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Brain Chips – A Novel Vision

Nakka Manasa, Mandadi Nishita, Volluru Akshitha, Chapala Mayukha, *B. Raveendranadh Singh
Bhoj Reddy Engineering College for Women (BRECW), Saidabad, Hyderabad, Telangana, India.
*Corresponding author Email: brn.singh@gmail.com

Abstract. Technology is helping us go back to our roots in order to address two big problems that humans are currently facing: the volume of data and the speed of data processing. Today's rate of data production takes 10-20 minutes compared to the past few decades. A decade from now, it will be produced in 5-8 seconds, an undeniable fact no matter what technology we use. The importance of this relates to the fact that everything is becoming digital across the globe. This requires the development of brain chip interfaces which will improve the brain's cognitive capacities. These interfaces can also be used for medical problems, such as for patients with neurological conditions including paralysis, stroke, or epilepsy. To assist those who lost control of their limbs or other physiological functions, a device was created. An implanted computer chip in the patient's brain tracks all brain activity and translates user intentions into computer commands.

1. Introduction

In brain-chip interfaces (BCHIs), which are hybrid systems, chips and nerve cells work closely together physically to transmit information in either one direction or both. The chip now employs 100 extremely thin electrodes to "hear" neurons firing in particular regions of the brain. The device will track brain activity, including that in the region that regulates arm movement, and may even stimulate it. The actions are converted into electrically charged signals, which are then deciphered by computer software to cause the arm to move. The Brain-gate network can collect electrical data for later examination in addition to real-time analysis of neural models to diffuse movement. To put it another way, we may say that the computer will pick up on anything the brain cells say, but that communication between the two devices is two-way, meaning that the computer can also communicate with the chip by sending instructions to carry out a certain task. It sounds like science fiction when machines behave like human brains. This resembles a fusion of engineering and neurobiology. Nanotechnology is used to create brain chips with the goal of making a person into a superhuman.

Fifty Years of Progress

Brain chips have been a far-fetched dream ever since Jose Delgado began his research in the early 1950s. Known as the pioneer of brain chip technology, he implanted primitive devices in animal and human brains. Delgado was able to control his subject's emotions by stimulating different areas of the cortex.

In his most famous experiment in 1963, Delgado implanted a miniature electrode, called a stimoceiver, into the brain of a fighting bull. This stimoceiver received and transmitted signals over FM radio waves, and could be controlled remotely. By stimulating a specific part of the charging bull's brain, Delgado was able to stop the bull in its tracks. This and experiments like it, were the earliest forms of BCI research.

Jose Delgado stimulating the bull

FIGURE 1. History

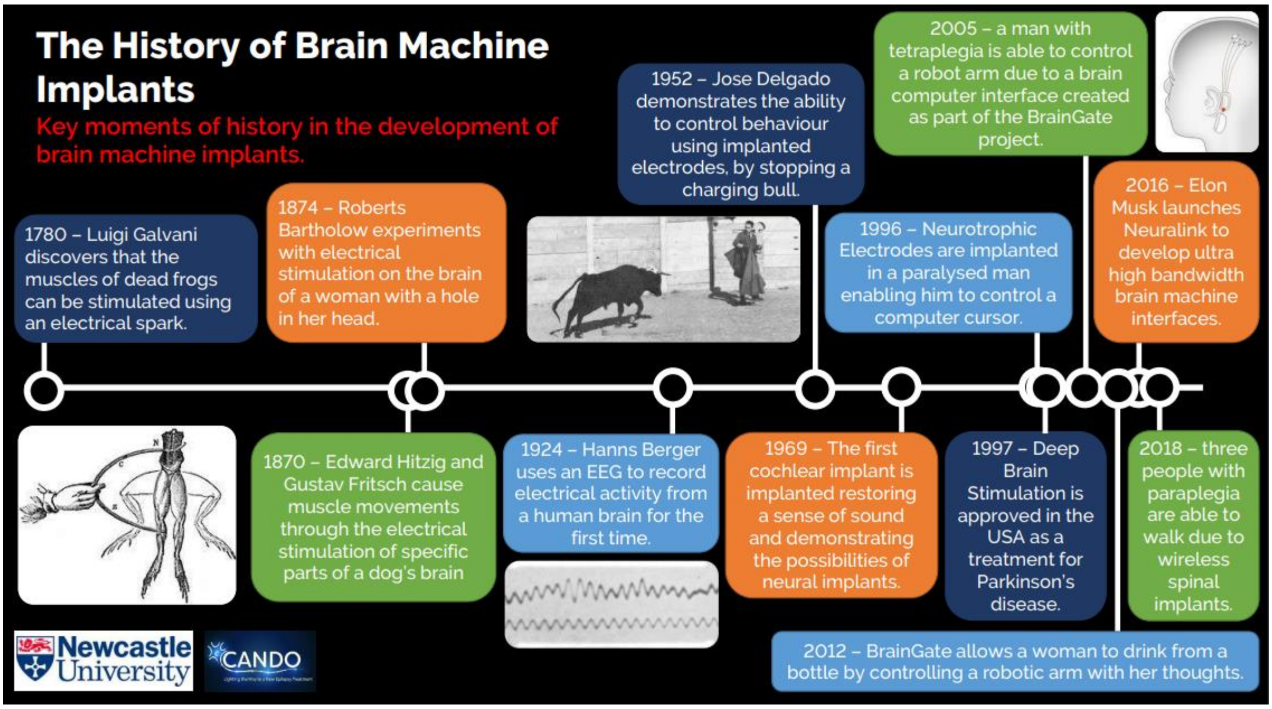

FIGURE 2. History of brain machine implants

2. Electroencephalography (EEG)

The EEG is a gadget that captures each and every brain activity using electrical impulses transmitted by the brain's nerve cells. They capture each neuronal connection's pattern and image and send it back to the computer via the chip. For each activity the human brain performs, different patterns are produced by different electric signals in the brain's neural network.

FIGURE 3. EEG

When the patient agrees to work, the computer receives a unique pattern. The computer receives a new pattern if the patient responds negatively. The brain impulses are converted into digital data and sent to the computer once each activity is recorded. The electrical signals in the brain's nerve cells are transformed into digital data by the EEG, and vice versa. An EEG headgear that analyses the functional signals of the brain has been developed by researchers.

3. Neural network with brain chips

In order to study the brain, researchers must first understand how neurons are formally shaped and what the requirements of neurons and neural networks are. The brain has various areas for each action we perform, as is well known. Neural networks carry out the brain's functions by collecting information from each individual cell body and connecting them together using nerve cells which thereby process the actions a person performs.

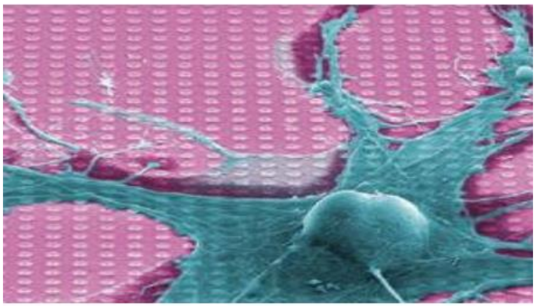

FIGURE 4. Neural network

The electrode sensors on the brain chips are utilized to capture each signal sent by the brain while the neural network and brain chips connect electrically. On top of the chip, we can directly cultivate brain cells. Furthermore, they develop on-chip with close electrical interaction, which is a really exciting element.

4. Evolution toward brain chip interface

One well-known aspect of contemporary culture is brain chip implantation. In order to record the brain's electrical activity, HANS BERGER created the Electro Encephalography (EEG) equipment in 1929. When discussing this subject, we think of JOSE DELGADO's experiments in which he embedded sensors in animal brains and connected them to "STIMOCEIVERS". The first brain chip for recording brain activity was inserted in the human brain in 1998 by researcher PHILP KENNEDY. The brain gate was created by JOHN DONOGHUE and the Cyber Kinetics group at Brown University Research in 2001. In 2004, an EEG cap was created by JONATHAN WOLPAW and his team at New York State, and in 2009, With 5.4 billion transistors, IBM built a wireless Brain Chip Interface that can activate 256 million brain connections and 1 million neurons. Soldiers will receive BCI implants from DARPA, the covert research division of the Department of Defense, for a variety of beneficial uses.

5. Essential brain chip interface components:

The Chipped Pedestal: A 4mm microelectrode array (brain chip) is linked to a 2-centimeter pedestal by means of the pedestal. It transfers to a signal amplifier all of the electric pulses produced by the brain's nerve cells for recording.

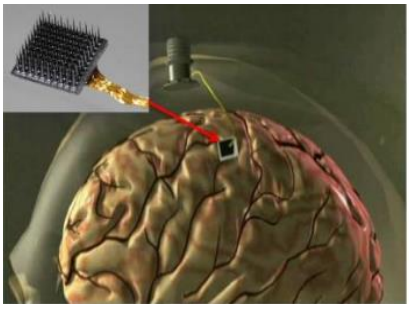

FIGURE 5. The Chipped Pedestal

Optical Fiber Cable: The neural activity translator receives the information given by the device and sends them to it.

FIGURE 6. Optical Fiber Cable

The computer: With the help of online data provided by a neural activity translator, it absorbs all terms of its design by cells in the brain of each and every action that the human mind makes.

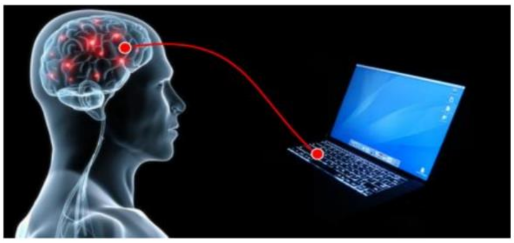

FIGURE 7. The computer

An interpreter of neural signals: It does this by converting cerebral activity into electrical impulses that are then sent to the computer. It is also possible to reverse the phase.

FIGURE 8. An interpreter of neural signals

What is the process?: The brain chip can be implanted into the human brain. The pedestal connector, to which the chip's extension wire is connected, captures every signal created by the neural circuits that govern every function of the brain. Then, using a fiber optic connection, this connection transmits all the impulses to a brain processor.

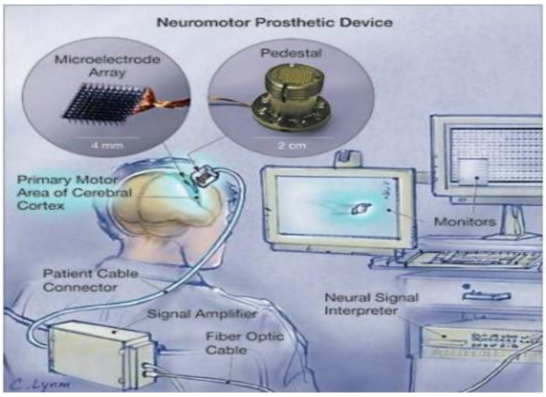

FIGURE 9. Neuromotor Prosthetic Device

The neural signals are subsequently converted into digital signals via a neural signal translator, which would be transferred to the computer. The prostatic device enables all patients to accomplish all activities just by the patient's ideas by replicating all of the brain's functions and delivering them to the computer.

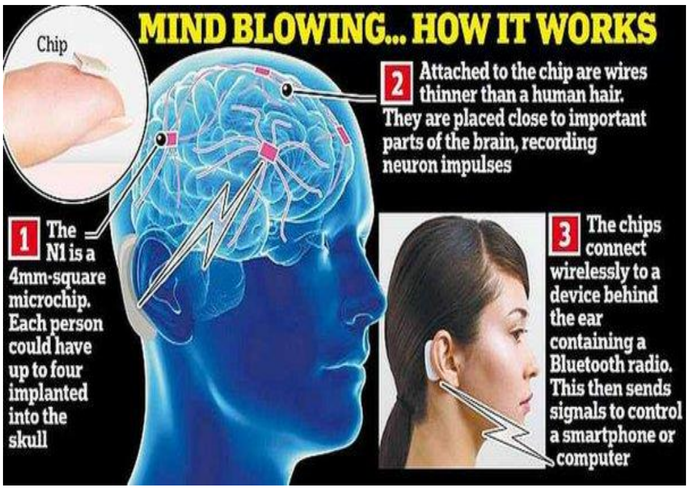

FIGURE 10. Chip

6. Accomplishments and applications

Patients who are paralyzed can move: Brain chip implants allow patients to communicate with computers in a way that allows the computer to understand their minds, enabling the immobilized part to move on its own. Patients who have lost all physical functions can communicate with one another through the mind.

FIGURE 11. Patients who are paralyzed can move

Telepathy: The alleged transmission of thoughts or ideas via channels other than the five senses is known as telepathy. When two persons use this brain chip interface, it can be described as a hidden kind of interaction.

FIGURE 12. Telepathy

Remote-controlled animals: For army rescue operations, these are utilized for animals like dogs, rats, sharks, etc. DARPA will give predators neurological devices. These devices can be utilized by Shark's special sensors to provide information about the movement of enemy ships or underwater bombs.

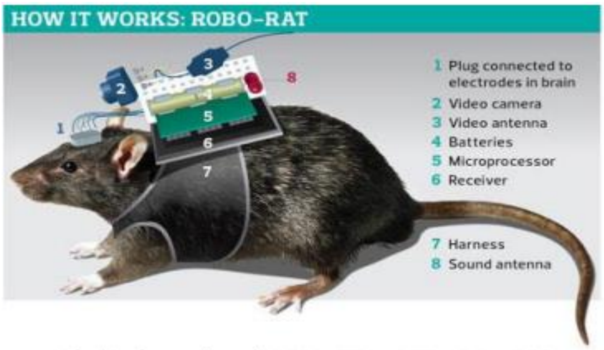

FIGURE 13. ROBO-Rat

7. Brain Chip Interface Advantages

Despite being in the development phase, it is anticipated to offer its customers a number of advantages in a range of disciplines. A few of the main advantages of BCI are Shrewd Technology: The potential of Brain Chip Interaction to transform passive, previously inactive equipment into smart, active people is among the major motivations of why it has been regarded as advanced innovation. "Biomaterials" is an instance of such equipment. For example, a person who wears a prosthesis can engage this equipment to hold and drink from a glass of water just as they would with their own hands. The same technique could be used to facilitate communications among deaf and dumb people using equipment that are handled by Brain Chip Interactions. Telepresence: In the context of tele robotics, telepresence is a technique that allows individuals to make their presence felt at a distance. Army forces could be capable of monitoring anything unusual behavior that may just happen there at the boundary owing to telepresence and the Brain Chips Interaction. Therefore, telepresence may detect any unusual behavior as well as help with preventing it. To be precise, they are

Reliable	**:**	Consistently good at performance, and trusted by researchers.
Adaptive	**:**	The human mind should improve its ability.
Self-learning	**:**	Greater memory could be increased via brain chips.
Contextual	**:**	Brain chips may indeed be beneficial under certain scenarios.
Personalized	**:**	Can indeed be created to satisfy the demands of the individual.
Productivity	**:**	Extremely effective in enhancing mental function in individuals.
Security	**:**	Human memory can indeed be maintained via brain chips without loss of memory.

8. Risks Associated with Brain-Computer Interface

The Brain Chip Interface technology, which is directly connected to the human brain, may cause harm to its users if improperly used. Some of the possible dangers connected to BCI are

Results that are inaccurate: Our brain is an extremely complicated organism. We occasionally find ourselves unable to comprehend what is occurring in our thinking. Therefore, it is unreasonable to expect a man-made Brain Chip Interface to accurately translate every signal from our brains. The user's intentions may occasionally be misinterpreted by the Brain Chip Interface. For instance, the Brain Chip Interface might incorrectly identify a disabled individual using a prosthetic device who wishes to raise his index finger, causing the middle finger to lift instead.

The large size of the network: A Brain Chip Monitoring program will potentially lead to a very terrible customer experience since it needs an installation of various cables since the brain and machine should be linked. As a consequence, one of the major flaws of a Brain Chip Control surface will be its large structure which would force that person under tremendous physical and psychological stress due to the massive cabling needed.

Insufficient security: People expect confidentiality to become a vital requirement when people acquire and enroll in such technological goods and services. In reality, confidentiality for personal information cannot be assured using the Brain Chips Technologies that have emerged. Digital allows it easy for any individual to analyze what’s really occurring within one’s mind but also steal personal security.

9. Brain Chips' Disadvantages

- Due to the greater cost, it’s really hard to afford.
- Surgical Risk

10. Conclusion

The expansion of brain chip engineering methodology is a great boost for sick people suffering from neurological illnesses; there has been a breakthrough within technology, as well as neuroscience. Interaction via brain-based neural activity can be feasible as a result of brain chip technology. The outcomes are astoundingly fantastic and incredible. The benefit of brain chips using nanotechnology allows researchers to develop fewer but also improved processors, enabling brain chip technology less burdensome but more reliable possibility to individuals. Better productive in restoring limb function as assisting patient’s proper treatment. Eventually, it offers incredible, limitless benefits.

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