

Mind Reading Computer

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Abstract— Modern technology has led to many new inventions to satisfy the growing needs of people. One of the leading new inventions is mind reading computer. The concept of human-computer interaction has emerged due to advancements in computer technology. The art of mind reading involves understanding another person's mental condition. This may be accomplished by observing his behavior and capturing his facial expression. To comprehend oneself and other agents in terms of beliefs wants, and intentions, it is necessary to be able to infer the mental states of other individuals and utilize this information to anticipate and explain their behavior. Looking at and interpreting facial expressions is the simplest method for mind reading. Making a mind-reading computer will make it easier for technology to understand people's emotions and respond to their mental states. The method described in this paper allows a computer system to read a person's mental state, turning it into a mind-reading computer.

Index Terms— Human Computer Interaction, Mind Reading Computer, Facial Expression.

I. INTRODUCTION

The ability to understand another ideas without using the usual communication channels, mainly through supernatural power. The practice of reading minds has a long history. Ancient Greek writings and the Old Testament of the Bible both contain accounts of mind-readers. There have been countless science fiction writers throughout history. Scientists have already anticipated a day when it is possible to read minds. But mind reading is already a reality because of neuroscience and computer coding developments. Since the 1970s, government organizations and numerous university institutions have actively explored research on mind reading. Researchers from the Massachusetts Institute of Technology, University of Rochester, University of Illinois, UCLA, and Stanford Research Institute have worked with DARPA since 1973 to study mind-reading technology. Recently, some of the largest IT companies (including Facebook, Microsoft, Elon Musk's Neuralink, etc.) have also been working on projects in this area. Recognizing basic emotions like happiness, sadness, disgust, and fear, as well as complicated mental states like hate, realization, anticipation, admiration, curiosity, thoughtfulness, etc., relies significantly on facial expressions and eye language. The computer analyses a person's facial expressions using a special camera to determine their emotions. This can be paired with electroencephalogram (EEG) and other technologies that use sensors on a person's head to read brain activity. A computer's ability to read minds has many applications in daily life, particularly medicine. This technique has significant implications for medical research and can potentially enhance the lives of people with various illnesses, from autism to paralysis. Numerous research initiatives and tests have successfully detected brain impulses through brain-computer interfaces, enabling patients unable to perform particular body movements to do so. The paper focuses on how mind-reading computers can improve human health and wellness. Moreover, it highlights the ongoing studies' research trends and the risk associated with BMI devices.

II. MIND READING COMPUTERS

Mind-reading machines are computers that implement a computational model of mind-reading to infer people's mental states, using influence from psychology, computer vision, and machine learning. The intention is to increase user productivity and allow programs to start conversations with and on behalf of users without needing their direct input. Types of Mind Reading Computers

- 1) Brain Computer Interfaces and Neuroprosthetics The Brain-Computer Interface (BCI) technology is a significant device for user-system interaction. There is no need for an external device or muscle action to assign commands and finish the transmission. BCI technology captures brain activity And transmits them to the computer system so that it can finish the intended activity. Therefore, the delivered waves are employed to convey ideas or manipulate objects. The field of neuroscience, known as neuroprosthetics, is concerned with neural prostheses or the use of artificial devices to replace the function of sensory organs or defective neurological systems. BCIs and neuroprosthetics differ because the former attaches the nervous system to a machine, while the latter typically connects the brain or the central nervous system to a computer. With the help of BCIs and neuroprosthetics, people can regain their abilities to move, hear, see, hear, speak, and even think. Both technologies use similar surgical and experimental approaches. Measuring oscillations produced by the brain This is one of the critical elements of these strategies. Methods for acquiring brain signals can be classified as either invasive or non-invasive.
- 2) Whole Brain Emulation (WBE) Whole brain emulation (WBE), also known as mind upload or brain upload and also referred to as "mind copying" or "mind transfer," is a hypothetical future method that involves scanning a specific brain substrate and replicating its mental state to a computer. Then, the computer might run a simulation model of how the brain processes information such that it reacts similarly to the real brain and feels as though it has a conscious mind. The primary goal of mind uploading is data capture rather than brain data upkeep. A technique known as loosely coupled off-loading (LCOL) is occasionally employed to describe and replicate the mental contents of a brain. This may use video recordings and self-reports from life logs and artificial intelligence-analyzed life logs.
- 3) EEG AND BCI Because of its simplicity and lack of intrusion, using surface electrodes, the EEG system collects electrical brain impulses from the scalp. It can be divided into several categories, with EEG MI-based BCI being one of the most popular. A motor imagery signal is employed as an input signal for this kind of BCI system. In this approach, a BCI user must focus on a MI task to create a distinctive brain pattern corresponding to the desired control. The EEG MI-based BCI system block diagram as shown in the below figure.

III. MIND-READING COMPUTERS IN HEALTHCARE

The World Health Organization (WHO) recently gave a report that noted that 6.3% of all diseases worldwide are neurological disorders, including neuropsychiatric problems. The most disabling are neurological conditions. Clinical conditions greater than HIV include malignant tumors, myocardial infarction, respiratory illness, and digestive disorder. Cerebrovascular diseases, such as stroke, account for more than half of the burden of neurological disorders in terms of disability-adjusted life years (DALYs), followed by Alzheimer's disease and other dementias (12%), migraine (7.9%), and epilepsy (7%). Because of the constantly aging population, there will probably be a rise in the number of persons suffering from dementia and stroke in the upcoming years. However, some other conditions can affect people at any age and may be so severe as to impair their capacity to function. Therefore, it has become a top goal in healthcare around the world to improve the recovery of cognitive, sensory, and motor abilities in these circumstances. It is evident from the scenario shown above that brain illnesses pose one of society's and healthcare's major issues and that the lack of efficient treatments necessitates the development of novel solutions.

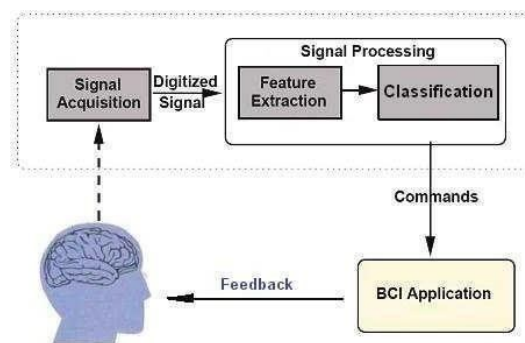


Fig. 1.

IV. ONGOING RESEARCH WORKS

1. Neuralink One of Elon Musk's top neuroprosthetics businesses is this one. The company's primary goal is to create short-term treatments for severe brain diseases and stroke-related brain damage. The company's long-term objective is to advance technologies for human enhancement.
2. Kernel Bryan Johnson developed this other neuroprosthetic business intending to preserve the life of the human brain while unleashing its full potential and powers. The company aims to restore neurons that have been destroyed by conditions like Alzheimer's and other neurodegenerative disorders. The business is developing implantation chips intended to improve human intelligence and memory.
3. Neurale Contrary to many other businesses, this neuroprosthetic company is concentrated on improving existing electroencephalograms rather than developing new gear. The firm uses this technology to decipher neural activity and help patients with severe disabilities.
4. Delta Brain Inc A newcomer in the neuroprosthetic industry, Delta Brain Inc., conducts studies on enhancing heart health. This business helped many people who had heart and liver issues.
5. Novela The development of a flexible electrode array by this wellknown company in the neuroprosthetic industry led to the creation of a closed-loop system for detecting and cessation seizures.
6. Eyewink Another startup in the neuroprosthetic industry has created a technology that allows people to operate electronic devices in the blink of an eye.

V. RISKS AND CHALLENGES OF USING MIND COMPUTERS

A. Lengthy training process

Training the user takes time, regarding the number of recording sessions and leading the user through the process. In the initial stage, the user is instructed on how to utilize the device and control his or her brain's feedback signals. The applied classifier is learned during the calibration phase using the brain signal of the trained user. The user may find this process to be quite drawn out and annoying. However, several approaches to this time-consumption issue include using single-trial analysis rather than multi-trial analysis, which is utilized to improve the signal-to-noise ratio[35] and shifting the responsibility of handling a limited training size to later BCI system components.

B. Technical Challenges

1. Noise One of the major difficulties in analyzing and interpreting brain signals is noise. It includes ambient noise and unwanted signals brought on by changes in electrode location. Enhancing the signal-to-noise ratio (SNR) of EEG signals by raising or lowering the noise level can help with the noise issue.
2. Risks with implantation Electrodes are implanted beneath the scalp using invasive recording techniques. Making holes in the skull to implant electrodes is dangerous and difficult and might harm the brain's most crucial regions. Additionally, implants have the potential to move unintentionally. Additionally, implants must be small and rechargeable, made of harmless substances that won't cause the human body to reject them as foreign objects.
3. Data acquisition and interpretation One major obstacle to be solved is the relatively poor capacity to extract the necessary information from the brain. The current technique for gathering brain data, which ranges from invasive to non-invasive technologies, only yields ambiguous and incomplete information on the user's purpose. This has prevented the technology from succeeding.

C. Ethical Challenges

1) Cyber Security threat

The constant worry about data theft, which might seriously harm the industry's reputation, makes the rising cyber threat a significant concern for this sector. Some people are against brain-computer interfaces because they fear that unauthorized parties could access some of their private and personal information.

2) Legality

The sector has been working to solve the barrier of legality and regulations. The usage of this technology must not infringe any fundamental human rights laws.

D. Social Challenge

According to a recent survey in the USA, most individuals are not interested in brain implants that could enhance memory or mental capacity, and some even believe that if most people wear implants that provide them knowledge

about the outside world, it will be a change for the worst. Therefore, it can be difficult to pique people's interest in this technology.

VI. OUTCOMES OF SOME SIGNIFICANT EXPERIMENTS

- a. With 87 percent accuracy, the Carnegie Mellon University (CMU) Thought Identification algorithm was able to foretell the missing sentence from a brain activation pattern.
- b. According to claims made by the Wyss Centre for Bio and Neuro engineering, its brain-computer interface can converse with people who have "locked-in syndrome" and consistently receives binary responses 70% significantly more often than chance.
- c. In pilot research, children with ADHD who played games created by Neuro Plus while donning a brain-sensing headset demonstrated improved focus and attention after ten weeks.
- d. The BCI-FES system by Meng et al. demonstrated that chronic post-stroke patients could learn to enhance their motor imagery activities based on the closed loop sensory- motor control via the BCI-FES system when the error rate of the system was less than 20
- e. All patients showed neurological improvements in somatic feeling (pain localization, fine/crude touch, and proprioceptive sensing) in numerous dermatomes after completing a 12-month training program using a VR-based paradigm. According to EMGs, patients also acquired voluntary motor control in significant muscles below the SCI level, significantly improving their walking index.

VII. RESULTS AND DISCUSSIONS

A mind-reading computer may infer people's mental states using a computational mind-reading model. It's still early days for this technology. This article's major objective is finding out how mind-reading computers are used to promote human health and wellness. Brain signals may be beneficial for various health disorders throughout the associated phases, such as prevention, identification, diagnosis, restoration, treatment, and rehabilitation. Avoiding omnibus and sleep inertia can be accomplished by using a mind reading computer. Multiple diseases, including intracranial conditions like brain tumors and cerebral atherosclerosis, neurodegenerative conditions like Alzheimer's disease and Huntington's disease, sleep disorders, smoking and alcoholism, dyslexia, and ADHD, among others, can be found and diagnosed with the aid of this technology. The use of mind-reading computers for treatment and rehabilitation is also widespread. Deep brain stimulation (DBS), a brain-machine interface combined with neuromodulation, has emerged as the most significant advancement in the medical treatment of Parkinson's disease-associated dystonia, or essential tremors. The feasibility of an EEG-based BCI-FES system has been demonstrated for patients with chronic post-stroke. Kids with signs of ADHD might benefit from the games provided by NeuroPlus. Diverse reality techniques, including natural, virtual, and augmented ways, have also been proven for BCI-based rehabilitation training. This essay has also mentioned some ongoing studies. A drug called Neuralink can treat severe brain disorders and stroke-related brain damage. A kernel may be able to restore neurons that have been harmed by diseases like Alzheimer's and other neurologically debilitating conditions. Heart health would be improved by Delta Brain Inc. Restoring Active Memory (RAM), a DARPA research that could reverse memory loss, and SUBNETS, a technology that could treat PTSD, depression, and pain, have also been suggested. The use of mind-reading computers comes with many risks and difficulties. Technical difficulties, such as noise issues, the brain's non-linearity, implant-related hazards, a limited capacity to extract pertinent information from the brain, etc., exist in addition to the time-consuming training process. There are ethical issues, such as the fear of cyberspace.

VIII. CONCLUSION AND FUTURE SCOPE

Over the years, different brain-machine interface techniques have been developed in medical research, including the prevention, diagnosis, and treatment of serious disorders. However, this is where they have been most useful and successful. There are many potential uses for this technology in the future. For instance, scientists are already working on zoomable contacts. With implants, we could operate them with our minds, allowing us to change the zoom as necessary and look up more information about what we see online. This technology will benefit everyone, including patients and medical professionals. The concept of an identification system may also be used with a speech synthesizer to provide a voice output to assist those with severe speech impairments. Although some dangers are associated with employing mind-reading computers, we anticipate that these hazards will eventually disappear as this business develops. Right now, mind-reading computers are leading us to a new frontier in daily life and medical research.

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