MIND READING: AN EMERGING TECHNOLOGY

[1]G Nitin, [2]Prof. Madhu B R

[1]Student,[2]Associate professor,
Computer Science and Engineering,
SET, Jain University, Bengaluru, India.

Abstract - **Mind reading is an emerging technology which has the potential to bring humongous changes in various fields. Mind reading, basically, is the technique or the method to identify emotions and responses by taping the signals from the brain. There are a lot of techniques that are already being used to perfect this technology and deploy it in the real world. Mind reading technology has a potential game changing effect in many industries. Few of the applications of this technology in the real world would be neuromarketing, help physically handicapped, especially blind people, to use the computers and other computing devises just like a normal human being. This paper focuses on the study of various applications of this this emerging technology.**

Keywords - **Mind reading, functional MRI, Electroencephalography.**

I. INTRODUCTION

The automated interpretation of human minds has been an emerging research field that enables to characterize underlying cortical processes, the monitoring and automated identification technique of human thoughts may lead to potential applications in the areas of the motor rehabilitation, neurosurgical planning, and brain-computer-interface (BCI) for tetraplegic patients. An increased understanding of the function of the brain, an appreciation of its incredible adaptability, access to powerful inexpensive computer hardware, and intelligent software, allows us to decode brain activity in real time.

A BCI is a system that measures central nervous system (CNS) activity and converts it into artificial output that replaces, restores, enhances, supplements, or improves natural CNS output and thereby changes the ongoing interactions between the CNS and its external or internal environment. Recent developments hint at the significant future role BCIs could play as the control system for devices that can restore function to the disabled or augment the healthy.

From an evolutionary perspective, mindreading in humans have developed for a number of aspects, for example, intention, attention, emotion, knowing. In the first perspective it is assumed that mindreading takes place by using the facilities involving the own cognitive states that are counterparts of the cognitive states attributed to the other person.

These days it is expected that the era of human-robot symbiosis is rapidly approaching along with the rapid improvement of robot technology and artificial intelligence (AI). To keep the relationship between human and robot that live close together and depend on each other in particular ways in a certain environment, natural and rational human-robot interaction (HRI) is needed. Thus, the research on HRI is required and it has become one of the fast growing fields in robotics.

II. ADVANTAGES

Few of the advantages of the min reading technology are:

- Help paralytic people
- Help coma patients
- Help blind people
- Help handicapped people
- More effective search results
- Better expression of thoughts

III. DISADVANTAGES

Few of the disadvantages of the mind reading technology are:

- Privacy
- Expensive
- Potential risk of negative usage

IV. APPLICATIONS

There are a lot of applications of this technology. Few among them are:

- Brain-computer interfaces
- Lie detection
- Pain detection
- Neuromarketing
- Psychiatry
- Search engines

V. METHODS

There are various techniques that are currently being used for reading minds of the human beings. Few among them are:

A. Functional Magnetic Resonance Imaging(fMRI)

Functional magnetic resonance imaging or functional MRI (fMRI) measures brain activity by detecting changes associated with blood flow. This technique relies on the fact that cerebral

blood flow and neuronal activation are coupled. When an area of the brain is in use, blood flow to that region also increases. Among the present functional neuroimaging modalities, functional MRI (fMRI) can observe dynamic neuronal activity changes in the human brain with superior spatial resolution based on the blood-oxygenation-level-dependent (BOLD) signal contrast The concept of automatic pattern classification of fMRI data has been successfully addressed by recent studies based on the block-based paradigm design employing multiple sensory, motor and cognitive tasks. fMRI offers the most comprehensive evaluation of brain processing because it is the only technique that can monitor activity in deep brain structures involved in functions such as memory encoding and reward processing.

B. Electroencephalography (EEG)

EEG is an electrophysiological monitoring method to record electrical activity of the brain. It is typically noninvasive, with the electrodes placed along the scalp. EEG measures voltage fluctuations resulting from ionic current within the neurons of the brain. Clinically, EEG refers to the recording of the brain's spontaneous electrical activity over a period of time, as recorded from multiple electrodes placed on the scalp.

VI. DISCUSSIONS

Paper Title	Summary
Mind Reading: An Automated Classification of Thought Processes from Imagery fMRI Data.[1]	This paper presents a method for automated classification of human thoughts reflected on an event-based paradigm using functional Magnetic Resonance Imaging(fMRI). The regions of interest were described from the activated regions that were consistently and exclusively activated during the training phase. Feature vectors of activations extracted were recognized by using a Support Vector Machine (SVM) classifier. This classifier had an 80% average accuracy.
Reading Minds: Brain Decoding Scientists move closer to Discovering the Key to Unlock the Brain.[2]	This paper discusses about decrypting brain patterns and decoding brain activities. The Functional Magnetic Resonance Imaging(fMRI) is the technology that has been explained for decryption of brain patterns and decoding the brain activities.
Reading the Mind: The Potential of Electroencephalography in Brain Computer Interfaces.[3]	This paper discusses about the potential of electroencephalography (EEG) brain computer interface (BCI) to be used in the real world. It states that EEG based BCIs are the best for practical BCIs due to its relatively low cost, high temporal resolution, and low clinic risk. The paper claims that there would be no physically handicapped people other than the most severely brain damaged. It also claims that the barriers between our brain and the computer would be disappeared and a large amount of possibilities would be created.
Read My Mind: What Users Want From Online Information.[4]	This paper discusses about the expectations of the user of the help function offered in numerous programs. It postulates a conversation model rather than a book model.
Cognitive and Biological Agent Models for Emotion Reading.[5]	This paper focuses on modelling the capabilities to a participant's emotions and their biological realization. A cognitive and a biological agent model which involve the generation and sensing of body states are introduces. The Simulation Theory approach to mindreading is followed to show emotion reading can be modelled both at a cognitive and at a biological level.
Reading Users' Minds from Their Eyes: A Method for Implicit Image Annotation.[6]	This paper aims to explore the possible solutions for image annotations and image retrieval by implicitly monitoring user attention through eye tracking. Gaze Inference System, a fuzzy logic-based framework, analyses the gaze- movement of the user and measures the user interest level. In the paper it is showed that the machine's judgement of image content can be improved by employing the existing information in gaze patterns. The chosen gaze features of the framework make it flexible.
A Novel Emotion Recognition based Mind and Soul-relaxing system.[7]	This paper proposes to detect the emotions of a human from the facial expression by using real time embedded system and play audio in accordance to the emotion to comfort the user. The proposed model captures the image of the user, Viola-Jones algorithm is used to detect human face, Local Binary Pattern is used to extract facial features and finally SVM classifier is used to classify the emotion.
Deep Learning Human Mind for Automated Visual Classification.[8]	This paper aims to address the possibility of reading the human mind effectively and transfer human visual

	capabilities to computer vision methods by developing the first visual object classifier that is driven by human brain signals. In the first of the two stages, an RNN-based method is used to learn visual stimuli evoked EEG data and also find compact and meaningful representation of the data. In the second stage, a CNN-based method is used that is aimed at regressing images into the learned EEG representation. This enabled automated visual classification. The RNN-based approach had an accuracy of 83%. In the end, it is claimed that the approach used in this paper obtains competitive performance that is comparable to those achieved by powerful CNN models.
Human-Robot Interaction by Reading Human Intention based on Mirror-Neuron System.[9]	This paper has proposed an effective human-robot interaction by reading human intention by using cognitive architecture where the intention reading algorithm proposed was inspired by mirror-neuron system and simulation theory which are the important parts of human mind reading skill. The cognitive architecture proposed for human intention reading consisted of eight modules. the proposed scheme observed the human behavior and used it identify the human intention and was simulated on the robot's own behavior model. The effectiveness of the proposed scheme was demonstrated through computer simulations where the human-robot was allowed to play with two different objects. The robot could identify human intention and choose the appropriate behavior for natural and effective human-robot interactions without explicit commands and prior knowledge about humans and objects.

VII. CONCLUSION

After the survey of the aforementioned papers, one can confidently assert that this mind reading technology will bring about major changes in the lifestyle of people, and in various fields wherever applicable. But there is always a threat of negative usage of this technology if it falls in the wrong hands and could prove dangerous consequences.

VIII. ACKNOWLEDGEMENT

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