APPLICATIONS

- Gathering and testing 100 years of data.
- Cracking the Neural Code
- Understanding Neocortical Information Processing
- A Novel Tool for Drug Discovery for Brain Disorders
- A Global Facility
- A Foundation for Whole Brain Simulation.
- A Foundation for Molecular Modeling of Brain Function

6. ADVANTAGES

- We can remember things without any effort.
- The activity of different animals can be understood. That means by interpretation of the electric impulses from the brain of the animals, their thinking can be understood easily.
- Decision can be made without the presence of a person.
- Even after the death of a man his intelligence can be used

7. LIMITATIONS

- Further, there are many new dangers these technologies will open. We will be susceptible to new forms of harm
- Computer viruses will pose an increasingly critical threat
- We become dependent upon the computer systems. Others may use technical knowledge against us.
- The real threat, however, is the fear that people will have of new technologies. That fear may culminate in a large resistance. Clear evidence of this type of fear is found today with respect to human cloning.

8. FUTURE PERSPECTIVE

The synthesis era in neuroscience started with the launch of the Human Brain Project and is an inevitable phase triggered by a critical amount of fundamental data. The data set does not need to be complete before such a phase can begin. Indeed, it is essential to guide reductionist research into the deeper facets of brain structure and function. As a complement to experimental research, it offers rapid assessment of the probable effect of a new finding on preexisting knowledge, which can no longer be managed completely by any one researcher. Detailed models will probably become the final form of databases that are used to organize all knowledge of the brain and allow hypothesis testing, rapid diagnoses of brain malfunction, as well as development of treatments for neurological disorders. In short, we can hope to learn a great deal about brain function and disfunction from accurate models of the brain.

The time taken to build detailed models of the brain depends on the level of detail that is captured. Indeed, the first version of the Blue Column, which has 10,000 neurons, has already been built and simulated; it is the refinement of the detailed properties and calibration of the circuit that takes time. A model of the entire brain at the cellular level will probably take the next decade. There is no fundamental obstacle to modeling the brain and it is therefore likely that we will have detailed models of mammalian brains, including that of man, in the near future. Even if overestimated by a decade or two, this is still just a 'blink of an eye' in relation to the evolution of human civilization. As with Deep Blue, Blue Brain will allow us to challenge the foundations of our understanding of intelligence and generate new theories of consciousness.

9. CONCLUSION

In conclusion, we will be able to transfer ourselves into computers at some point. Most arguments against this outcome are seemingly easy to circumvent. They are either simple minded, or simply require further time for technology to increase. The only serious threats raised are also overcome as we note the combination of biological and digital technologies.

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