A STUDY OF COGNITIVE FUNCTION WITH MEMORY OF HUMAN BEING USING BLUE BRAIN

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Abstract— Cognitive function has a vital role in human life. Particularly cognitive function with memory is most important factor to study the day to day life of human body. In this paper it has been study the cognitive function of human body using his/her memory with the help of blue brain concept whereas; blue brain is a novel tool for brain disorder. It can be used for volatile and short term memory at an old age and also treated as foundation for whole brain simulation.

Index Terms— Dendrites; cognitive function; memory model; Consciousness; Blue Brain;

1 INTRODUCTION

Cognitive psychology is known as study of thinking. There are two words one is cognition which is also known as "to recognize something" other term is psychology which is also known as "study of mentality". Cognitive psychology encloses everything what we are doing or what we can do. Cognitive psychology attempts to understand and measure many types of memory where some people are performing better and some are performing worst in resolving problem than other people. Broca's area is indicating the left frontal lobe of brain which helps in speech production. And the Wernicke's area involves making comprehension or understanding the language. The followings are different terms mentioned related brain of the human being.

1. PERCEPTION- It has some sense like sight, smell, taste, hearing and touch some lesser known senses like proprioception, interception, etc. These sensory events are called perception.
2. ATTENTION- Attention is the cognitive process to choose the significant data from the world around us using all the 5 senses.
3. MEMORY- Memory is the imagination of a person. What we learn is store and transpose into memory like short term memory, long term memory and some different types of memory such are contextual memory, auditory memory, naming and recognition.
4. THOUGHT- something happened suddenly in mind or thinking process called thought.
5. LANGUAGE- it is very significant to wide range of human activities. It allows us communication by representing information by help of Broca's area and Wernicke's area.
6. LEARNING- it is the knowledge that we can learn from society or adopting culture of our society.

In this paper, it has been attempted to analyze the concept to design a device which will work based on using cognitive computing concept with blue brain.

2 RELATED WORKS

Human brain is the most complex structure ever seen, most important part which control the entire human body. Within brain neurons are interconnected to each other which decide human behavior. Human Brain consists of the cerebrum, the brainstem and cerebellum. Brain consists of ~10^{10} basic units and each basic unit connected with ~10^{4} other units [1]. Guinness world record holder Mr. Krishan Chahal is the world's foremost authority on the memory improvement. He told two key points to improve memory. One of them is Modifying the information-which makes it easier for brain to memorize it. Other one is Reprogramming our mind-to is more focused and attentive to the important aspect. He also suggested that if we are weak at something, we need to increase our depth of focus, by trying to recall that event in more detail later on. Brain Computer Interface (BCI) is a technology, act as a bridge between brain and computer system or other output devices. The main aim of Brain Computer Interface is to improve the quality of life for those with severe disabilities [11]. Mainly Brain Computer Interface is a communication channel for paralyzed people [4].

Cognition is the ultimate function of brain. Cognition function includes Attention, Working memory, Long Term Memory and Perception. Attention is the complex cognitive process. In attention the important thing is focus. People have focus problem but they are relating it with their own concentration of the brain activity. Working memory is an area of high speed memory that used to store program or information

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currently in use. The old and new data collected are repeatedly converted, integrated and modified. Working memory model challenge the capacity of Short Term Memory is limited to about 7 items. If an event is important for a person then that event converted to Long term memory which can store for life long (in years). A single information or data can derive from person's life long experience [3]. This can be implemented by using Blue Brain concept.

3 Brain and its Cognitive Function with its Computation

Attention means to concentrate on one particular thing. Paying attention is also known as focus on one thing. People can perform better at their work that pays attention than those who are not paying attention to their work. Attention is the cognitive process of human brain which was developed by British psychologist Donald Broadbent in the year of 1958 who wrote a book known as "Perception and Communication"[3]. If simultaneously two works is performing we can't focus on both by giving our 100%. Accuracy will be less. For example, while driving a car and even listening to the radio in car at the same time, but it is difficult to attend simultaneously and the accuracy will decrease. There are 5 issues of attention: Processing capacity and Selectiveness, Control, Automatic processing, Consciousness and Cognitive neuroscience. For this memory also influences during any activities.

In 1960 the working memory has been developed by Miller, Galanter and Pribram[7]. This concept has been used by Atkinson and Shiffrin in 1968. The working memory has been adopted by Olton in connection with performance of animals especially rats [10]. The working memory concept found from Short Term Memory which is the temporary storage of brain can hold data for small amount of time. The model of working memory has been proposed in 1974 placed in Figure-1.

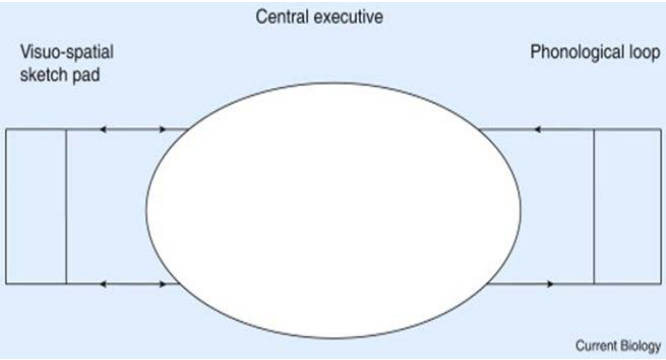

Figure-1: The model of working memory proposed in 1974[6]

A multi component model has been presented as a broad theoretical background. A development of multi component model has been presented in Figure-2 with 3 different components.

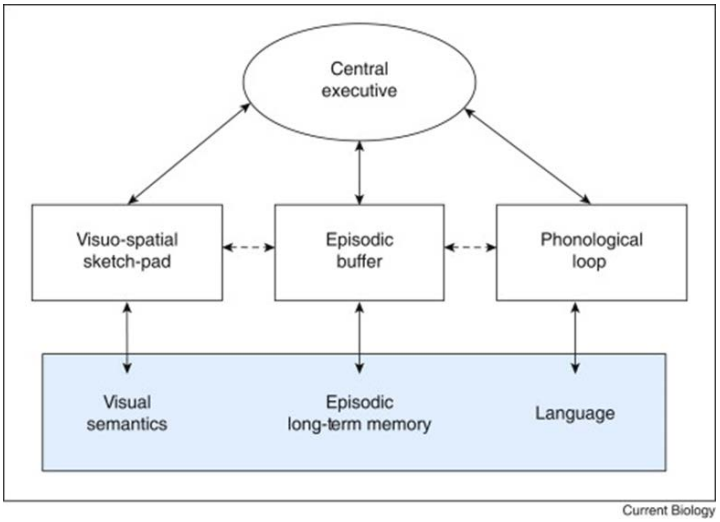

Figure-2: A development of multi component model [5]

Long term memory of a person can be limitless. And duration of long term memory is endless. Long Term Memory stores data or information from 1 second to extended period (in years) [3]. Short Term Memory can be converted to Long Term Memory by repeating or by practicing. Most of the Cognitive Scientist believes that Long Term Memory (LTM) is the permanent storage of a human being whatever he learned from his/her childhood. But this can be exceptional in case of different diseases e.g. Alzheimer's disease, memory loss in old age, etc. Many long term memories have been stored and processed in cerebral cortex. In Long Term Memory data is coded acoustically, visually and semantically. Many people have experienced with tip of tongue where people can remember some aspect of the item they are trying to recall but can't recall the entire item.

4 Blue Brain

According to brain, it is the most important organ of human body and also contains the most complex networking which is impossible to understand. The aim of this project is to reverse engineer the brain into a supercomputer. Blue brain project was started in the year of 2005. Prof. Henry Markram is the director of Blue brain project was founded at Echole Polytechnique Federal de Lausanne, Switzerland (EPFL). It will be the world's 1st virtual brain that can think, take decision and remember. The requirements for the blue brain project are[8]:-

- Supercomputer
- Memory of large storage capacity
- Small robots known as nanobot in size of 0.1-10 micrometer
- Huge network connection.

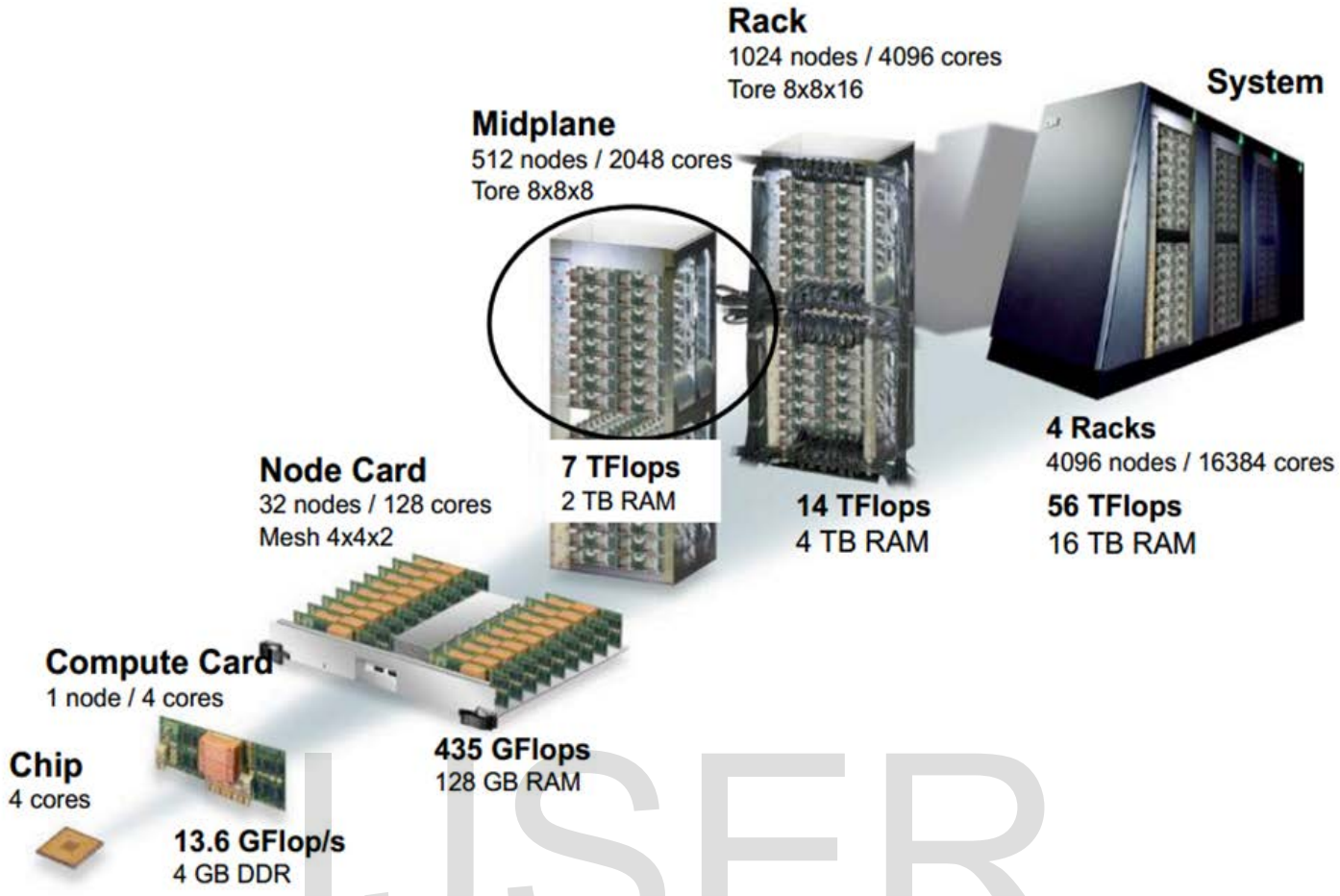

Figure-3: Blue Gene/L supercomputer architecture [8]

5 PROPOSED MODEL

In this section it has been analyzed the memory of human being and its capability using blue brain concept. As per the observation it has been considered cognitive concept with blue brain to study the memory capability of a human being. Dendrite in brain is a characteristics tree-like structure. It usually forms under non-equilibrium conditions. Growing dendrites is equal to learning and vice versa. Dendrite is indication of memory and intellectual property of human being. Dendrites & learning capability are mutually beneficial and interdependent. The more the brain learns new things in a particular direction, the more number of dendrites will grow on that direction. Also the more dendrites a brain grows, the higher it's learning capability becomes.

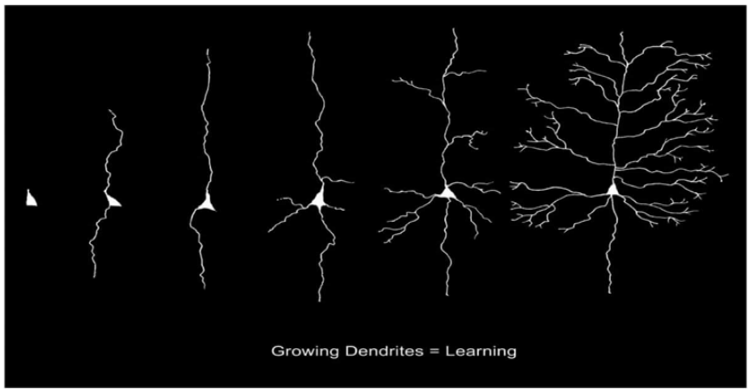

Figure-4: Increasing level of Dendrites [9]

Memory Balancing factor=Time*Effort +Past Learning
As per the above equation Past Learning=const.
Its mathematical form is:

$$Y = bX + a \quad \text{.....(1)}$$

Where Y is memory capability; and
X is time;
a is Past Learning;
b is Effort ;

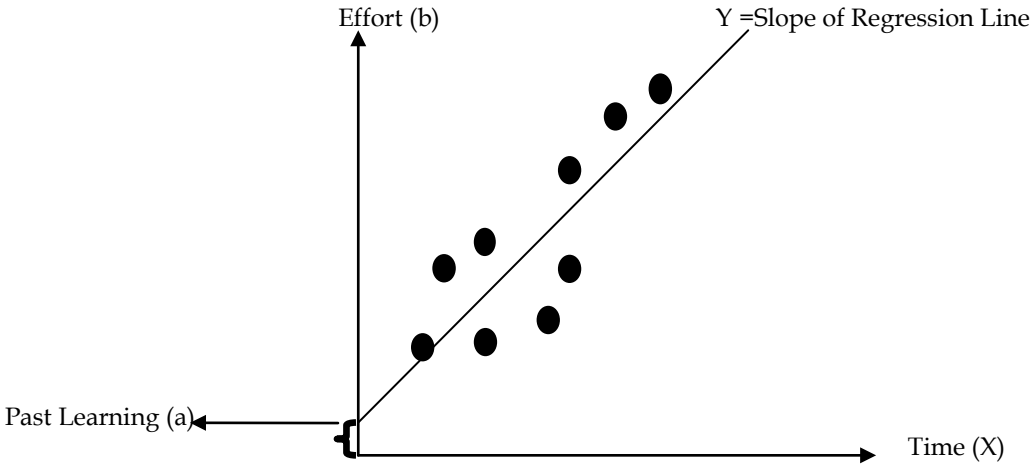

Figure-5: Memory Capability in Liner Regression form

It can be design the device with blue brain concept which can collect the data from brain and store in a designed device. The designed device may be used for future prediction of memory and other application related to different types of memory. The data collection and implementation may be used as in following figure Brain Computer Interface (BCI).

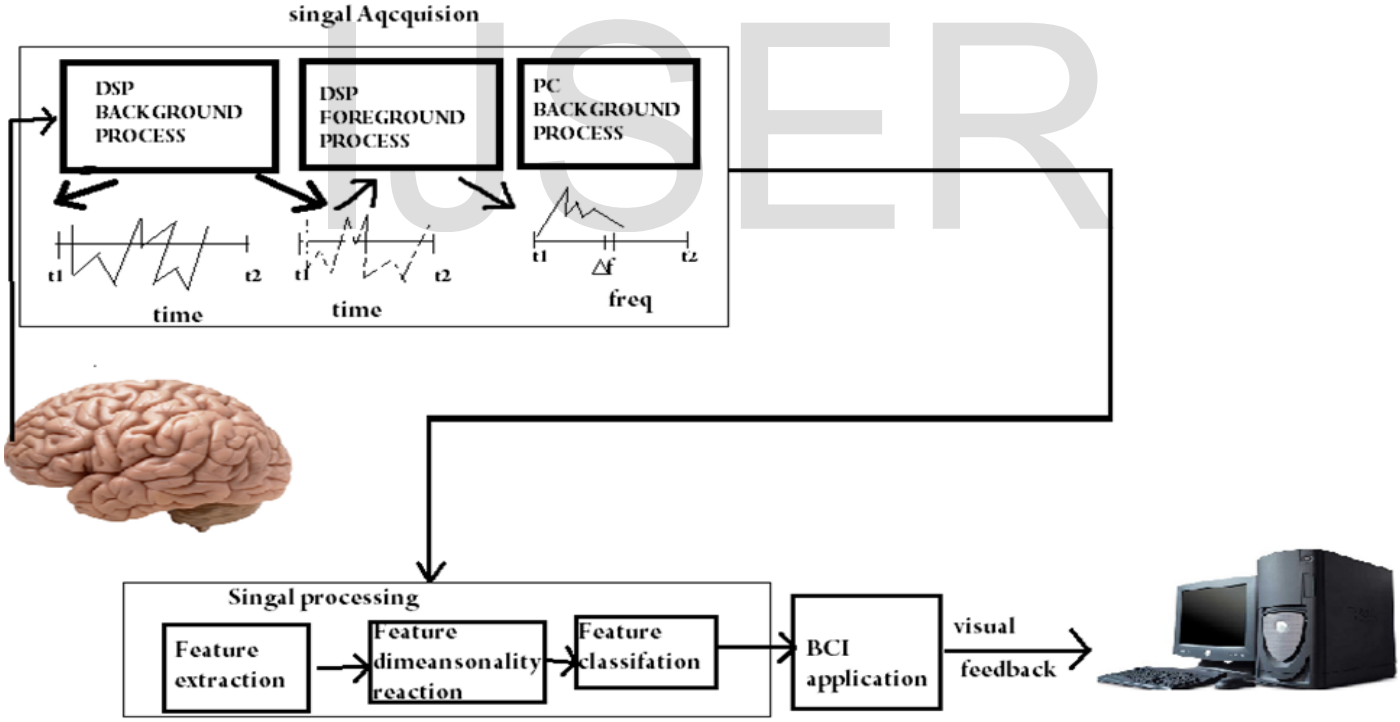

Figure-6: Brain Computer Interface functional model [4]

6 Conclusion

Human can transfer themselves in to supercomputer, which can be used to take vital decision in future as good as a particular person. This can be implemented by the concept of Blue Brain through many dark secret of human brain. It need to build a supercomputer replica of human brain through Blue Brain which take vital role to make decision in real life applications.

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