Blue Brain: The Stimulation Algorithm

Harshal Saraogi*Kriti Jain**

ABSTRACT:
Blue Brain is a virtual machine that will act as a brain, using AI (Artificial Intelligence) to interpret the human brain. The major motivations behind this technology are treatments that combine psychology, revealing the hidden secrets of the human mind and to process that information some recent research on the field of brain stimulation by Julich Institute of Neuroscience. To use this the brain is stimulated at the cellular level and fully activated using reverse engineering concepts. To make a machine of thought and data to keep track of all the results of neuroscience and past issues, a standard method which involves complex mathematical algorithms of brain stimulation. The most common steps are to improve the acquisition of information combining brain information, simulation and visual imagery of results, and the then train a system according to the gained information. The motivation for such a brain development is to study the actual functioning of the brain by building a theoretical framework of artificial intelligence after collecting all available brain information and process that complex information by using supercomputers to build an artificial intelligence system so we can make a person's brain working even after its death. By the new research from IBM, we can speed up the process of brain stimulation as it was a very time taking procedure for the researcher. A human brain consists of 100 billion neurons so it was a very time consuming procedure to map the whole human brain.

Keywords: I

INTRODUCTION

In the future, our brain is susceptible to the blue brain! Still, we need not worry, for it will ultimately work for us. Sir Newton once said, we are like children on the coast, curious and excited about finding shells and oceans, but on the far side of the sea there is a vast sea with many creatures and objects yet to be discovered. He also says that in the field of technology, there are a few things that need to be done that can make a big difference in the field of study. God's most important creation is the human brain. Intelligence is lost when one dies. But how can we return this wisdom? Is there a solution to it? Yes, and that's called blue brain technology. The world's first virtual brain developed by IBM and within 30 years we are ready to test it internally on computers.it? Yes, and that's called blue brain technology. The world's first virtual brain developed by IBM and within 30 years we are ready to test it internally on computers.

History of Virtual Brain

The main purpose of the project was established in May 2005 by the Brain and Mind Institute at the Ecole Poly process of Federal de Lausanne, Switzerland. Its purpose is to create artificial brain architecture and its functioning principles. The project is led by Henry Markam, director of the Swiss center using Blue Gene super computer developed by IBM and Michael Hines, a neuron software operating on a super computer. The simulation involves not an almost neural network but a model of biology facts. The human mind is considered to be the greatest gift God has given the world. Man is known as the most intelligent animal because of his abilities and his brain. The human mind changes the information transmitted by the senses that allow the person to respond. The death of a man brings about the loss of information as his body is destroyed. Similar information could be used to further the community. What would the world be like today if we couldn't connect with the great scientists who are doing all they can to make a better society? Enter the Blue Brain.

What is virtual brain?

Virtual Brain is the name of a high-tech computer developed by IBM. If possible, it would be the world's first brain. Within 30 years we would be able to upload our intelligence and brain to a high-end computer. The ingenuity with which we can use this knowledge for the development of the next generation of a person even after the death of a man. Decisions can be taken from one's past experiences and can be applied to the same situation that is happening in the present. With the help of an artificial brain we can scan our brains online. The

*Student, Asian School of Business, Noida** Student, Asian Business School, Noida

information stored in the natural brain can be downloaded to a computer. The different processes and structures of our central nervous system can be studied.

Need of virtual brain

Intelligent is a quality that is unique to all of us. It is the quality of birth. There is someone with a very high level of knowledge and intelligence. Sometimes they can think up to this information that others cannot. Examples are Einstein, Newton etc. But after death knowledge is lost. The solution to this is the Artificial Brain that can be retained after death. We all have trouble remembering past information history and important dates etc. All of this can be done by a blue brain or virtual brain.

Steps for building a blue brain

A. Data Acquisition
B. Data Simulation
C. Visualization of result

A. Data Acquisition

Data acquisition involves capturing specific pieces of the brain, and placing a microscope for visualization purposes, measuring electrical activity and the shape of individual neurons. Neurons are appropriately captured by their morphology (their shape), the area within the cortex, their populations and electro physiological
behavior. Cataloging and study methodology is very common worldwide. The visual is then translated into mathematical algorithms that describe the function, form and position of the neurons. Algorithms are used for producing biologically realistic artificial neurons which are appropriate for the simulation phase.

B. Data Simulation

The Data Simulation itself consists of 3 major parts namely:
I. BBP-SDK
ii. Simulation Speed
iii. Simulation Workflow

i. BBP-SDK (NEURON)
The main software used by BBP (Blue Brain Project) for neural simulation is a package called NEURON. It is a software development kit, developed in 1990 by Michael Hines at Yale University and John Moore at Duke University. It is written in C, C ++ and FORTAN programming languages. The BBP-SDK is open source software and is available for free online to work on (where the website includes the necessary codes and binary data for free. The BBP team worked with Michael Hines to set up this package in Blue Gene magazine in 2005).

ii. Simulation algorithm
It involves integrating the cells used by algorithms available to define real neurons. Algorithms and parameters are modified for animal models, animal disease classification and the age.

iii. Simulation Workflow
Every single protein is made (and there are about a billion of these in a single cell). Measures: First, skeleton networks are formed from all synthesized neurons. Afterwards the cells are connected together (subject to the rules obtained by experiment). Eventually the neurons become more efficient and memory is revealed. Outbreaks of behavior that occur are visualized using software.

C. Visualization Of Results

The first app used by BBP to visualize neural simulation is called RTNeuron. The software was written in C++ programming language and OpenGL, and was developed internally by the BBP team. RTNeuron is an ad-hoc software written exclusively for neural simulation (meaning it cannot be used or made for any other information). RTNeuron delivers output from Hodgkin-Huxley simulations for Neurons in 3D that allows researchers to visualize as the energy of activation propagates through neurons and between neurons, the images can be compiled and zoomed, paused, to allow researchers to interact with the model.

The Stimulation Algorithm

Improving algorithms and data structures within an existing software project requires first of all identification of the main bottlenecks. This involves measurements of runtime and memory usage since any intuitions about possible bottlenecks can be severely misleading . This is ever more the case when redesigning algorithms and data structures that need to scale to tens of thousands of processes. Measurements for large-scale applications, however, consume time and resources. therefore introduce a model that allows the prediction of the memory usage of a neural simulator accounting for contributions from different objects, such as neurons, synapses, and the corresponding infrastructure. The model considers only the leading order contributions to the overall memory consumption and needs to be checked against actual measurements to prove its sufficiency.
The model describes the memory consumption per MPI process as a function of compute environment and network parameters such as the number of MPI processes, the number of threads per process, and the total number of neurons in the network. Applying this model to NEST as a concrete use case allows us to predict the effect of potential changes to code quickly, without running simulations, and hence

*Student, Asian School of Business, Noida** Student, Asian Business School, Noida

to target our efforts on critical parts of the codebase. In addition the model enables us to determine the limits, in our case in terms of network size, for a particular amount of compute resources . In the following we only mention changes to the previous formulation of the memory-usage model arising due to the introduction of a two-tier connection infrastructure.

In the previous simulation kernel, all information about connections is exclusively stored on the postsynaptic side, which is the compute node on which the target neuron resides. The main differences in the memory-usage model for the new kernel are additional terms that describe the memory used for constructing and storing the presynaptic part of the connection infrastructure. Originally, the model was defined as a function of the number of MPI processes M, the number of threads per MPI process T, the total number of neurons N and the average number of connections per neuron K. Since we keep K fixed throughout this study, we will describe the memory usage as a function of only three variables: MM (M, T,N). The total memory usage can be divided into three components: base memory usage and MPI buffers MM0 (M, T,N), memory usage of nodes MMn (M,N), and memory usage of connections MMc (M, T,N). The latter two components do not just contain the memory usage of individual neuron and synapse objects, but also contributions from infrastructure needed for efficient access to the individual objects during simulation. This leads to the following definition of the full model.

M(M, T,N) =M0 (M, T,N) +Mn (M,N) +Mc (M, T,N).M(M, T,N) =M0 (M, T,N) +Mn (M,N) +Mc (M, T,N).

The first term contains the empirically measured base memory usage MMb, including the memory required by the simulation kernel just after startup as well as MPI and OpenMP overhead. Furthermore this term additionally captures the memory usage of MPI buffers for the communication data required for constructing

the presynaptic part of the two-tier connection infrastructure (see section 3.1.3) and for the spike events during simulation. This leads to the following definition of Mm0:M0 (M, T,N) = Mb + min(Bc,NM min(K,MT))mtd + min(Bs,NMvmax min(K,MT))msd ,M0 (M, T,N) = Mb + min(Bc,NM min(K,MT))

mtd + min(Bs,NMvmax min(K,MT))msd ,where we introduce the shorthand NM: =NM.NM: =NM. Here mtd denotes the memory consumption for a single entry in the MPI buffer used for communication of connectivity data and msd denotes the memory consumption for a single entry in the MPI buffer used for communication of spikes.

The particular forms of the latter two terms result from the following considerations: Since we employ MPI_ All to all , the buffer size for a single communication round must be the same across all MPI processes. If more data need to be communicated than a single communication round can handle, we initiate another round of collective communication and double the size of the respective buffers, up to a user-defined maximal size, denoted by Bc and Bs, respectively. The (average) number of connections and spikes can be estimated as NM min (K, MT) and NMνmax min(K, MT), respectively, where max denotes the maximal firing rate in the network. We assume that a single neuron has an average out-degree of K, independent of the size of the network as described in section 2.1 and consistent with biological data. The occurrence of the total number of threads (MT) in min(K, MT) is due to adaptations for pre-petascale machines.

As the redesign affects only the connection infrastructure

and communication framework, the contributions of neurons and neuronal infrastructure are the same as in the memory-usage model for the previous kernel. For a definition and discussion of this second contribution MMn (M,N) to the overall memory consumption .

Finally, contributions of connections and corresponding infrastructure in the new kernel are described by:

Mc(M, T,N) =KstatM mstatc+ KstdpM mstdpc+KNM ms +NM min(K,MT

mt.Mc(M, T,N) =Kmstat mcstat+KMstdp mcstdp+KNM ms +NM min(K,MT)mt.

The first two components describe the memory consumption of the actual synapse objects, proportional to the local number of synapses of a particular type and the size of an individual synapse The third term is the contribution of the data structure

storing the sources of the respective KstatM+KstdpM=KNMKMstat+KMstdp=KNM synapses. The fourth term accounts for the presynaptic part of the two-tier connection infrastructure: each local node needs to store a certain number of targets, each of which consume mt bytes. As above, the appearance of min(K, MT) is due to adaptations for pre-petascale machines

How to transfer data to Virtual Brain?

Uploading and transferring is possible using small bots known as “Nanobots”. They are too small that they can travel by brain and spiral. Its basic function is that it will monitor the functions of the

*Research Scholar, AIBS, Amity University, UP** Associate Professor, Amity University, UP

neuron and examine the structure of the brain. It explains information using sensor technology there is a technique known as data acquisition where by using the software package that works on digital computer we reconstruct the neuronal 3D morphologies by taking brain fragments from a living person. In the brain project Blue is a tool of twelve basic elements that is specially developed to study the behavior of neurons.

In simulation, there is a software written in C, C ++ and FORTRAN wherever we read cells using algorithms. These algorithms must be computed based on age; species. The software collection should be from nanobots by BBP-SDK i.e. Project Development Kit. The results are visualized by an RT neuron application written in C ++ and openGL. Using these developments, a study was conducted using the headquarters of South America. A model of the bird's lung was developed as the bird sings in; the impulses are transferred to the model that started singing like a bird.

BLUE BRAIN as Efficient Storage Space

The beauty of the Blue Brain is the frequent responses and maintenance of the giant storage. Providing the brain in a professional system provides the added benefit of the existing storage space. Man's intelligence is the result of his brain. Similarly, providing intelligence and programming gives him the wisdom to respond in a voice, text and so on. The idea of the storage space behind Blue brain is the additional

digital programming memory alongside the primary memory and the secondary storage space. The feature of BB storage space is 'Brain Loading'. And it's nothing more than collecting data from memory using real-time Machine Learning algorithms. The collected information is separated into different storage folders or registers based on the information variance. This input is completed based on changes identified in the input values. Only values can be used to determine the presence of data are Binary values (1 and 0). The indigenous language integration process for natural language processing (NLP) makes the project user-friendly and easy to use; each user is comfortable while they communicate in the regional language. Each merger makes a big hit in the field of AI and Natural language programming (NLP).

Working of entire system

The user can enter verbal / voice comments. The user is able to input in the standard language (English) or input can be in any of the regional languages. When the input is received and correctly received based on the syntax of the specified regional language it generates an electrical impulse and then is transmitted to the registers. When the sensors reach the registers, they check if the token already exists in the registers. If Tokens are not present in registers, text analytics performed. Alternatively, the answer is computed based on system information. A simple user and program discussion is as follows: Message: Hi, how are you? Answer: Hi, I'm fine. How is your day? Message: The day was amazing. Answer: Can you share what interests you the most? Similarly, discussion is ongoing. Based on these interactions, the user can understand that the system is completely intelligent, because it has the ability to see the user in the positive form from the word amazing. That way the system invites sharing of the user's most enjoyable user experiences.

Requirement- hardware and software

A. Super computer

B. A memory with a very large storage capacity

C. Processor with very high input capacity

D. Wide network.

E. 100 kilowatts of energy use.

F. The process of converting electric impulses from the brain to the input signal, which will be accepted by the computer, to the contrary.

G. Very powerful Nanoboats.

Future scope

BB storage space is a storage-focused concept where input and output are provided only by voice / speech. As a future extension of this concept we may include visual data as input. Visual data can be videos, images or real-time action. Using similar decomposition algorithms we can split images and videos into smaller pieces resulting in larger data storage.

Conclusion

We lose brain information when the body is destroyed after death. Here is the blue brain coming into the picture. Some great brains like Bill Gates and Stephen Hawking can be connected to computers to make a high-end computer. Blue Brain is an upcoming new technology that is an attempt to reverse engineer a human brain and bring it to the cellular level within computer simulation. WHAT DOES IT MEAN TO DO?

As Christopher Nolan quotes it as “Perhaps we have just forgotten, that we are still pioneers and we have barely begun ". The blue brain project is a step taken to provide answers to the many mysteries of darkness that are not revealed. The blue brain is a tool for brain disorders. It will be helpful to keep the brain of a wise person and use its IQ in research even after his death. It

*Student, Asian School of Business, Noida** Student, Asian Business School, Noida

can be a solution to short-term memory and adaptive memory in old age. A compilation of all the results of neuro science worldwide, this technology will move towards the development of thinking machines (bottom to top approach). As of August 2012 the largest simulations are of mesocircuits containing 100 cortical columns similar to that of the honey bee brain. Hopefully the rat brain neocortical simulation (~ 21 million neurons) will be available by the end of 2014. If provided with enough funding, a full simulation of the human brain (86 billion neurons) is due by 2023.

References

1. The Blue brain project Hill Sean: Markham Henry International conference of IEEE 2008.

2. Henry Markram "The Blue Brain Project" Nature Reviews Neuroscience 7:153-160 2006 February.

3. http://bluebrainproject.epfl.ch.

4. http://research. ibm. com/bluebrain.

5. Reconstructing the Heart of Mammalian Intelligence Henry Mark ram's lecture March 4 2008.

6. Henry Mark ram builds a brain in supercomputer TED conference July 2009

7. Indian startup to help copy your brain in computers Silicon India 2009

8.http://thebeutifulb rain. com/2010/02/bluebrain-film-preview/

9. Levine DS (2009) Brain pathways for cognitive-emotional decision making in the human animal.

10. Huettel SA Misiurek J Murkowski AJ McCarthy G (2004) Strategic aspects of executive processing.

11. http://ibm. com

12. http://www. wikepedia. com https://bluebrain.epfl.ch/

13. https://bluebrainfilm.com/bb/

14.https://www.artificialbrains.com/blue-brain-project

*Student, Asian School of Business, Noida** Student, Asian Business School, Noida