MIND READING COMPUTER TECHNOLOGY: A DETAILED STUDY

Anitha Thampy[1], Shyma Kareem[2]

[1]*Student, Master of Computer Application, Dept of CSE, Musaliar College of Engineering and Technology*
[2]*Asso. Professor, Dept of CSE, Musaliar College of Engineering and Technology*

---***---

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. Mind is an abstract entity; which consists of sensations, emotions, feelings, desires, intentions etc. Mind reading is a way to detect or predict a person's mental states. The technology is based on the ability to read human mind with the use of computers. These computers analyze human brain to infer what it is trying to convey. It provides an effective way to blend human mind and the computers. The simplest way for mind reading can be done by simply looking and understanding the facial expressions. For example the smile can give us an expression of happiness. But now a day, it may be possible that not only one people can understand the other's mental state but also a computer might understand the mental states of the people. Here describes the ways how a computer might speculate the mental state of a human and thus becomes the mind reading computer. This emphasizes on the ways by which a computer might speculate the mental state.*

Key Words: Mind reading, Facial affect detection, Facial electromyography, Electroencephalography, Galvanic Skin response, Futuristic headband.

1. INTRODUCTION

People express their mental states; like emotions, thoughts, and desires, all the time through facial expressions, vocal nuances and gestures etc. this is often true even once they are interacting with computers also as humans. Our mental states shape the choices that we make, govern how we communicate with others and affect our overall performance. The power to infer mental states to others from their behavior and to use that knowledge to guide our own actions and predict those of others is understood as **theory of mind** or **mind reading.** A computer may wait indefinitely for input from a user who is not any longer there, or plan to do irrelevant tasks while user is frantically working towards an imminent deadline. As a result, existing computer technologies often disappoint the user, have little effective power and can't begin interactions with the user. They are doing take the initiative, just like the retired Microsoft Paperclip, they're often misguided and irrelevant, and easily frustrate the user. With the increasing complexity of technology and therefore the omnipresence of mobile and wearable devices and there's a requirement for machines that are conscious of the user's psychological state which adaptively answer these mental states [1].

A theory of mind may be a representational set of abilities that permits one to read the mind. It's the power to attribute mental states of others, and use that to predict the actions and expressions of others within an intentional or goal-directed framework (Dennett in [2] refers thereto because the intentional stance). Facial movements and eye language especially play an important role in recognizing basic emotions (such as happiness, sadness, disgust and fear) also as "cognitive" or complex mental states (such as distrust, recognize, scheme, admire, interest, thoughtfulness etc.)[3]. Employing a digital video camera, the mind-reading computing system analyses an individual's facial features in real time and infers that person's underlying psychological state , like whether he or she is agreeing or disagreeing, interested or bored, thinking or confused. Prior knowledge of how particular mental states are expressed within the face is combined with analysis of facial expressions and head gestures occurring in real time. The model represents these at different granularities, starting with face and head movements and building those in time and in space to make a clearer model of what psychological state is being represented. Software from Neven vision identifies 24 feature points on the face and tracks them in real time. Movement, shape and colour are then analysed to spot gestures sort of a smile or eyebrows being raised. Combinations of those occurring over time indicate mental states. For instance, a mixture of a head nod, with a smile and eyebrows raised might mean interest. The connection between observable head and facial displays and therefore the corresponding hidden mental states over time is modelled using Dynamic Bayesian Networks. Current projects in Cambridge are considering further inputs like body posture and gestures to enhance the inference. We will then use equivalent models to regulate the animation of cartoon avatars. We also are watching the utilization of mind-reading to support on line shopping and learning systems. The mind-reading computing system can also be wont to monitor and suggest improvements in human interaction [4].

1.1 Definition of Mind Reading

Mind reading may be defined as inferring of the human thoughts emotions and desires, etc. The simplest method

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

of mind reading is by simple understanding the facial expression given by the person as people express their mental states mostly through facial expression and gesture. Using a digital video camera the mind reading computing system analyses an individual's countenance in real time and infers that persons underlying psychological state.

A Computational Model of Mind Reading

The goal is to reinforce the human-computer interaction through compassionate responses, to increase 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.

The model represents these 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. Colour, Movement and Shape are then analysed to identify the gestures like a smile or eyebrows being raised. Combinations of all these gestures occurring over time indicate the various mental states. For example, a mixture of head nods, with a smile and eyebrows raised might mean interest.

2. TECHNIQUES USED IN MIND READING COMPUTER

2.1 Facial Affect Detection

Face detection or facial affect detection may be a technology getting used during a sort of applications that identifies human faces in digital images. Face detection also refers to the psychological process by which humans locate and attend the faces during a visual scene.

Face detection are often considered a selected case of object-class detection. In object-class detection, the task is to seek out the locations and sizes of all objects in a picture that belong to a given class. Face-detection algorithms specialise in the detection of frontal human faces. It's analogous to image detection during which the image of an individual is matched bit by bit. Image matches with the image stores in database. Any facial feature changes within the database will invalidate the matching process. Firstly, the possible human eye regions are detected by testing all the valley regions within the grey-level image. Then the genetic algorithm is employed to get all the possible face regions which include the eyebrows, the iris, the nostril and therefore the mouth corners. Each possible face candidate is normalized to scale back both the lighting effect, which is caused by uneven illumination; and therefore the shirring effect, which is thanks to head movement. The fitness value of every candidate is measured supported its projection on the Eigen faces [5]. After variety of iterations, all the face candidates with a high fitness value are selected for further verification. At this stage, the face symmetry is measured and therefore the existence of the various countenances is verified for every face candidate. It's done using the hidden Markov Model [6], Active Appearance Model [7].

2.2 Emotion Classification

Emotion classification, means by which one may classify one emotion from another, is a contested issue in emotion research and in affective science. Researchers have approached the classification of these emotions from one of two fundamental viewpoints:

1. that emotions are discrete and fundamentally various constructs
2. that emotions can be distinguished on a dimensional basis in groupings

This Classification was done by Paul Ekman [8]. The emotions include in this classification are Happiness, Sadness, Surprise, Anger, Disgust etc.

2.3 Facial Electromyography

Facial electromyography (fEMG) means to an electromyography (EMG) technique which measures muscle activity by infering and amplifying the small electrical impulses that are generated by the muscle fibers when they contract. When we generate a movement, an electrical action potential passes from the brain down the spinal cord, to specially-designated motor neurons. These motor neurons release acetylcholine into the neuromuscular junction, causing the ejection of calcium ions within the muscle. This calcium influx causes the sliding of motor filaments, actin and myosin, which shortens muscle cells and causes the muscle contraction. Similar to other passive recording tools like electrocardiography (ECG) or electroencephalography (EEG), we can observe this complex electrical activity by placing electrodes on the surface of the skin above the muscle fibers. By measuring this electrical activity, we can get a sense of when a muscle is activated, as well as the strength of that contraction. Facial EMG, specifically, pertains to electromyography that is specific to the muscles of the face. Facial EMG has a wide variety of uses in the medical field, particularly in movement and rehabilitation research pertaining to neuromuscular diseases like ALS, Parkinson's disease and stroke. Facial EMG has also been utilized in emotion studies with individuals with Autism. More recently, facial EMG has increasing uses in marketing research, gaming and VR. Facial EMG is additionally commonly utilized in web usability studies, marketing research and human factors research, as they supply sensitive measures of valence which may not be picked up using webcam-based methods [9].

2.4 Galvanic Skin Response

The Galvanic Skin Response (GSR), also named Electro Dermal Activity (EDA) and Skin Conductance (SC), is that the measure of the continual variations with in the electrical characteristics of the skin, as an example the conductance, caused by the variation of the physical body sweating. The normal theory of the GSR analysis is predicated on the assumption that skin resistance varies with the state of sweat glands in the skin. Human body sweating is regulated by the Autonomic Nervous System (ANS). Especially, if the sympathetic branch (SNS) of the autonomic nervous system is very aroused, which successively and the other way around. In this way, skin conductance is a measure of the human Sympathetic Nervous System responses. Such system is directly involved with in the emotional behavioral regulations with in the humans. The GSR signal is extremely easy to record: generally just two electrodes put at the second and third finger of one hand are necessary. The variation of a low-voltage applied between the two electrodes is employed as measure of the EDA. Recently, new commercial healthcare devices more and more wearable and fancy (bracelets, watches) are developed, thus such measure is usable in each research activity within the neuroscience domain also in no-laboratory settings [10].

2.5 Blood Volume Pulse

The blood volume pulse (BVP) is used as a method of measuring the heart beat rate and is embedded in lots of heart rate variability (HRV) biofeedback training systems and Applications. The BVP measures heart rate based on the amount of blood that passes through the tissues in a localized area with each pulse of the heart. Wherever there is easy access to a pulse there is a potential measurement site - but usually the pads of the fingers or the earlobes are commonly used. BVP measurement is obtained by the use of a photoplethysmography (PPG) sensor. This component measures variations in blood volume in the arteries and capillaries that correspond to variations in the heart rate and blood flow. The PPG sensor detects changes by shining an infrared light, typically via a light-emitting diode (LED), onto the surface of the body. This light is transmitted through the tissues, then backscattered and reflected by the tissue before reaching the photo detector of the PPG sensor. The technology works because red light is selectively captured by the hemoglobin of the red blood cells and reflected by the other tissues. The amount of light that returns to the PPG photo detector is proportional to the relative volume of blood present in the tissue.

3. WORKING

The mind reading actually involves measuring the quantity and oxygen level of the blood round the subject's brain, using technology called functional near-infrared spectroscopy (fNIRS). The user wears a kind of futuristic headband that sends light therein spectrum into the tissues of the top where it's absorbed by active, blood-filled tissues. The scarf then measures v what proportion light wasn't absorbed, letting the pc gauge the metabolic demands that the brain is making. The results are often compared to an MRI, but are often gathered with lightweight, non-invasive equipment. Wearing the fNIRS sensor, experimental subjects were asked to count the amount of squares on a rotating onscreen cube and to perform other tasks. The themes were then asked to rate the problem of the tasks, and their ratings agreed with the work intensity detected by the fNIRS system up to 83 percentage of the time. The actual area of the brain where the blood-flow change occurs should provide indications of the brain's metabolic changes and by extension workload, which might be a proxy for emotions like frustration. "Measuring mental workload, frustration and distraction is usually limited to qualitatively observing computer users or to administering surveys after completion of a task, potentially missing valuable insight into the users' changing experiences. NASA has developed the pc program which may read silently spoken words by analysing the nerve signals in our throats and mouth [11]. Just the slightest movement within the larynx and tongue is enough to figure. Initially scientists trained the software program to acknowledge the six words-including go, left, right and 10 numbers. Participants attached to the sensors silently, said the words to themselves and therefore the software correctly picked up the signals 92% of the time.

3.1 Futuristic Headband

The user wears a futuristic headband that sends the light in that spectrum into the tissues of the head where it is absorbed by active, blood-filled tissues. The headband after measures amount of light was not absorbed, letting the computer gauge the metabolic demands that the brain is making.

The results are then compared to an MRI, but can be collected with lightweight, non-invasive equipment. When user wears the fNIRS sensor then an experimental subjects were asked to count the number of squares on a rotating onscreen cube and to perform some other tasks that are necessary. The subjects were then asked to rate the complexity of the tasks, and their ratings agreed with the work intensity detected by the fNIRS system up to 83 percent of the time. 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.

Mind Reading Computer involves 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 instrument measures the physiological activity such as skin temperature, heart function brainwaves, breathing and muscle activity. These instruments gives 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 are 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.

Electroencephalography

Electroencephalography (EEG) is a type of electrophysiological monitoring technique to record electrical activities of the brain. It is typically non-invasive, with the electrodes placed outside the scalp, although invasive electrodes are sometimes used, as in electrocorticography. EEG measures voltage variations resulting from ionic current within the neurons of the brain. Clinically, EEG means the recording of the brain's spontaneous electrical activity over a period of time, as recorded from multiple electrodes placed on the scalp. Diagnostic mainly focus either on event-related potentials or on the spectral content of EEG. The former investigates potential fluctuations time locked to an occasion, like 'stimulus onset' or 'button press'. Later analyses the sort of neural oscillations which will be observed in EEG signals within the frequency domain. EEG is most frequently wont to diagnose epilepsy, which causes abnormalities in EEG readings. It is also used to diagnose sleep disorders, depth of anaesthesia, coma, encephalopathy and brain death. EEG won't to be a primary technique of diagnosis for tumors, stroke and other brain disorders, but this use has decreased with the introduction of high-resolution anatomical imaging techniques such as resonance imaging (MRI) and computerized tomography (CT). It is one among the few mobile techniques available and offers millisecond-range temporal resolution which isn't possible with CT, PET or MRI. Derivatives of the EEG technique include evoked potentials (EP), which involves minimizing the EEG activity time-locked to the presentation of a stimulus of some kind. Event-related potentials (ERPs) means averaged EEG responses that are time-locked to more complicated processing of stimuli.

3.2 Web Search

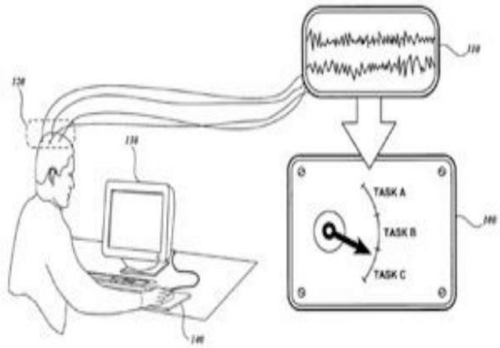

Fig -1: Web search using mind reading computer

When the primary test of sensors were performed scientists trained the software program to acknowledge only the words which are "go", "left" and "right" and 10 numbers. The Researchers put the letters of the alphabet into a matrix with each column and row named with a single-digit number therein way, each letter was represented by a singular pair of number co-ordinates. These were wont to silently spell "NASA" into an internet program using the program. "This proved we could browse the online without touching a keyboard".

3.3 Algorithms

Algorithms can be used to implement the mind reading system includes LDA, k-NN, SVM, Decision Tree Algorithm

3.3.1 Linear Discriminant Analysis

Linear Discriminant Analysis (Normal Discriminant Analysis or Discriminant Function Analysis or LDA) is a type of dimensionality reduction technique which is especially used for the supervised distinguishing problems. It is used for modelling differences in groups i.e. separating two or more classes. It is used to forecast the features in higher dimension space into a lower dimension space.

For example, we have two classes and we need to separate them efficiently. Classes can have multiple features. Using only a single feature to classify them may result in some overlapping as shown in the below figure. So, we will keep on increasing the number of features for proper distinguishing.

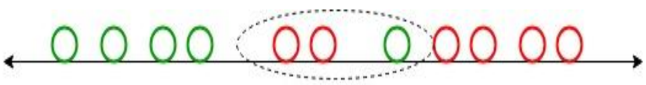

Fig -2: Overlapping

Listed below are the 5 general steps for performing a linear discriminant analysis; we will explore them in more detail in the following sections.

1. Compute the d-dimensional mean vectors for the various classes from the dataset.
2. Calculate the scatter matrices (in-between-class and within-class scatter matrix).
3. Compute the eigenvectors (e1, e2,..., ed) and corresponding eigenvalues (λ1,λ2,..., λd) for the scatter matrices.
4. Sort the eigenvectors by decreasing eigenvalues and choose k eigenvectors with the largest eigenvalues to form a d×k dimensional matrix W(where every column represents an eigenvector).
5. Use this d×k eigenvector matrix to transform the samples onto the new subspace. This can be summarized by the matrix multiplication: Y=X×W (where X is a n×d-dimensional matrix indicating the n samples, and y are the transformed n×k-dimensional samples in the newly formed subspace).

Suppose we have two sets of data points belonging to two different classes that we want to classify. As shown in the given 2D graph, when the data points are plotted on the 2D plane, there's no straight line that can separate the two classes of the data points completely. Hence, in this case, LDA (Linear Discriminant Analysis) is used which reduces the 2D graph into a 1D graph in order to maximize the separability between the two classes.

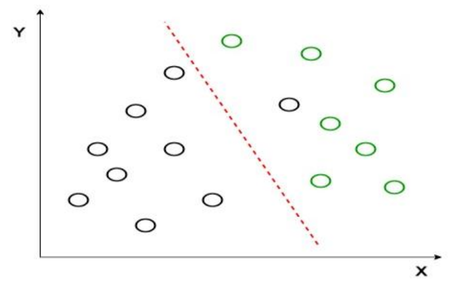

Fig -3: Linear separation of two different classes

Here, Linear Discriminant Analysis uses both the axes (X and Y) to create a new axis and projects data onto a new axis in a way to maximize the separation of the two categories and hence, reducing the 2D graph into a 1D graph.

Two criteria are used by LDA to create a new axis:

1. Maximize the distance between means of the two classes.

2. Minimize the variation within each class.

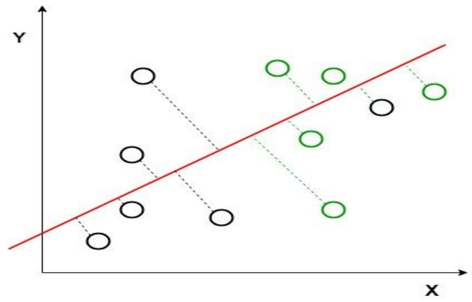

Fig -4: Finding variation

In the above graph, it can be seen that a new axis (in red) is generated and plotted in the 2D graph such that it maximizes the distance between the means of the two classes and minimizes the variation within each class. In simple terms, this newly generated axis increases the separation between the data points of the two classes. After generating this new axis using the above-mentioned criteria, all the data points of the classes are plotted on this new axis and are shown in the figure given below.

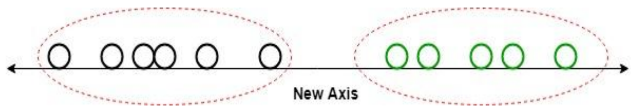

Fig -5: New axis with greatest separation

Linear Discriminant Analysis fails when the mean of the distributions are shared, as it becomes impossible for LDA to find a new axis that makes both the classes linearly separable. In such cases, we use non-linear discriminant analysis [16].

3.3.2 K-Nearest Neighbor Algorithm

K-Nearest Neighbor Algorithm (KNN) algorithm is a stable and efficient method of classification based on examples. KNN are often used for both classification and regression predictive problems. However, it is more widely used in classification problems in the industry [17]. The k-NN algorithm gets its name from the fact that it uses information about an example's k-nearest neighbors to classify unlabelled examples. The letter *k* is a variable term implying that any number of nearest neighbors could be used. After choosing *k*, the algorithm requires a training dataset made up of examples that have been classified into several categories, as labelled by a nominal variable. Then, for each unlabelled record in the test dataset, k-NN identifies *k* records in the training data that are the "nearest" in similarity. The unlabeled test instance is assigned the class of the majority of the k nearest neighbors [18].

The KNN Algorithm

1. Load the data

2. Initialize K to your already chosen number of neighbors

3. For each example in the actual data

3.1 Calculate the space between the query example and therefore the current example from the actual data.

3.2 Add the space and therefore the index of the example to an ordered collection

4. Sort the ordered collection of distances or spaces and indices from smallest to largest (in ascending order) by the distances.

5. Pick the primary K entries from the sorted collection

6. Get the labels of the chosen K entries

7. If regression, return the mean of the labels of choosed K entries.

8. If classification, return the mode of the labels choosed K entries.

Choosing the right value for K

To select the K that's right for your data, we run the KNN algorithm several times with different values of K and choose the K that reduces the amount of errors we encounter. While maintaining the algorithm's ability to accurately make predictions when it's given data it hasn't seen before.

Here are some things to keep in mind:

1. As we decrease the value of K to 1, our predictions become less stable. Just think for a moment, imagine K=1 and that we have a question point surrounded by several reds and one green (I'm brooding about the highest left corner of the coloured plot above), but the green is the single nearest neighbor. Reasonably, we might think the query point is presumably red, but because K=1, KNN incorrectly predicts that the query point is green.
2. Inversely, as we increase the worth of K, our predictions become more stable thanks to majority voting / averaging, and thus, more likely to form more accurate predictions (up to a certain point). Eventually, we start to witness an increasing number of errors. It is at now we all know we've pushed the worth of K too far.
3. In cases where we are taking a majority vote (e.g. picking the mode in a classification problem) among labels, we usually make K an odd number to have a tiebreaker [19].

3.3.3 Support Vector Machine

A Support Vector Machine (SVM) are often known as a surface that makes a boundary between points of knowledge plotted in multidimensional that represent examples and their feature values. The goal of a SVM is to make a flat boundary called a hyperplane, which divides the space to make fairly homogeneous partitions on either side. SVMs are often adapted to be used with nearly any sort of learning task, including both classification and numeric prediction. Many of the algorithm's key successes have come in pattern recognition. Notable applications include:

• Classification of microarray organic phenomenon data within the field of bioinformatics to spot cancer or other genetic diseases

• Text categorization such as identification of the language used in a document or the classification of documents by subject matter

• The detection of rare yet important events like combustion breakdown, security breaches, or earthquakes

Classification with hyperplanes

As noted previously, SVMs use a boundary called a hyperplane to partition data into groups of comparable class values. For example, the subsequent figure depicts hyperplanes that separate groups of circles and squares in two and three dimensions. Because the circles and squares are often separated perfectly by the line or flat surface, they're said to be linearly separable. SVMs can also be extended to problems where the points are not linearly separable.

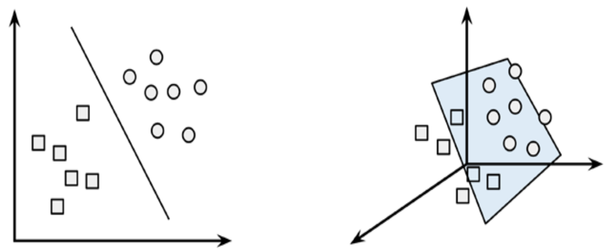

Fig -6: Linearly separable data 2D and 3D

In two dimensions, the task of the SVM algorithm is to spot a line that separates the 2 classes. As shown within the following figure, there's quite one choice of line between the groups of circles and squares. Three such possibilities are labelled a, b, and c.

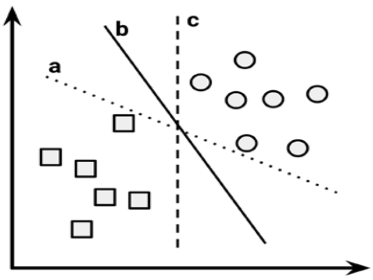

Fig -7: Linearly separable data with 3 hyperplanes

Maximum Margin Hyperplane (MMH) creates the best separation between the 2 classes. Although any of the three lines separating the circles and squares would correctly classify all the info points, it's likely that the road that results in the best separation will generalize the best to the future data. The maximum margin will improve the chance that, in spite of random noise, the points will remain on the correct side of the boundary. The support vectors are the points from each class that are the closest to the MMH; each class must have a minimum of one support vector, but it's possible to have more than one. Using the support vectors alone, it's possible to define the MMH. This is a key feature of SVMs; the support vectors provide a very compact way to store a classification model, even if the number of features is extremely large

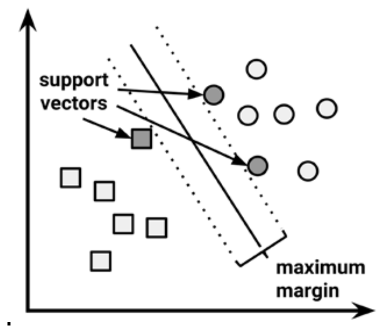

Fig -8: Support vectors

The algorithm to identify the support vectors relies on vector geometry and involves some fairly tricky math that is outside the scope of this book. However, the basic principles of the process are fairly straightforward [18].

3.3.4 Decision Tree Algorithm

Decision tree learners are powerful classifiers, which use a **tree structure** to structurize the relationships among the features and therefore the potential outcomes. A decision tree classifier utilizes a structure of branching decisions, which channel examples into a final predicted class value. To better understand how this works in practice, let's consider the following tree, which predicts whether a job offer should be accepted. A job offer to be considered begins at the basis node, where it's then skilled decision nodes that need choices to be made supported the attributes of the job. These choices split the info across branches that indicate potential outcomes of a choice, depicted here as yes or no outcomes, though in some cases there could also be more than two possibilities. In the case a final decision can be made, the tree is terminated by leaf nodes (also known as terminal nodes) that denote the action to be taken as the result of the series of decisions. In the case of a predictive model, the leaf nodes provide the expected result given the series of events within the tree. In Decision Tree the main challenge is to identification of the attribute for the basis node in each level. This process is known as attribute selection. We have two popular attribute selection measures:

a) Information Gain, b) Gini Index

a) Information Gain

When we use a node during a decision tree, to partition the training instances into smaller subsets the entropy changes. Information gain is a measure of this change in entropy.

Definition: Suppose S may be a set of instances, A is an attribute, Sv is that the subset of S with A = v, and Values (A) is that the set of all possible values of A, then

$$Gain(S,A) = Entropy(S) - \sum_{ve\ Values(A)} |S_v| / |S| . Entropy(S_v)$$

Entropy

Entropy is the measure of uncertainty of a random variable; it characterizes the impurity of an arbitrary collection of examples. Higher the entropy more the information content. Definition: Consider S is a set of instances, A is an attribute, S_v is the subset of S with A = v, and Values (A) is the set of all possible values of A, then

$$Gain(S,A) = Entropy(S) - \sum_{ve\ Values(A)} |S_v| / |S| . Entropy(S_v)$$

b) Gini Index

- Gini Index is a metric to find out how often a randomly selected element would be incorrectly identified.
- It says that an attribute with lower Gini index should be preferred.
- Sklearn supports “Gini” criteria for Gini Index and by default, it takes “gini” value.
- The Formula for the calculation of the the Gini Index is given below [20]

$$Gini\ Index = 1 - \sum_j P_j^2$$

4. APPLICATIONS

4.1 Mind Controlled Wheelchair

The mind controlled wheelchair was developed by the University of Electro-Communications in Japan. With the power of mind you can move the wheelchair. It can be done by mapping the brain waves when you think about moving forward or backward, left, right and then assigns required actions to a wheelchair command of actually moving forward or backward, left, right.

Fig -9: A man sitting on mind controlled wheel chair

Mind Controlled Wheelchair could be useful for people who are paralyzed, and are not able to control their body parts. The main parts of this wheel chair system include an electrical wheelchair, a laptop pc, an Arduino, an interface circuit, an EEG headset, and a set of ready-made and custom software. The EEG headset, which connects wirelessly to laptop and then allows the operator to simply think "forward" or "left" or "right" to cause the wheelchair to move. The Performance is directly related to practice by the user, better configuration of the software, and good contact made by the EEG electrodes on the scalp of the operator. The interface circuit connects between the Arduino's digital pins and therefore the joystick of the wheelchair. When the Arduino receives a command from the pc, it makes the circuit to "fool" the wheelchair into thinking that the operator or the human has moved the joystick.

4.2 Brain to Vehicle Communication

Autonomous driving has been portrayed as a really hands-off, computer-led concept. Most manufacturers use pictures of individuals reading the newspaper or scrolling through their phone, in cabins with no wheel or pedals, whenever a replacement self-driving concept is released. You may have heard of Vehicle-to-Vehicle or V2V technology, but Nissan calls this new technology Brain-to-Vehicle or B2V technology. It's a driving system that interprets signals from the driver's brain to "make the drive even more exciting and enjoyable". Future vehicles will be both self-driving (autonomous) and manual. Car makers and tech companies from Ford to Google have made huge progress in making fully automated cars a reality - but there are still hurdles to beat. Changing and unpredictable weather can interfere with the car's ability to identify or track moving objects and GPS and AI vision systems can struggle in remote or inaccessible areas. Nissan thinks so called brain-to-vehicle technology will mean a driver's reaction times are sped up, making driving safer and easier. As cars with more autonomous capability make their thanks to the road, Nissan is seeking to capture the eye of these people that aren't able to abandoning of their steering wheels. Nissan Brain-to-Vehicle technology provides the world's first system for real-time detection and analysis of brain activity concerning driving. It includes activity in advance of intentional movement (eg. steering), known as movement-related cortical potential (MRCP), and activity that reveals the variance between what the driver expects and what they are experiencing (eg. car moving too fast for comfort), known as error-related potentials (ErrP). The brainwave activity is measured employing a skullcap worn by the driving force and analyzed and interpreted for immediate implementation by on-board autonomous systems. EEG cap gathers raw data from the driver's brain; the car's artificial intelligence interprets it. The headset contains numerous electrodes that press on the brink of the person's scalp. The prototype cap uses electroencephalography (EEG) to decode thoughts while driving. By anticipating intended movement, systems can engage (turning the wheel or slowing the car) 0.2 to 0.5 seconds faster than the standard human response time, improving reaction times while being largely imperceptible for the driver. The signals produced in the driver's frontal motor cortex are detected using a sensor-equipped EEG headset (futuristic cap). They are then sent to the smart vehicle for processing. By combining that data with the knowledge detected by its own sensors, the car can react to things at hand. "If you're coming to a red light and preparing to brake, the car will assist you by starting to brake 200–500 milliseconds before you're doing. But if you approach a red light and your brain shows no intention of slowing the car down, the car will warn you that the sunshine is red to make sure you've seen it. We all generate different patterns of brain signals, so the vehicle learns from each driver and customize its software. It stores each driver's regular routes, also as their driving habits and elegance, using this information to more accurately anticipates what each driver might do at any time. The brain-machine interface not only makes driving easier, it also creates a more personalized experience, because the car will always be in sync with the drive. Even the car's setting can be transparently adapted to the driver's preferences. For instance, if the driving force has adopted a more relaxed driving style, the interface will detect that the chosen sports mode isn't appropriate and switch the car to a more comfortable setting.

Fig -10: Driving car which uses brain to vehicle communication

4.3 Drowsy Driver Detection

Driver's drowsiness detection is a car safety method which helps to prevent accidents caused by the driver getting drowsy. Various studies have introduced that around 20% of all road accidents are fatigue-related, up to 50% on certain roads. The state of drowsiness can be defined as "a state that cannot be defined as sleepy but an inclination to sleep". This state of mind causes the driver to lose his/her attention from the current scenario and the ability to react against various phenomena. Hence it is very much necessary to take preventive measures to detect the drowsiness of the person on road so as to prevent the road accidents caused by the drowsiness of the driver. Physiological measures use the physiological signals such as Electrocardiogram (ECG), Electromyogram (EMG), Electroencephalogram (EEG), and delectrooculogram (EoG) to detect drowsiness. a smart wearable device named BioHarness, manufactured by Zephyr Technologies, has been introduced. It is a module that enables the capture and transmission of comprehensive e physiological data on the wearer via mobile and fixed data networks. Hence it guarantees to enable genuine remote monitoring of human performance and condition in the real world. This device can be placed closer to the person's chest by wearing a shirt, a strap or a holder when he is driving.

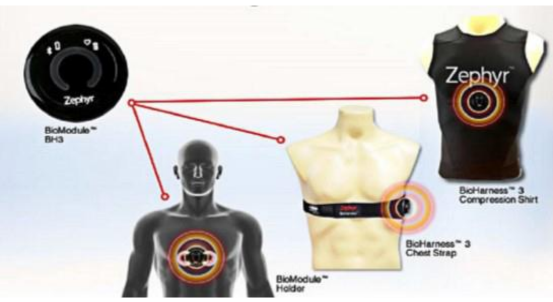

Fig -11: Bioharness

The sensor monitors the physiological parameters and transmits them to the smart phone. The measured data will be processed by the drowsiness detection application on the smart phone. If the processing result is above threshold, a wake up signal will be played to alert the driver.

5. ADVANTAGES

- Computer can read minds.
- Help paralysed patients.
- Help handicapped persons.
- Help comma patients.
- Help people who cannot speak.
- Can be used for military field and sting operation.
- Used for mind gaming, robotics, etc.
- Eliminate the capability of persons to lie.
- For controlling a mechatronic device.

6. DISADVANTAGES

- Breach in privacy.
- Can extract through an individual important, secure and confidential information of another individual, state or even a country.
- If developed or used by sinners can be highly dangerous.
- Eavesdropping.
- No way to neutralise this technology.

7. CONCLUSION

Mind reading is the ability to infer people's mental state and use that to make sense and predict their behaviour. In this paper we had a brief study regarding major aspects of mind reading techniques, applications, result, advantages, disadvantages, etc. IBM says that mind reading computers are no longer from the world. Computer Scientist are biomedical engineers at Tufts University are collaborating to make this a reality someday soon. Thus, the mind reading technology will bring amusing changes in technical fields which will be rather more efficient and useful.

REFERENCES

[1] Aarti, Renuka, "Mind Reading Computer", International Journal of Engineering Research & Technology (IJERT),ISSN: 2278-0181, 2017
[2] Daniel Dennett, "International System Theory", The Intentional Stance, 1987
[3] Baron-Cohen, S., Wheelwright, S., and Jolliffe T, "Is There a Language of the Eyes? Evidence from Normal Adults, and Adults with Autism or Asperger Syndrome", Visual Cognition 4 (3): 311-331, 1997
[4] Komal Tomar, "How Mindreading Computer Work And How It Is Useful In Different Working Areas?", International Journal of Computer Applications Technology and Research Volume 3– Issue 8, 505 - 509,ISSN: 2319–8656, 2014
[5] http://www.scholarpedia.org/article/Eigenfaces

[6] https://medium.com/@kangeugine/hidden-markov-model-7681c22f5b9
[7] https://en.wikipedia.org/wiki/Active_appearance_model
[8] https://www.paulekman.com/wp-content/uploads/2013/07/Basic-Emotions.pdf
[9] https://imotions.com/blog/facial-electromyography/
[10] https://www.brainsigns.com/en/science/s2/technologies/gsr
[11] https://www.newscientist.com/article/dn4795-nasa-develops-mind-reading-system/
[12] Mindreading computers-Wikipedia-the free encyclopedia
[13] Mind reading and the cognitive Architecture underlying Altruistic Motivation by Shawn Nicols
[14] http://1000projects.org.mind-reading-computer-seminar-report.html.
[15] http://seminarprojects.com/Thread-technical-seminar-onmindreadingcomputer.
[16] https://www.geeksforgeeks.org/ml-linear-discriminant-analysis/
[17] https://www.analyticsvidhya.com/blog/2018/03/introduction-k-neighboursalgorithm-clustering
[18] Brett Lantz "Machine Learning with R", Second Edition
[19] https://towardsdatascience.com/machine-learning-basics-with-the-k-nearest-neighbors-algorithm 6a6e71d01761
[20] https://www.geeksforgeeks.org/decision-tree-introduction-example/