COMPUTER VS HUMAN BRAIN: AN ANALYTICAL APPROACH AND OVERVIEW

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Abstract - *The brain is the center of the human nervous system, controlling our thoughts, movements, memories, and decisions. With evolution, the human brain has become more and more complicated; many of its interesting properties are still not well understood by scientists. Computers might be able to beat human brains every time when it comes to mathematical calculations, quantitative analysis, and game show questions, but that doesn't mean they're smarter overall. Humans are better at analyzing new situations by recalling past experiences and making inferences about a new challenge. Humans are capable of qualitative analysis and emotional intelligence.*

Key Words – *Human Brain, Computer Complexity, Supercomputer, Gray Matter, Adaptability, Computer Science, etc.*

1.   Introduction

The human brain is like a powerful computer that stores our memory and controls how we as humans think and react. It has evolved over time and features some incredibly intricate parts that scientists still struggle to understand. The human brain is over three times as big as the brain of other mammals that are of similar body size. Each side of the brain interacts largely with just one half of the body, but for reasons that are not yet fully understood, the interaction is with opposite sides, the right side of the brain interacts with the left side of the body, and vice versa. The brain is suspended in Cerebrospinal fluid, effectively floating in the liquid that acts as both a cushion to physical impact and a barrier to infections. Most strokes result from a blood clot in the brain that blocks the local blood supply; this causes the damage or destruction of nearby brain tissue and a wide range of stroke symptoms.

80% of the brain is water. Our brain isn't the firm; gray mass you've seen on TV. Living brain tissue is a squishy, pink and jelly-like organ thanks to loads of blood and high water content of the tissue. So the next time you're feeling dehydrated get a drink to keep your brain hydrated.

Our brain is as sensitive as a rosebud and it is as powerful as a supercomputer but it never needs any downtime like other computers. It has some highly surprising and most amazing features.

The brain is the most complex part of the human body. This three-pound organ is the seat of intelligence, interpreter of the senses, initiator of body movement, and controller of behavior. Lying in its bony shell and washed by protective fluid, the brain is the source of all the qualities that define our humanity. The brain is the crown jewel of the human body.

For centuries, scientists and philosophers have been fascinated by the brain, but until recently they viewed the brain as nearly incomprehensible. Now, however, the brain is beginning to relinquish its secrets. Scientists have learned more about the brain in the last 10 years than in all previous centuries because of the accelerating pace of research in neurological and behavioral science and the development of new research techniques.

On the other hand, a supercomputer is a computer at the frontline of contemporary processing capacity – particularly speed of calculation which can happen at speeds of nanoseconds.

Many of us think that computers are many times faster, more powerful and more capable when compared to our brains simply because they can perform calculations thousands of times faster, workout logical computations without error and store memory at incredible speeds with flawless accuracy.

But is the computer really superior to the human brain in terms of ability, processing power, and adaptability? An Indian lady Shakuntala Devi who was born with a natural gift for mental mathematics and gained world fame in 1977 when she calculated the 23rd root of a more than 100-digit number in 50 seconds - 12 seconds faster than the best performing computer at that time. Three years later she multiplied two randomly-generated 13 digit numbers in 28 seconds.

Another example is Bobby Fischer. Bobby Fischer is a big name in chess and he is one of the all-time best chess players. After the 1972 World Chess Championship Fischer

did not play any competitive game in public. During his 20 years of isolated life in 1977, he played three games in Cambridge, Massachusetts against the MIT Greenblatt computer program, winning all of them.

However, this is only one side of the coin. Even if we discuss chess game because it is famous as a game of genius, we have many examples where computer defeated even grandmasters. I think the most popular example would be the game between Gary Kasparov vs. IBM Supercomputer Deep Blue. Actually in 1996 Kasparov had a match of six games and won with 4-2 which was a good performance. One year later both of them had another match but this time Deep Blue made history by defeating Kasparov with 3.5-2.5. In short, the most intelligent chess player of the current time is not a human, it is a chess engine. At present Houdini3 64-bit, 4 CPU is on the top with 3316 rank point and 3000 rank point is still a challenge for any grandmaster. So we can't blindly favor any one of them. In some cases, we will find that humanity is better but on the other hand at the same time, we will find that in some cases a computer is much better than humans. So to find out any conclusion and before taking any decision we must thoroughly analyze the human brain and computer at the same criteria. Now I am giving you the real comparison according to my study and critical analysis.

2.   PROCESSING POWER AND SPEED

We can only estimate the processing power of the average human brain as there is no way to measure it quantitatively as of yet. If the theory of taking nerve volume to be proportional to processing power is true we then may have a correct estimate of the human brain's processing power.

The retina is nerve tissue in the back of the eyeball which detects lights and sends images to the brain. A human retina has a size of about a centimeter square is half a millimeter thick and is made up of 100 million neurons. Because the 1,500 cubic centimeters human brain is about 100,000 times as large as the retina, by simple calculation, we can estimate the processing power of an average brain to be about 100 million MIPS (Million computers Instructions Per Second). In case you're wondering how much speed that is, let us give you an idea. 1999's fastest PC processor chip on the market was a 700 MHz Pentium that did 4200 MIPS. By simple calculation, we can see that we would need at least 24,000 of these processors in a system to match up to the total speed of the brain!! (Which means the brain is like a 168,0000 MHz Pentium computer).

Improvements in computer speeds, however, have some limitations. The more memory it has, the slower it is because it takes longer to run through its memory once. Computers with less memory hence have more MIPS but are confined to less space to run big programs. The latest, greatest supercomputers can do a trillion calculations per second and can have a trillion bytes of memory. As computer memory and processors improve, the Megabyte/MIPS ratio is a big factor to consider. So far, this ratio has remained constant throughout the history of computers.

3.   MEMORY POWER

So far, we have never heard of anybody's brain being "overloaded" because it has run out of memory. (So it seems as if, the human brain has no limit as to how much memory it can hold. That may not be true)

Our best possible guess of the average human brain's capacity would by calculating using the number of synapses connecting the neurons in the human brain. Because each of the synapses has different molecular states, we estimate each of them to be capable of holding the one-megabyte worth of memory. Since the brain has 100-trillion-synapses, we can safely say that the average brain can hold about 100 million megabytes of memory!!!

However, we all know that the memory of the brain is not absolute. It does not have set files or directories that can be deleted, copied or archived like those of a computer. For example, a particular person who thought he had memorized a telephone number for good suddenly realizes he can't recall the number. But some half-a-day later, he may suddenly recall the number again.) It is a strange phenomenon that we still can't really explain. A simple theory is that the brain treats parts and pieces of these ignored memories like an inactive "archives" sections until they are required. Some guys don't rely on it but it is true that those things which we are using frequently are stored in our conscious mind and those things which we are not using, transferred to the subconscious mind. Even our computer system is also using the same strategy for memory mapping and database management systems are also never delete anything, just tag it as deleted.

Computers have more than one form of memory. We can generally classify them into primary and secondary memory. Primary memory is important when executing programs, bigger programs require more primary memory. RAM (random access memory), Caches & buffers are just a few examples of primary memory.

Secondary memory often comes in the form of hard disks, removable disk drives, and tape drives. Secondary memory

is used for the storage of most of a system's data, programs and all other permanent data that should stay there even when the power is turned off

The latest, greatest supercomputers (as of 2014, Tianhe-2) have 14.08 million gigabytes of memory. Today's latest model of hard disk drives on the personal computer market can hold about 6 terabytes of memory.

4.   ADAPTABILITY AND LEARNING

Because the human brain receives so much information from all the senses at a constant rate, it is only natural that it would tend to learn and adapt very quickly about its environment and surroundings. In fact, a glance at any of the senses at the surroundings would already provide the brain with enough information about the environment to allow the brain to react immediately with a response.

However, when learning a new skill or quitting an old habit, the human brain requires time to adapt to the behaviors required. When a person does a particular task repeatedly for a number of times, he would realize that the more times he does it, the easier it is for him to do the same task. When continued over long periods of time, it becomes so easy for the person that he does it sub-consciously; hence, it becomes a habit.

Remember that we told you that the memory of a brain seems un-absolute. That could also be a reason behind the need for adaption during learning. The hand-eye coordination, finger control or the sense of timing required for the new skill are acquired mostly through trial and error, hence explaining the need for adaption.

Computers are getting smarter by the day. Computer programs at research labs are constantly learning anything that the programmers are feeding them with. Voice recognition engines are developed but feeding the program with thousands of different voices from entire towns so that it could pick up patterns in speech, accents, and slangs and learn to recognize them. OCR (optical character recognition) programs are picking up new tips and patterns as it observes the different styles of writings from its ever-increasing database. Smarter programs are now able to classify pictures of objects it never saw before into different categories in real-time by studying their shapes and textures or by observing similar patterns in the picture's coding.

Since the memory of computers is absolute (either recorded or deleted), computers need no adapting when they are loaded with traditional programs and are asked to run them. However, some smart programs are capable of learning by trial & error, learning from their mistakes and

recording the best solutions to any problems it faces. (an example is the household robot, Cye (created by Henry Thorne) which would memorize the way around a new house without any help simply by trial and error; banging into walls and barriers and drawing a map of the landmarks it has banged into)

5.   NETWORK AND ENERGY

Our brain is also communicating like an advanced computer network. For transmitting signals, the brain uses Neurotransmitters. Neurotransmitters are the brain chemicals that communicate information throughout our brain and body. They relay signals between nerve cells, called "neurons." The brain uses neurotransmitters to tell your heart to beat, your lungs to breathe, and your stomach to digest. They can also affect mood, sleep, concentration, weight, and can cause adverse symptoms when they are out of balance. Neurotransmitter levels can be depleted in many ways. As a matter of fact, it is estimated that 86% of people have suboptimal neurotransmitter levels. Stress, poor diet, neurotoxins, genetic predisposition, drugs (prescription and recreational), alcohol and caffeine usage can cause these levels to be out of optimal range.

The brain operates on the same amount of power as a 10-watt light bulb. The cartoon image of a light bulb over your head when a great thought occurs isn't too far off the mark. Your brain generates as much energy as a small light bulb even when you're sleeping. Although the brain accounts for less than 2% of a person's weight, it consumes 20% of the body's energy. The average power consumption of a typical adult brain is about 100 W.

Our brain uses 20% of the oxygen that enters your bloodstream. The brain only makes up about 2% of our body mass, yet consumes more oxygen than any other organ in the body, making it extremely susceptible to damage related to oxygen deprivation. So breathe deep to keep your brain happy and swimming in oxygenated cells.

Is it possible that one day my brain will be full and I would not store information in my brain anymore? The deadpan answer to this question would be, "No, your brain is almost certainly not full." Although there must be a physical limit to how many memories we can store, it is extremely large. We don't have to worry about running out of space in our lifetime.

According to John Von Neumann, the capacity of a human brain is 2.8×10^{20} bits. It is almost 3.1×10^4 petabyte, which is Even relative to today's computers would be a very large memory.

All of us know that either a personal computer or Super Computer, both will be run on electric power and as soon as its power has off it must be shut down. Most of the computer must be shut down either in a week or in a year.

6.   CONCLUSION

So, even though the brain is far more superior to today's best computers, many of us out there wouldn't believe it. Why? Because of the differences in performance. We can obviously see that any low-end computer can beat the fastest human at calculation as well as storing and processing of any information. Here's what we have to say.

Although the brain has got more ability, it has got more tasks to perform than that expected of a computer. Did you realize that the brain has to constantly take charge of maintaining the human body functions for the entire lifetime of its host? Actions like breathing, blinking, and coordination of all the body parts are controlled subconsciously by the brain all the time.

At the same time, the brain is constantly bombarded by all your senses all at once. In one mere second, the retina sends ten one-million-point images to the brain. At the same time, your eardrums pass sound information in real-time at higher-than-DVD-quality. And don't forget the information sent to the brain by your sense of touch and smell. If a normal higher-end computer was fed with the information from a human's senses constantly and asked to process and react to them, the computer would overload from too much information because it can't react as fast as the brain could.

There are many reasons why the brain loses out to computers in simple and straightforward jobs. The brain is made for general purposes, not specifically just for computational jobs. In theory, the brain could be as quick as a computer in computational and recording jobs but in real life, it will never be possible because the average human is constantly distracted by his overwhelming senses, his emotions, and his own thoughts. There are exceptional people who could read through a 500-page book in less than an hour and remember all the contents as well as people who could perform mathematical calculations at a snap of their fingers but they are only rare examples that prove the hidden potential of the human brain.

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