IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, June 2022
Impact Factor: 6.252

Importance of MIND Reading Computer – An Overview

Krishnapriya K. J[1] and Dr. Kurian M. J[2]
Student, B. P. C. College Piravom, Kerala[1]
Associate Professor, B. P. College, Piravom, Kerala[2]

Abstract: *Drawing the attention of Machine Learning, Psychology and Computer Creativity, the researchers at University of Cambridge have developed Mind Reading Computers to infer the mental states of human beings from the expressions or signals of the face. It is mainly for the smoothening of man-machine communication and to improve their productivity without waiting for explicit input from the human beings. The model represents the mental state expressed in the face, combined with analysis of facial expression, head gestures and eye movement. This paper revels the ways by which system might predicts the mental state by Facial Expression Analysis (FEA) and Futuristic Headband. The pros and cons of mind reading system are also revealed clearly in this paper, which is a motion for researchers and technologists.*

Keywords: Mind Reading Computes, Machine Learning, FEA, Futuristic Headband, EEG, fNIRS, Dynamic Bayesian Networks, etc.

I. INTRODUCTION

With facial expressions, gestures and vocal implication, human beings can express the mental states, like thoughts, emotions and desires every time. Mind reading machine receives the mindset of a person as an input just like mouse or a keyboard receive the input, which is the co-ordination of human psychology and computer technology. The main aim of such a device is to improve the interaction among human beings and computer. With the help of digital video camera, human expressions or signals are recorded in the AI based mind reading computer system processes the mental state of whether the person is in feel of boring or interesting, willing or unwilling, like or dislike, thinking or confusing, which is used for further prediction known as 'Theory of mind reading'. With the advanced complexity of computer technologies and the popularity of mobile phones and wearable devices, there is an unconditional requirement for the machine that are aware of the mind setup of the user and that adaptively respond to their mental states. The ability of mind reading by a computer can provides us many applications in the field of bankruptcy prediction, facial recognition Medical, Crime detection and so on.

II. WHAT IS MIND READING COMPUTER?

Mind reading computer may be defined as the machine that speculates the human mental states. Mind reading is the ability to infer other people's mental state and use that to make sense of and predict their behavior and also to understand both oneself and other gents in terms of beliefs, desires and intentions [8]. Baron-Cohen's mindreading system [5] consists of four modular components, Intentionality Detector(ID), Eye-Detection Director(EDD), Shared Attention Mechanism(SAM),Theory of Mind Mechanism(ToMM) for the implementation. The most difficult task is the understanding of a human's thoughts and feelings.

None of them clearly knows what a person would do in the next instant by executing his current thoughts, feelings or desires. So, by drawing inspiration from psychology, machine learning through AI, frequent development in computer technology especially in hardware and software, the team in the Computer Laboratory at the University of Cambridge has developed mind-reading machines that could give the answer of all these questions. The goal is to enhance human-computer interaction through empathic responses, to improve the

IJARSCT
ISSN (Online) 2581-9429
ternational Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, June 2022
Impact Factor: 6.252

productivity of the user and to enable applications to initiate interactions with and on behalf of the user, without waiting for explicit input from that user.

Machine learning-based analysis of human functional magnetic resonance imaging (fMRI) patterns has enabled many discoveries. The application of computer vision in neuroscience has also led to many approaches that have given us insights about how the brain works and how it carries out its functions. Research coming out of Kyoto University has shown that careful analysis of functional magnetic resonance imaging (fMRI) can enable the visualisation of perceptual content in our brain. In a way the research shows that we can project images from our brains analyzing fMRI images.

The neuroscientists in research present a novel image reconstruction method, in which the pixel values of an image are optimized to make it a deep neural network (DNN) features similar to those decoded from human brain activity at multiple layers. The researchers identified that hierarchical visual information in the brain can be effectively combined to reconstruct perceptual and subjective images.

III. RELEVANCE OF MIND READING COMPUTER

The main aim of Mind reading computers is to help those persons who cannot speech properly due to some diseases but their feeling can be read from the facial expression or eye movement or lips movements. It also involves the head movements of a person. The accurate and perfect detection of 24 facial features like eyebrows, eyes, mouth and nose which are landmark surrounding facial components is essential in applications like face recognition, face tracking, criminal identification, security and surveillance systems, Human computer interaction(HCI), model-based video coding. Consider the case of the identification of the smile and raised eyebrows of a person, the movement, shape, and color changes are monitored. All these combinations help a mind-reading computer to know the mental state of a person. In the modern era, all leading car manufacturers are forced to implement this system in their products to detect driver mental states like anger, distraction and drowsiness. It is also used to identify the health condition of human being by considering the thoughts and feelings.

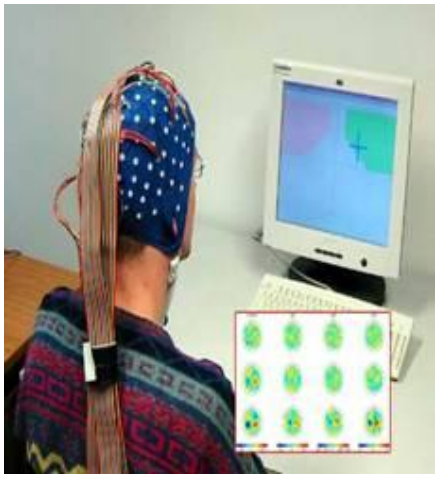

Figure 1

The mind-reading computer system may also be used to monitor and suggest improvements in human- human interaction. The Affective Computing Group at the MIT Media Laboratory is developing an emotional-social intelligence prosthesis that explores new technologies to augment and improve people's social interactions and communication skills.

IV.TECHNOLOGY AND WORKING OF MIND READING

The mind reading actually involves measuring the volume and oxygen level of the blood around the subject's brain, using technology called functional near-infrared spectroscopy (fNIRS).

IJARSCT
ISSN (Online) 2581-9429
ternational Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, June 2022
Impact Factor: 6.252

The neurotechnology of today cannot decode thoughts or emotions. But with artificial intelligence, that might not be necessary. Powerful machine learning systems could make correlations between brain activity and external circumstances.

Futuristic Head: The futuristic head is responsible for measuring the blood and oxygen levels around a person's brain using a method called spectroscopy. The light is emitted by the futuristic head. The head calculates the light that the human head was unable to absorb thereby giving it a sense of the metabolic needs of the human brain. A chip is installed in both the right and left brain that allows data transfer between the brains and also is a way of storing data for the long term.

Preliminary outputs show that using button size sensors, which are attached under the chin and on the side of the Adam's apple, it is possible to pick up and recognize the nerve signals and patterns from the tongue and vocal cords that correspond to specific words

Brain Chip: It is a processor with a connection to the neurocomputer. It contains data about the sensory information and thoughts of a person. It is inserted in the brain of a person to control his/her thoughts and movements.Brain-chip-interfaces (BCHIs) are hybrid entities where chips and nerve cells establish a close physical interaction allowing the transfer of information in one or both directions. Most of the people relay on an external artificial intelligence system and a wireless neural connection [4].

For mind reading to work, FNIRS or functional Near-Infrared Spectroscopy is utilized. This technology measures the amount of blood in the human brain. It also takes into account the oxygen level in the brain. The people whose minds are to be read are given head gears and are asked to do simple tasks such as basic maths etc. to know their brain functioning. The headband is studded with lights that are absorbed by the head tissues and get activated. The results of the tests ate correlated with the MRI scans. The person would then be asked to rate the level of complexity of the task and all such data would be noted and analyzed.

Software from Neven vision identifies 24 feature points on the face and tracks them in real time. Movement, shape and colour are then analyzed to identify gestures like a smile or eyebrows being raised. Combinations of these occurring over time indicate mental states. For example, a combination of a head nod, with a smile and eyebrows raised might mean interest. The relationship between observable head and facial displays and the corresponding hidden mental states over time is modelled using Dynamic Bayesian Networks

Visualization: Greatest Challenge of Neuroscience

The externalization and visualization of states of the mind is a challenging goal in neuroscience. Although decoding and encoding methods that could render human brain activity into images existed, they were not very effective. But those methods were essentially limited to image reconstruction with low level image bases, hence failing to combine visual features of multiple hierarchical levels.

The researchers present a novel approach, named deep image reconstruction, to visualize perceptual content from human brain activity. The researchers combined the feature decoding from fMRI signals and the methods for image generation recently developed in machine learning. The reconstruction algorithm starts from a random image and iteratively optimise the pixel values so that the DNN features of the input image become similar to those decoded from brain activity across multiple DNN layers.

In this process the resulting optimized image is taken as the reconstruction from the brain activity. There was also a deep generator network (DGN) as a prior to make reconstructed images similar to natural images. The decoders are trained to predict DNN features of viewed images from fMRI activity.

Stages of Experiments

1. Training natural image sessions,
2. Test natural image sessions,
3. Geometric-shape sessions
4. Alphabetic-letter sessions
5. Mental-imagery sessions

IJARSCT
ISSN (Online) 2581-9429
ternational Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, June 2022
Impact Factor: 6.252

A Computational Model of Mind Reading

The goal is to enhance the human-computer interaction through compassionate responses, to improve the productivity of the user and to enable the applications to initiate interactions with and on behalf of the user, without waiting for an input from that user.

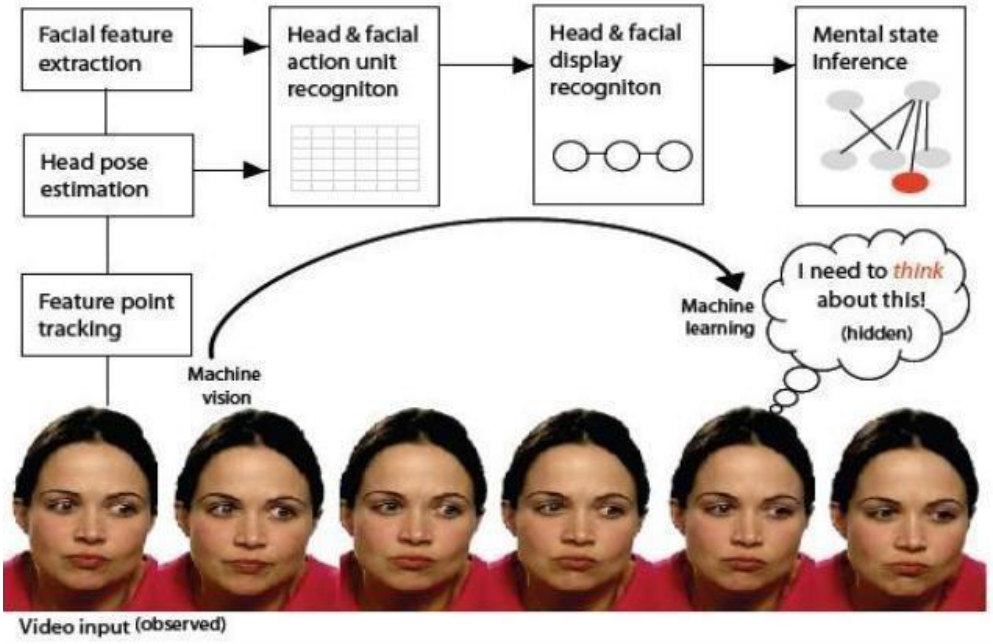

Figure 2[3]

An electroencephalogram (EEG), a device used by the medical researchers to pick up electrical currents from the various parts of the brain.

Functional near-infrared spectroscopy (fNIRS) Technology, which measures the volume and an oxygen level of the blood around the subject's brain. Futuristic head band that sends light into the tissues of the head where, it is absorbed by the active, blood-filled tissues and then it measures how much light was not absorbed. NASA has developed the computer program which can read silently spoken words by analyzing the nerve signals in our throats and mouth. Just the slightest movement in the Voice box and tongue is enough to work. Initially scientists trained the software program to recognize the six words-including go, left, right and 10 numbers. Participants hooked up to the sensors silently, said the words to themselves and the software correctly picked up the signals 92% of the time.

Mind Reading Computer uses the following two approaches

1. Bio Feedback: In this process an individual can learn how to change the physiological activity for purposes of improving the health and performance. Accurate instruments measure the physiological activity such as skin temperature, heart function brainwaves, breathing and muscle activity. These instruments give rapidly and accurately 'feedback' information to user. A subject is connected to an electroencephalograph (EEG) and particular groups of brain signals are monitored.The cons of biofeedback is that the training period can stretch to long duration approximately around the months, and the results can be changed between subjects and the tasks which they try to perform.
2. Stimulus and Response: When a subject is given a certain stimulus, the brain will automatically produce a measurable response so there is no need to train the subject to manipulate the specific brain waves.

IJARSCT
ISSN (Online) 2581-9429
ternational Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, June 2022
Impact Factor: 6.252

V. ARCHITECTURE OF MIND READING

It integrates an automated eye language interpreter and a theory of mind model to enable the recognition and prediction of the user's mental state.

Eye Language Interpreter: The eye language interpreter involves the use of technology to understand what the mental states are with respect to the eye expressions. Baron-Cohen's research on a Language of Eyes [6] to develop an automated eye language interpreter that recognizes eye expressions of image sequences and interprets them a mental state. Facial Action Coding System (FACS) [7] to identify expression of the eye is used to further enhance the understanding of the mental state. This uses facial expressions to know that a person is either happy or sad and knows even other emotions are recorded by this system

The Mind reading System: This comprises 4 parts[5]

a) The Intentionality Detector (ID) is a component of the Mind reading system. This is used to detect the intentions of a person with respect to his/her goals or desires.
b) Eye-Direction Detector (EDD) is a system that calculates information about the stimuli and knows if the human eye is looking at it or not.
c) Shared Attention Mechanism (SAM) is used to know the joint action behaviors. It also is the connector between the ID and the EDD.
d) Theory of Mind Mechanism (ToMM) involves the use of everyday tasks and makes theories for humans on the basis of such activities.

Automated Facial Feature Analysis: To enable the Eye Language Interpreter system, another system was required to be called the Automated Facial Feature Analysis system. This system is under development. It would involve the comparison of changes in facial expressions with respect to the frames to know the mental state of the person

The model represents this at different granularities, starting with the Face and Head movements and building them in time & in space to form an effective and clearer model of what mental state is being represented. Color, Movement and Shape are then analyzed to identify the gestures like a smile or eyebrows being raised. Combinations of all these gestures occurring over time indicate the different mental states.For example, a combination of a head nod, with a smile and eyebrows raised might mean interest. The relationship between observable head and facial displays the corresponding hidden mental states over time and is modelled using the Dynamic Bayesian Networks.

VI.METHOD OF MIND READING

Facial Affect Detection: It is done using the hidden Markov Model, Active Appearance Model or Neural Network processing as in figure 3.

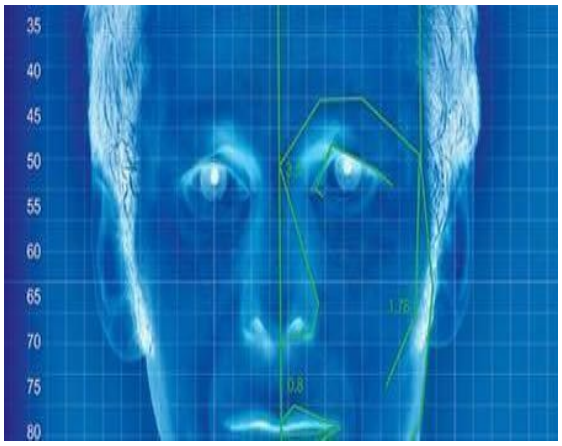

Figure 3[3]

IJARSCT
ISSN (Online) 2581-9429
ternational Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, June 2022
Impact Factor: 6.252

Emotional Classification: This Classification was done by Paul Ekman.The emotions include in this classification are Happiness,Sadness, Surprise, Anger, Fear, Disgust as in Figure 4.

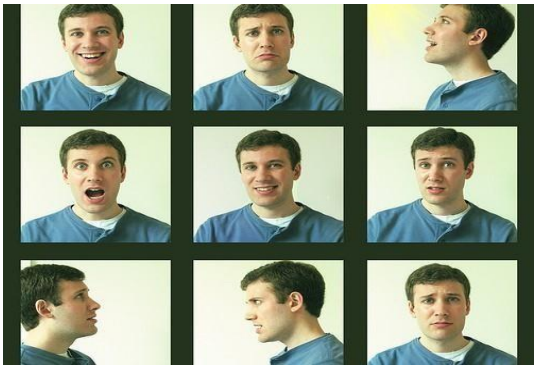

Figure 4[3]

Facial Electromyography: This technique is used to measure electrical activity of the facial muscles. Muscles used are "corrugator supercilii muscle", which are two small, triangular facial muscles, which contribute to movement of the eyebrows, including frowning, and others as figure 5.

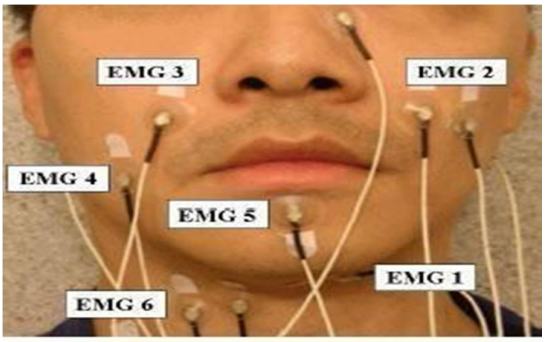

Figure 5[3]

Galvanic Skin Response: It is a measure of skin conductivity, which is dependent on how moist the skin is.

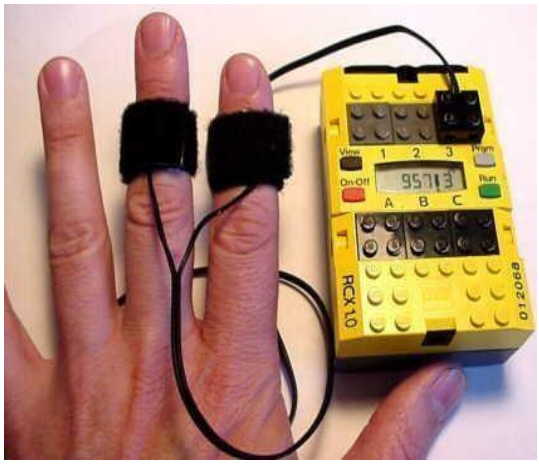

Figure 6[3]

Blood Volume Pulse:It is measured by a process called photoplethysmography. It produces a graph indicating blood flow through the extremities as in figure 7.

IJARSCT
ISSN (Online) 2581-9429
ternational Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, June 2022
Impact Factor: 6.252

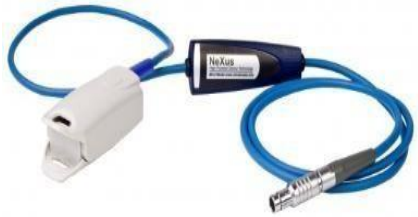

Figure 7[3]

VII. ADVANTAGES ANDDISADVANTAGES OF MIND READING COMPUTER

Advantages:

- Mindset of person can be easily read by computer.
- Brain reading computer can help handicapped persons, paralyzed patients, comma patients & mute
- Can be used for mind gaming, robotics, military field and sting operation
- Used for mind gaming, robotics,etc.
- Eliminate the capability of persons toile
- Used for the interaction within virtual environment.
- The mind-reading system can help banking sector to identify bankrupt.
- Helpful to court for correct judgment by knowing the statement presented by the witness.
- Moreover, it is very much helpful for the sooth running of the society.

Disadvantages:

- Only 70 % accuracy was achieved through Using computer algorithms and functional magnetic resonance imaging (fMRI).
- Individual brain differs, so scientists need to study a subject's pattern before they can train a computer to identify those patterns or make prediction.
- This system might breach the confidentiality of a person.
- The mind-reading system can be outright dangerous if handled carelessly or with vile intentions. It can be used by terrorists to know the secret information of an enemy country.
- Since human brain is super complex,It is never possible to know the complete information with 100% accuracy.

VIII. FUTURE ASPECTS OF MIND READING

Automobile industries especially car industry is being researched in field of mind reading technology. The system would know the driver's mindset be fit for driving or not. Meanwhile such development will help the public with disability of unable to speak or paralysed.

IX.CONCLUSION

This paper reveals the scope of research and need for the mind reading system in forthcoming era. It is aninference system for people's mental state and make use to predict their behavior. Since mind reading system is a part machine learning, it will be a motivation to the students, researchers, technologists and manufactures.

REFERENCES

[1] Mindreading Computers –the free encyclopedia

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, June 2022
Impact Factor: 6.252

[2] Komal Tomar, "How Mind reading computer works and how it is useful in different working Areas? International Journal of Computer Applications Technology and Research, ISSN:2119-8656,Volume-3-Issue5, 505-509, 2014.
[3] Aarli,Renuka, "Mind reading Computer ", International Journal of Engineering Research & Technology, ISSN 2278-0181,special issue 2017.
[4] Mindtech Sweden, Mind control mind Computer.
[5] Baron-Cohen S,1994. "How to build a baby that can read minds: cognitive Mechanism in mindreading", Current Psychology of Cognition13(5):513-552.
[6] Baron-Cohen S,Wheelwright, S and Jolliffe.T, 1997, Is There a "Language of the Eyes?" Evidence from Normal Audults, and Adults with Austism or Asperger Syndrome, Visual Cognition4 (3): 311-331.
[7] Ekman P and Friesen. W 1978,Facial Action Coding System: A Technique for the measurement of facial movement. Consulting Psychologists Press.
[8] Paul bello,2012, Cognitive Foundation for Computational Theory of Mindreading.
[9] M. Pantic and L.Rothkrantz. "Expert system for automatic analysis of facial expressions", Image and Vision Computing18:881-905,2000.
[10] P, Ekman and W.Friesen. "Facial action coding system: A technique for the measurement of facial movement". Consulting Psychologists Press., 1978.
[11] S.Baron-Cohen and T.ah.E. Tead. Mind reading: The Interactive Guide to emotion, 2003.
[12] Generation of a Vision-Based Computational Model of Mind- Reading Rana elKaliouby and Peter Robinson Computer Laboratory, University of Cambridge,15, J J Thomson Avenue, Cambridge, UK CB3 0FD.