**BLIND HUMAN EMOTION RECOGNITION AND PATTERN CLASSIFICATION ALGORITHM TO IDENTIFY VISION IMPAIRED LEARNER**

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Project Proposal Report

(Proposal documentation submitted in partial fulfilment of the requirement for the Degree of Bachelor of Science Special (honors) In Software Engineering)

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Bachelor of Science Special (honors) In Software Engineering

Department of Information Technology

Sri Lanka Institute of information technology

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**DECLARATION**

We declare that this is our own work and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The supervisor/s should certify the proposal report with the following declaration.

The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

Signature of the supervisor: Date

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**1.INTRODUCTION**

Emotions often mediate and facilitate interactions among human beings. Thus, understanding emotion often brings context to seemingly bizarre and complex social communication. Emotion can be recognized through a variety of means such as voice intonation, body language, and more complex methods such as electroencephalography (EEG). Recognizing human facial expression and emotion by computer is an interesting and challenging problem.

Blind students deal with many of the same emotions normal students do. They get angry, sad, frustrated, nervous, happy, or embarrassed, but they often do not have the words to talk about how they feels. There is no existing system to identify interesting for lecture using their emotions.

The task of blind emotion recognition is particularly difﬁcult for two reasons: 1) There does not exist a large database of blind training images and 2) classifying emotion can be difﬁcult depending on whether the input image is static or a transition frame into a facial expression. The latter issue is particularly difﬁcult for real-time detection where facial expressions vary dynamically. Recognizing blind people’s emotions from their facial expression is more challenging as we cannot track their eye expressions.

The primary strategy of optimizing the classroom behavior is that the teachers must have the competence to feel student’s minds changing. They must be excellent at monitoring student’s facial expression, every action and movement. This allows the teacher to understand their own weakness and to change it.

Children with visual impairments are increasingly becoming students in general education classrooms. Though in a regular classroom it’s difficult to identify blind student’s comprehension based on facial expressions. So it’s difficult for the tutors to understand the student’s comprehension in real time.

We are going to use neural network based solution combined with image processing in order to classify the universal emotions: Happiness, Sadness, Anger, Disgust, Surprise and Fear. frontal face images are given as input to the system. Eyes are most important body part for expressing facial expressions. Unfortunately, we can’t get eye expressions from blind people. So, we consider other facial areas such as mouth, nose, lips, cheeks, forehead etc. After the face is detected, image processing based feature point extraction method is used to extract a set of selected feature points. Finally, a set of values obtained after processing those extracted feature points are given as input to the neural network to recognize the emotion contained.

For further clarification, we determine user emotions by analyzing the rhythm of an individual’s typing patterns on a standard keyboard. Our keystroke dynamics approach would allow for the uninfluenced determination of emotion using technology that is in widespread use today.

It is the detailed timing information which describes exactly when each key was pressed and when it was released as a person is [typing](https://en.wikipedia.org/wiki/Typing) at a [computer keyboard](https://en.wikipedia.org/wiki/Computer_keyboard). Using keystroke dynamics we can identify whether they are in interest for the lesson or not. finally analyze those things according to them and attractive voice message will be send to the student to motivate him.

**2. BACKGROUND**

**2.1. Background & Literature survey**

Blind face detection and emotion recognition

Some face recognition [algorithms](https://en.wikipedia.org/wiki/Algorithms) identify facial features by extracting landmarks, or features, from an image of the subject's face. For example, an algorithm may analyze the relative position, size, and/or shape of the eyes, nose, cheekbones, and jaw.[[4]](https://en.wikipedia.org/wiki/Facial_recognition_system#cite_note-3) These features are then used to search for other images with matching features.[[5]](https://en.wikipedia.org/wiki/Facial_recognition_system#cite_note-Bonsor-4) Recognition algorithms can be divided into two main approaches, geometric, which looks at distinguishing features, or photometric, which is a statistical approach that distills an image into values and compares the values with templates to eliminate variances.

One of the earliest successful systems is based on template matching techniques[[6]](https://en.wikipedia.org/wiki/Facial_recognition_system#cite_note-7) applied to a set of salient facial features, providing a sort of compressed face representation.

PCA is used for dimensionality reduction in input data while retaining those characteristics of the data set that contribute most to its variance, by keeping lower-order principal components and ignoring higher-order ones. Such low-order components contain the "most important" aspects of the data. Three basic steps involved in PCA are identification by eigen faces, recognition, Matching eigen faces, categorization by grouping.Eigenfaces is the name given to a set of [eigenvectors](https://en.wikipedia.org/wiki/Eigenvector) when they are used in the [computer vision](https://en.wikipedia.org/wiki/Computer_vision) problem of human [face recognition](https://en.wikipedia.org/wiki/Facial_recognition_system).[[1]](https://en.wikipedia.org/wiki/Eigenface#cite_note-1)The approach of using eigenfaces for [recognition](https://en.wikipedia.org/wiki/Facial_recognition_system) was developed by Sirovich and Kirby (1987) and used by Matthew Turk and [Alex Pentland](https://en.wikipedia.org/wiki/Alex_Pentland) in face classification.[[2]](https://en.wikipedia.org/wiki/Eigenface#cite_note-2)

Ekman proposed geometric model in which to extract shape and appearance of lip, nasolabial furrow and wrinkles with 96% accuracy [11]. Recently, M. Karthigayan proposed a method that extracts region of eye and lip by genetic algorithm [12].

Mase proposed emotion recognition systems that use directions of facial muscles. Muscle movements were extracted use of optical flow with 11 windows method place in face [8]. For classification, K-nearest neighbor rule was used with an accuracy of 80% with happy, anger, disgust, surprise emotions [9].

Yacoob proposed same method instead of muscle action, he use edge of mouth, eyes and eyebrows, into a per frame, mid-level representation. He classified emotions with 88% accuracy [10]. Instead of using facial muscle actions, they built a dictionary to convert motions associated with edge of the mouth, eyes and eyebrows, into a linguistic, per- frame, mid-level representation. They classified the six basic emotions by the used of a rule-based system with 88% of accuracy. Black et al. proposed parametric model. In this model to extract the shape and movement of eyes , mouth, eyebrows, into a mid and high level representation of facial expression with89% of accuracy [5].

Tian et al. attempted to recognize Actions Units (AU), developed by Ekman and Friesen in 1978 [5], using permanent and transient facial features such as lip, nasolabial furrow and wrinkles [6]. Geometrical models were used to locate the shapes and appearances of these features. They achieved a 96% of accuracy. Essa et al. developed a system that quantified facial movements based on parametric models of independent facial muscle groups [7]. They modeled the face by the use of an optical flow method coupled with geometric, physical and motion-based dynamic models. They generated spatial-temporal templates that were used for emotion recognition. Without considering sadness that was not included in their work, a recognition accuracy rate of 98% was achieved.

Keyboard detection and emotion recognition

The Keystroke logging use for the monitoring the every key pressed on a keyboard. In Moscow and St. Petersburg spies started installing Key loggers in the US Embassy and Consulate buildings in 1970.In research papers they proposed to develop a voice recognition system which will be used for controlling computer without from use of mouse or keyboard. They can wear a headset and have their hands. The Speech recognition refers to the ability to listen and spoken words and identifies various sounds presents in it, and recognize them as words of some known language.

We use Key loggers for detecting every key pressed on a keyboard. Then we can identify the problems in the words such as spelling mistakes, incorrect words etc. We give voice notification when student type incorrect words then students can correct them. When detecting keys that typed by students we analyze student behavior and what are the needs they want. Then we motivate students and concern with lessons. When we compare with already existing keystroke loggers that function did not provide for the user.

Emotion recognition using mouse movements

Nowadays computer play major roll in human life. even though they have sight or not each and every person have to interact with computers for their day today work. But its much difficult forthe people who are visually impaired when they are using computers. there are some special sort of soft wares for them but Its little bit difficult to use key boards and mouse for them. When its come to class room they can be bored, sad, frustration ,angry etc. when they are using computers. there are many researches which are focusing on recognizing emotions of computer users but its less in blind people

A tactile mouse ,perkins-braille-display , are such kind of input devices which are made for blind people but there is no way to recognize how they feel when they are using these equipment.

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recognizing emotions using mouse movementsis less common than keystrokes but it is also investigated [1]. In this paper it has considered mouse speed , acceleration , direction , number of clicks etc. and the method has use to detect unauthorized users

**2.2. Research Gap**

Blind face detection and emotion recognition

Trying to interpret a person's emotional state in a nonverbal form, usually requires decoding his/her facial expression. Many times, body languages and especially facial expressions, tell us more than words about one's state of mind. Thus, understanding emotion often brings context to seemingly bizarre and complex social communication. Emotion can be recognized through a variety of means such as voice intonation, body language, and more complex methods such as electroencephalography (EEG). Recognizing human facial expression and emotion by computer is an interesting and challenging problem.

The task of blind emotion recognition is particularly difﬁcult for two reasons: 1) There does not exist a large database of blind training images and 2) classifying emotion can be difﬁcult depending on whether the input image is static or a transition frame into a facial expression.

Most of the face detection approaches are efficient and robust for normal people. In order to detect the emotion of a blind student in a classroom, it is very important to capture the student face accurately. It is really challenging to capture the face image and determine the emotion as we cannot get eye expressions from them.

Keyboard detection and emotion recognition

We try to detecting every key pressed on a keyboard. We can identify the emotion state of the student at that moment and give a positive response to them. The student have sad or confuse emotion state their behavior also change than when they are in happy emotion state. Then system provides voice notification for student to motivate and concern for the lessons. The blind student’s emotion recognize by analyzing the details getting from keyboard. The tutor can identify blind student’s behaviors in every time. We can improve the blind student’s knowledge and motivate attention for lessons by using voice notification. We can give voice notification for students by recognizing their emotion changes.

**2.3. Research Problem**

Blind students deal with many of the same emotions normal students do. They get angry, sad, frustrated, nervous, happy, or embarrassed, but they often do not have the words to talk about how they are feelings. There is no existing system to identify interesting for lecture using their emotions.

Emotions often mediate and facilitate interactions among human beings. Thus, understanding emotion often brings context to seemingly bizarre and complex social communication. Emotion can be recognized through a variety of means such as voice intonation, body language, and more complex methods such as electroencephalography (EEG). Recognizing human facial expression and emotion by computer is an interesting and challenging problem.

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The primary strategy of optimizing the classroom behavior is that the teachers must have the competence to feel student’s minds changing. They must be excellent at monitoring student’s facial expression, every action and movement. This allows the teacher to understand their own weakness and to change it.

Children with visual impairments are increasingly becoming students in general education classrooms. Though in a regular classroom it’s difficult to identify blind student’s comprehension based on facial expressions. So it’s difficult for the tutors to understand the student’s comprehension in real time.

**3.OBJECTIVES**

Main objectives:

* To examine blind student’s emotions and motivate them to perform attention to the lessons in classroom.
* Make lecturer easy to identify blind student’s problems in classroom.
* To provide support services for blind students to get education and improve their communication skills.

Specific objectives:

* Get the emotions in current moment by using facial Expressions.
* As blind students are not visible we use keystroke detection substitute for eye detection.
* The lecturer can identify blind student’s attitudes in current moment by facial detection and keystroke detection individually.
* The lecturer can identify blind student’s physical, mental condition in class room.
* The blind students motivated by using voice notification when their attention is low.
* Gives report to the tutor regarding the student’s state on that state.

**4.METHODOLOGY**

Blind face detection and emotion recognition

I will develop a new optimization algorithm for blind facial expression recognition which can classify the given image into one of the seven basic facial expression categories (happiness, sadness, fear, surprise, anger, disgust and neutral).

This system involves 3 steps: Firstly, a series of pre- processing tasks such as adjusting contrast, filtering, skin color segmentation and edge detection will be applying on the input image.

For skin color segmentation, first we contrast the image. Then we perform skin color segmentation. Then, we have to find the largest connected region and then have to check the probability to become a face of the largest connected region. If the largest connected region has the probability to become a face, then it will open a new form with the largest connected region

For face detection, first we convert binary image from RGB image. For converting binary image, we calculate the average value of RGB for each pixel and if the average value is below than 110, we replace it by black pixel and otherwise we replace it by white pixel. By this method, we get a binary image from RGB image.

Then, we try to find the forehead from the binary image. We start scan from the middle of the image, then have to find a continuous white pixel after a continuous black pixel. Then we want to find the maximum width of the white pixel by searching vertical both left and right side.

For lip detection, we determine the lip box and consider that lip must be inside the lip box. So, first we determine the distance between the forehead and eyes. Then we add the distance with the lower height of the eye to determine the upper height of the box which will contain the lip.

In the lip box, there is lip and may be some part of nose. So, around the box there is skin color or the skin. So, we convert the skin pixel to white pixel and other pixel as black. We also find those pixels which are similar to skin pixels and convert them to white pixel. Here, if two pixels RGB values difference is less than or equal 10, then we called them similar pixel. Here, we use histogram for finding the distance between the lower average RGB value and higher average RGB value.

Then we have to apply Bezier curve on the binary lip. For apply Bezier curve, we find the starting and ending pixel of the lip in horizontal. Then we draw two tangents on upper lip from the starting and ending pixel and also find two points on the tangent which is not the part of the lip. For the lower lip, we find two-point similar process of the upper lip. We use Cubic Bezier curves for draw the Bezier curve of the lip. We draw two Bezier curve for the lip, one for upper lip and one for lower lip.

So, in the binary image, there are black regions on lip, nose and may some other little part which have a little different than skin color. Then we apply big connected region for finding the black region which contain lip in binary image.

Secondly, features will be extracted with projection profile which has taken as processed input image. To extract features we will use a high-speed projection profile.

Feature extraction method is associated with the row-sum and column-sum of white pixels of edge identified image. The pattern of row-sum (Mh) along the column and the pattern of column-sum (Mv) along the row of white pixels are defined as the feature of each region. These patterns are known as projection profiles.

Finally, in third stage Iwill compute the optimized parameters of lips, eyebrows, nostrils, and chin through our algorithm. For that I will be using particle swarm optimization (PSO) to optimize ellipse characteristics. With the use of features obtained a person’s emotion will be classified according to experimental results and emotions represented by Ekman (sadness, angry, joy, fear, disgust, and surprise without consider natural emotion).

PCA is used for dimensionality reduction in input data while retaining those characteristics of the data set that contribute most to its variance, by keeping lower-order principal components and ignoring higher-order ones. Such low-order components contain the "most important" aspects of the data.

Three basic steps involved in PCA are identification by eigen faces, recognition, Matching eigen faces, categorization by grouping.

Eigenfaces is the name given to a set of [eigenvectors](https://en.wikipedia.org/wiki/Eigenvector) when they are used in the [computer vision](https://en.wikipedia.org/wiki/Computer_vision) problem of human [face recognition](https://en.wikipedia.org/wiki/Facial_recognition_system).[[1]](https://en.wikipedia.org/wiki/Eigenface#cite_note-1)The approach of using eigenfaces for [recognition](https://en.wikipedia.org/wiki/Facial_recognition_system) was developed by Sirovich and Kirby (1987) and used by Matthew Turk and [Alex Pentland](https://en.wikipedia.org/wiki/Alex_Pentland) in face classification.[[2]](https://en.wikipedia.org/wiki/Eigenface#cite_note-2)

The eigenfaces themselves form a basis set of all images used to construct the covariance matrix. This produces dimension reduction by allowing the smaller set of basis images to represent the original training images. Classification can be achieved by comparing how faces are represented by the basis set.

The extracted feature vectors in the reduced space are used to train the supervised Neural Network classifier. This approach results extremely powerful because it does not require the detection of any reference point or node grid. The proposed method is fast and can be used for real-time applications.

We are going to implemented a program that uses a webcam to capture your face and determine emotions. We use openCV computer vision library to preprocess the webcam image, and will use logistic regression algorithm to train on a provided dataset and evaluate the new image.

Keyboard detection and emotion recognition

We plan to use keystroke loggers for track every keys on a keyboard. The mechanism for detecting keys depends on upon the key press and key release duration. We can detect typing features such as typing speed, key latency, key duration, deletion rate, capitalization rate, spaces per responses. We can identify the emotion state of the student at that moment by detecting speed of typing keys in keyboard. The student have sad or confuse emotion state their typing speed is low and their attention for the lesson also low at that situation. Then system provides voice notification for student to motivate and concern for the lessons.

The blind students cannot identify correctness of words what they typed. We can give voice notification for each incorrect word and spelling mistakes that they are typed in every time. The blind students can response to the voice notification by entering key in keyboard. Then student can solve mistakes and learn it. We can get correct grammar mistakes when they type incorrect sentences. When students do grammar mistakes then provide a voice notification and correct them,so student can learn grammar mistakes in that time.

When we analyze which keys are numbers, symbol and words separately on a keyboard separately students are typed. We able to see each words that are typed in documents, search engine search and visited website and all programs running at that moment. We can generate full details report using key loggers.

We can detect the blind student’s behaviors and motivate them to current lessons in class room. The voice notification helps to get attention from students and motivate them. When they are in weak position, we can identify that and notify to the tutor. The tutor can organize which students need to more attention. The tutor can identify what are the things that should be improve in the classroom .we can track all keys that students are typed on keyboard and notify for tutor when students having problem or unsafe. We can improve the blind student’s knowledge when they type incorrect words by providing voice notification.

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**7. List of Figures**

A common assumption is that facial expressions initially served a functional role and not a communicative one. I will try to justify each one of the seven classical expressions with its functional initially role: [7]Below are the things

1. Anger: involves three main features- teeth revealing, eyebrows down and inner side tightening, squinting eyes. The function is clear- preparing for attack. The teeth are ready to bite and threaten enemies, eyes and eyebrows squinting to protect the eyes, but not closing entirely in order to see the enemy.



1. Disgust: involves wrinkled nose and mouth. Sometimes even involves tongue coming out.

This expression mimics a person that tasted bad food and wants to spit it out, or smelling foul smell.



1. Fear: involves widened eyes and sometimes open mouth.

The function- opening the eyes so wide is suppose to help increasing the visual field (though studies show that it doesn't actually do so) and the fast eye movement, which can assist finding threats. Opening the mouth enables to breath quietly and by that not being revealed by the enemy.



1. Surprise: very similar to the expression of fear.

Maybe because a surprising situation can frighten us for a brief moment, and then it depends whether the surprise is a good or a bad one. Therefore the function is similar.

1. Sadness: involves a slight pulling down of lip corners, inner side of eyebrows is rising. Darwin explained this expression by suppressing the will to cry. The control over the upper lip is greater than the control over the lower lip, and so the lower lip drops. When a person screams during a cry, the eyes are closed in order to protect them from blood pressure that accumulates in the face. So, when we have the urge to cry and we want to stop it, the eyebrows are rising to prevent the eyes from closing.

Happiness: usually involves a smile- both corner of the mouth rising, the eyes are squinting and wrinkles appear at eyescorners. The initial functional role of the smile, which represents happiness, remains a mystery. Some biologists believe that smile was initially a sign of fear.

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