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A Survey on Mind Reading Technology by Using Machine Learning

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ABSTRACT

Mental states have been discovered to be the one of the most important aspects that influence the quality of the areas. These studies primarily focus on the construction of a computer that can truly read people's minds and react to various computers that can be applied to a wide range of disciplines in the real world and increase the quality of human-computer interfaces (HCI). The 'Mind Reading Technology' is the ability to decode and interpret neural signals into machine signals/code. Mind-Reading includes the thought of opening one's mind.

Keywords : Neuroscience, Mind reading, HCI, SVM, Neurotechnology

I. INTRODUCTION

Many Universities worked on a system to determine how people understand colours and forms, as well as a method to detect daydreaming. The fundamental purpose of mind reading technology is to improve human-machine interaction by leveraging machines. We can forecast a person's mental state using a digital camera, such as whether they are agreeable, disagreeable, bored, and so on. The mental state is assessed by combining real-time facial expressions and head gestures. The visual cortex, a portion of the brain that interacts with information sent from the eyes to the brain, is where brain creativity is measured. The Functional Magnetic Resonance Imaging (FMRI) scans the results and displays them on a computer screen, where scientists manipulate the images and provide the user with the results.

II. LITERATURE REVIEW

2010 – The automated interpretation and classification of functional MRI (fMRI) data is a new research area that allows for the characterization of underlying cognitive processes with minimal human intervention. Human intervention is required. In this paper, we present a technique for human thoughts reflected on an automated classification event-related paradigm with significantly improved fMRI modality.

2015 – Many discoveries in psychology and affective computing have reshaped science's understanding of human mental states. One of the key factors that contribute to the quality of HCI has been discovered to be one's mental states. A number of experiments in affective computing and HCI are currently being carried out; the studies are primarily focused on the development of a novel computer system known as the mind reading computer. The mind reading

computer can truly read people's minds and respond to various emotions or commands. Researchers believe that in the future, mind reading computers will be used in a variety of real-world disciplines, improving the quality of HCI.

III. METHODOLOGIES

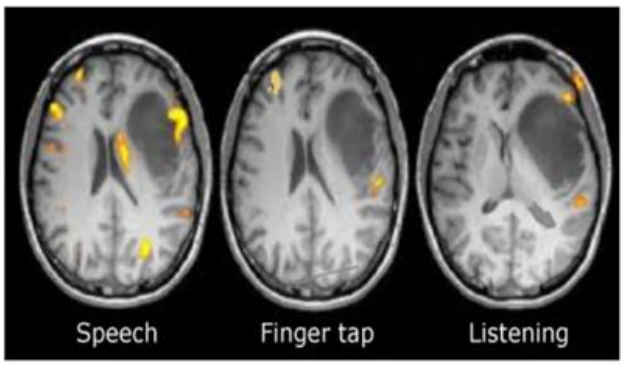
FMRI-based detection of brain activity

FMRI stands for functional magnetic resonance imaging. FMRI is a technique that measures and maps brain activity. The sole difference between MRI and FMRI systems is that an MRI detects body movements while an FMRI detects brain Movements. The image acquired by MRI scan is only of organs/tissues, whereas a fMRI image reveals blood flow in the brain, indicating which portion of the brain is elevated.[7]

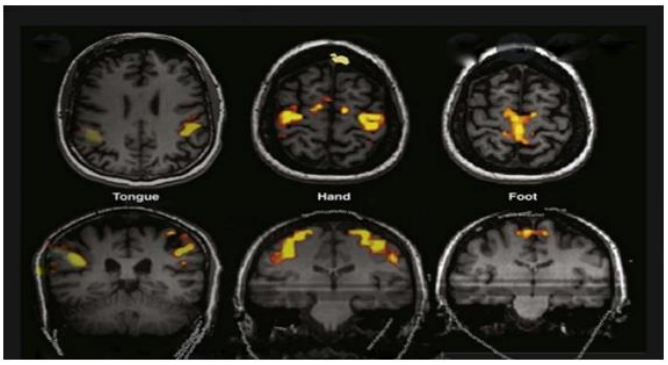
FMRI captures images of brain changes using a magnetic field. It detects variations in blood-oxygen levels because when an area of the brain is more active, it requires more oxygen and hence more blood. Mind-reading includes employing a technology called functional near-infrared spectroscopy (fNIRS) to measure the volume and oxygen level of blood around the subject's brain [8].

The patient is prompted to complete a specific task during fMRI scan in order to promote oxygen-rich blood flow to a specific area of the brain. The activities included imagining clenching their hands or wiggling their toes, subtracting odd numbers from two-digit figures above 20 in a sequential manner, and envisioning static scenes as clearly as possible. These tasks were completed seven times in total. Four of the seven outcomes were utilised to train the SVM algorithm, while the other three were used to test it.

Further photos will depict brain impressions during body motions such as speech, finger tapping, listening, hand tapping, foot tapping, and so on.



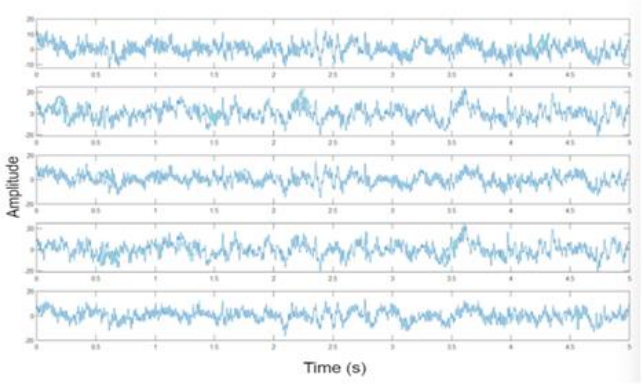
Movements of protons go through during MRI



Electroencephalogram (EEG)

The electroencephalogram (EEG) is now frequently used in medicine to record the electrical activity of the brain. EEG is also one of the most widely utilised methods for decoding speech images in order to facilitate mind reading. EEG is a technology that uses tint electrodes on the patient's scalp to map electrical activity in the brain and monitor brain signals. Even when the patient is sleeping, electrical impulses interact between neurons in the brain. EEG can detect variations in brain activity and produce wavy lines as a result.

When compared to other modalities such as fMRI (functional magnetic resonance imaging) and fNIRS (functional near-infrared spectroscopy), EEG has a number of drawbacks (functional near-infrared spectroscopy). The fact that EEG offers good temporal resolution, is non-invasive, and is cheap which makes it the most common choice. The EEG signals collected from a subject's brain are shown below. [11,12, 6]



SVM (supervised vector Machine)

Machine learning models are classified into three types. There are three types of learning: supervised, unsupervised, and reinforcement learning. The given model operates on the principle of supervised machine learning.

The SVM (supervised vector Machine) is used for labelled data classification as well as regression problems.

The SVM algorithm's goal is to find the best line or decision boundary for categorising n-dimensional space so that we can easily place new data points in the correct category in the future. A hyperplane is the best decision boundary.

Flow Chart Model For SVM:

➢ **SVM Architecture**

A region of interest (often abbreviated ROI) is a set of samples within a data set that have been identified for a specific purpose.[1] The concept of a ROI is widely used in a variety of applications. In medical imaging, for example, the boundaries of a tumour may be defined on an image or in a volume in order to measure its size.

Steps for ROI selection:

1. Analyze the results of previous marketing efforts during ROI analysis.
2. Examine the external environment, including competition and opportunities.
3. Reallocate marketing resources to take advantage of new opportunities.
4. Ensure that each marketing activity is transparent and accountable.

Arduino

Arduino is a programming platform for building interactive objects and environments. It interacts with both virtual and physical links. Arduino can be used to convert virtual signals and algorithms into physical movements or operations in the technologies.

Arduino can be used to build headband connections with different virtual algorithms in mind reading technology. With the use of a joystick, Arduino can assist in displaying physical output. The computer can transmit commands to Arduino, and the object will respond appropriately, i.e. Arduino will serve as a link between computer algorithms and physical output. [5]

IV. APPLICATIONS

- Mind-controlled Wheelchair:

Wheelchair is a mind-controlled wheelchair designed for physically handicapped people. This works on Human-Computer Interface. People use this wheelchair to help them move about independently. When a person thinks about moving around, this mind-controlled wheel chair maps brain waves. An electric wheelchair, a Laptop/PC, an Arduino, an interface circuit, and an electroencephalogram (EEG) headset are all part of this system. The user wears the EEG headset on his or her forehead. Wireless communication exists between the headset and the PC. This headset monitors brain impulses that reach the scalp and transfers the message to the microcontroller via neural waves, allowing the user's mental process to be detected. The computer system will use Arduino and joystick to manage wheelchair motions, comparable to self-driving cars

- Futuristic Headband:

The mind Reading techniques read the person's mental condition. This can be done by observing his facial expression and behaviour, such as if he is joyful or worried. Not only can humans read people's minds, but it's also possible for machines to do so. Face

expression analysis through a futuristic headband can be used to read people's minds. FNIRS is used to monitor the volume and oxygen level surrounding the Brain of a person wearing a headband (functional near infrared spectroscopy). When a user wears a headband, light is transmitted into the brain's tissues, where it is absorbed by active blood-filled tissues. The headband the determines how much light is absorbed or not absorbed. The results are compared to data from FMRI. The data is then processed for future use. [13][14]

- Brain-computer interface:

In brain-controlled interfaces, EEG and fMRI can enable disabled patients as well as "Locked-in" individuals to engage with the world.

- Pain Detection:

fMRI can be used to predict the subjective pain ratings of subjects.

- Lie detection:

With the use of all these technologies, we can quickly figure out what's going on in someone's head, which can aid in lie detection. It is also becoming easier to detect crimes

- Web search is also one of the important applications of mind reading.
- Future research and pattern analysis:

fMRI data can be employed in pattern-classification algorithms to decode the exact information represented in a patient's brain at any given instance. Mind reading can also allow you to play games without using a mouse, keyboard, or joystick.

V. CONCLUSION

We get a brief overview of approaches such as fMRI for graphical representation of internal brain movements, EEG for monitoring and mapping electrical activities of the brain, SVM algorithm for data pre-processing, and Arduino for virtual to physical machine connectivity during this study.

All of these approaches are applied in a variety of applications, including a mind-controlled wheelchair. Users put on a futuristic headband that sends brain signals, which are then translated into physical movements. Researchers are also working on self-driving cars, web search, and other technologies. [2][6]

To improve inference, current Cambridge initiatives are examining other inputs such as body posture and gestures. This research may also be applied to control the animation of cartoon avatars using the same models. Mindreading is also being investigated as a way to support online commerce and learning systems, according to researchers.

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