Neuralink: A Platform That Integrates Brain-Machine Interfaces.

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Abstract- *As time goes on, we come across new and innovative innovations that employ Artificial Intelligence to make our gadget usage easier. Though we are unable to treat some disabilities such as Alzheimer's and seizures, Neurological Science has advanced beyond its limits. Brain Machine Interfaces (BMI) or "Neural Lace" can be a technology that can improve the sensory and motor function of the brain and help to find solutions to neurological disorders. Using a genetic approach in conjunction with a Brain Machine Interfaces (BMI) therapy can be quite effective. Putting BMI into Practice Elon Musk's business, neuralink, has succeeded in developing a chip known as neuarlink or the LINK. The ultimate objective is to implant gadgets in paraplegic people that will allow them to control phones and computers. In this paper, we will look at how to use a brain machine interface and how neuralink works. We've also covered the neuralink implant method*.

***Key Words*: Artificial Intelligence, Brain-machine interface, Neural lace, Neuralink**

1. INTRODUCTION

Warren McCulloch, a neurologist, and Walter Pitts, a young mathematician, published a paper in 1943 on how neurons could work, displaying a simple brain structure with electrical pathways. John von Neumann suggested simple neuron functions using telegraph and vacuum tubes in 1957. Neural network research has recently increased, and it is already being utilized to treat patients with mental diseases. Through the use of a chip known as neuralink or the link, Neuralink has pushed the frontiers of current neural network research, not only treated patients but also connected them to digital devices and supporting them in using these technologies without the need of any of their body parts.

The Neuralink gadget will be surgically implanted in your brain and will allow you to communicate with and even control machines. It will also help researchers better understand brain electrical impulses and create remedies for a variety of medical issues. An 8 mm-diameter microchip called the N1 chipset will be implanted in your skull using neuralink, along with several cables including electrodes and wire insulation. According to the company, At 100 micrometers, the wire is as thick as your brain's neurons and as thin as a strand of hair. Imagine the diameter of your hair and multiply it by 10 to get a comparison.

Flexible "threads," which are less likely to injure the brain than conventional brain-machine interface materials, are the first big development. These threads, according to Elon Musk & Neuralink, also allow for more data to be sent. According to the abstract the gadget might have "as many as 3,072 electrodes per array dispersed over 96 threads."

2. BRAIN MACHINE INTERFACE

Brain Machine Interfaces (BMIs) or Brain Computer Interfaces (BCIs) gather, analyses, and interpret brain signals into commands that are sent to output devices that carry out the intended tasks. Brain Computer Interfaces do not employ normal neuromuscular output routes (BCI). BCI's major purpose is to help persons with neuromuscular illnesses including amyotrophic lateral sclerosis, cerebral palsy, stroke, or spinal cord damage replace or recover functional function.

Brain Machine Interfaces (BMI) or Brain to Machine Interfaces (B2M) have the potential to help people with a wide range of clinical issues, including impaired sensory and motor functions, as well as link us to any machine that can read our brain's inputs. We'll need a lot of bandwidth to do this.

Because of the restricted number of channels available for signal transmission, brain-machine interfaces weren't initially popular with clinical diseases, but they now have the potential to help people with a wide range of clinical difficulties. Researchers have demonstrated human neuroprosthetic control of computer cursors, robotic limbs, and voice synthesizers with no more than 256 electrodes (Figure 2).

Although these achievements show that high-fidelity recording is constrained by the inability to capture huge numbers of neurons.

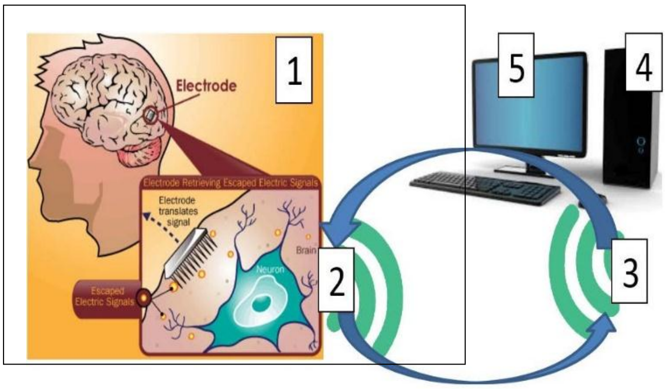

Figure 1: A brain computer interface product might include (1) an implanted array of electrodes to read brain signals and (2) the transition of that information into (3) a receiver machine, such as a computer, (4) that can read brain signals data, and (5) the ability to use it in a control process for a specific activity [5].

As a consequence, our brain is made up of neurons that fire constantly in response to electrical signals received when we see, hear, move, speak, or think. A small electromagnetic field is formed every time a neuron fires in response to these electrical inputs. The tiny electric fields created by sinus junctions in the brain will be used by Neuralink.

Tiny threads with electrodes around one-tenth the cross section of a human hair or roughly the size of a neuron are produced and injected into the brain to detect these action potentials. To avoid breaking blood vessels or generating stress, each thread will be introduced by a robot. The insertion needle has a diameter of 24 microns, which is far smaller than the present state-of-the-art in deep brain stimulation.

The n1 chip is the processor responsible for all of this. The n1 chip amplifies, digitizes, analyses, and sends analogue brain impulses recorded by the threads to a pod behind the ear. The implants will remain in place until the pod is removed and everything goes down, and only the pod gadget will be modified. The n1 chip is a low-power,4-by-5-millimeter Semiconductor with built-in brain data processing technologies. It can read 20,000 brain samples per second, showing that these are genuine raw impulses from a brain-attached neuralink.

The neural connection delivers a clearer, more trustworthy signal for more demanding applications since it has thousands of electrodes. The first use of the neural connection will be The primary motor cortex, which is the region of the brain that sends impulses down the spinal cord and onto the muscles to cause movement, should be tapped into. It will begin with basic devices such as a mouse and keyboard, but it might eventually be used to read signals from all types of movement, including voice, and to restore movement in a person's own body (Figure 3). The materials or characteristics that make the brain to accept and think that the neuralink is a part of it.

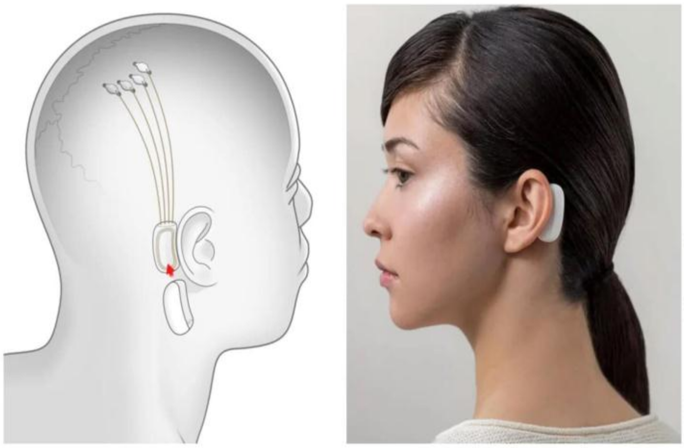

Figure 2: Graphic view of Electrodes implant in brain.

3. PROCESS OF IMPLANTATION (ROBOT)

Many folks are skeptical because we're talking about cutting a hole in your skull and inserting wires into your brain. According to Musk, the procedure is complex and beyond the capabilities of even the most skilled human hands. As a result, neuralink will implant the gadget into the brain using specially designed robots. To guarantee the operation's safety, the company indicated that it will carry out the procedure in accordance with health ministry regulations.

To detect these action potentials, tiny threads with electrodes (about the size of a human hair) are developed to be injected into the brain. Each of these strands is infused by a remotely controlled neurosurgical robot. The robot's insertion needle is around 24 microns in diameter, which is far smaller than the current state of the art for Deep Brain Stimulation (DBS). Similar Deep Brain Stimulation (DBS) procedures for Parkinson's sufferers have been conducted in the past, according to ColdFusion, but with 10 electrodes and a considerably bigger needle. On the other hand, traditional methods have a one-in-a-hundred chance of causing a significant brain hemorrhage.

Neuralink not only decreases the risk of brain injury by utilizing minuscule threads, but it also allows for huge data collection by using thousands of electrodes instead of only ten.

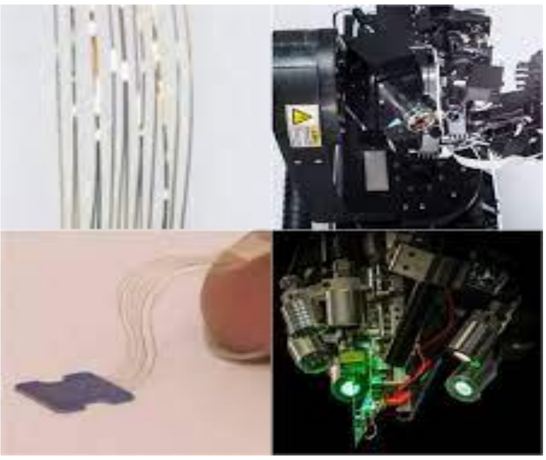

Figure 3: The neuralink N1 electrodes are implanted into the brain by a robotic surgeon.

This robot can make the exact motions necessary to implant the threads into your brain. It may appear to be a simple operation, but when the number of threads becomes large enough, it becomes a task almost as tough as landing a space rocket safely on Earth—a difficulty Musk is all too acquainted with.

"These are very, very minute things." You can't truly move them with your hand. The robot peels out the threads one by one and inserts them into the brain. As a result, we had to create a surgical robot. "Without the robot, the procedure would be impossible." - neuralink's President, Max Hodak.

4. ADVANTAGES

There are two kinds of advantages

Short term and Long term.

Short-term on the motor cortex with a first-generation device, and long-term anywhere on the brain with later-generation devices:

• Ability to use your thoughts to control a computer, allowing shut-in persons with severe paralysis to communicate.

• Investigate the capacity to watch high-results neural activity in real time to learn why people do certain things. It might be tremendously helpful in learning more about cortical circuitry.

Long Term

• A brain shunt that allows paralyzed persons to regain control of their body in the long run with successive generations of the same technology elsewhere on the cortex:

• Mental control of machinery with high accuracy.

• Telepathy between the brains.

A type of neurological telepresence allows for body switching.

• Taking notes on incoming sensory data.

• Eventually, a mechanism to back up your thinking, however this would have to reach beyond the cortex.

5. DISADVANTAGES

Brain surgery is less dangerous than we may anticipate if done carefully and under sterile settings.

• There may be some long-term effects on the brain from the electrode materials decomposing in the body over time.

• A Bluetooth gadget controlled by a digital computer that is directly connected to your brain. The security had better be top-notch.

• They mentioned the necessity for frequent updates, such as brain surgery every several years?

6. CONCLUSIONS

Following in the footsteps of the Utah Array, neuralink is a new and improved innovation in neural engineering. Although Neuralink may be the connection that connects humans to the next level of artificial intelligence, many individuals may be wary about having a computer chipset implanted in their heads. Although the neuralink has been successfully implanted in pigs, the technology has yet to be tested on humans. When neuralink is successfully implanted in people, the technology's vision will be realized. If Neuralink is successfully implanted in people, it might be the most significant invention/research of the century. The Neuralink chip also studies electrical impulses in the brains in order to develop solutions that will aid in the treatment of many people who suffer from neurological impairments or other medical issues.

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