# EMOFY: Emotional Data Acquisition within a controlled stimulus environment

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**Abstract.** Human being can be authenticated using three parameters, i.e., physical entities, behavioral and cognitive nature, and social associations. As we consider the finger print (or finger impressions) to authenticate a human being physically, this model can be used to authen- ticate a human being in terms of his/her cognitive nature, (or emotional parameters). We have taken the reference of "Pluckchit's Wheel of Emotion", who has classified the human emotions into eight categories, namely, positive- joy, trust, interest, anger; negative-sadness, disgust, surprise, fear. In this project, a user will be provided with an online portal, which will consist of the combination of four standard medias, i.e., images, videos, texts and audios (from the com- bination of eight standard emotional parameters). He will rate his eight standard emotions out of 10, with the help of a range slider, which he has felt after watching the particular media. The values of the emotions for every user will be stored in a database that will be eventually re- quired to generate the signature pattern for the emotions of every user visiting the portal. This signature pattern will be required further to authenticate a human being.

**Keywords:** Affective Computation, Emotion, Signature pattern, Plutchick wheel of emotion.

## 1    Introduction

The project Identification of Human Psycho-Emotional Signature Pattern from Mul- timodal Approach, is basically from the domain of "Affective Computation and Hu- man Emotion Mapper" [7]. Human being can be authenticated using the following parameters:

- **Physical Entities**- This includes age, weight, height or any other physical features of a person.
- **Behavioral and Cognitive Nature**- This includes restlessness, calmness, short temperedness, or after effect of some reaction.

- **Social Associations**-This comprises of name, address, father or mother's name of a person, etc.

The objective of our project is to authenticate a human being in terms of his/her emo- tional parameters, (or behavioral or cognitive nature). We have taken the reference of Dr. Robert Pluckchit Model [8], who has classified human emotions into 8 categories: Positive Emptions- joy, trust, interest anger;
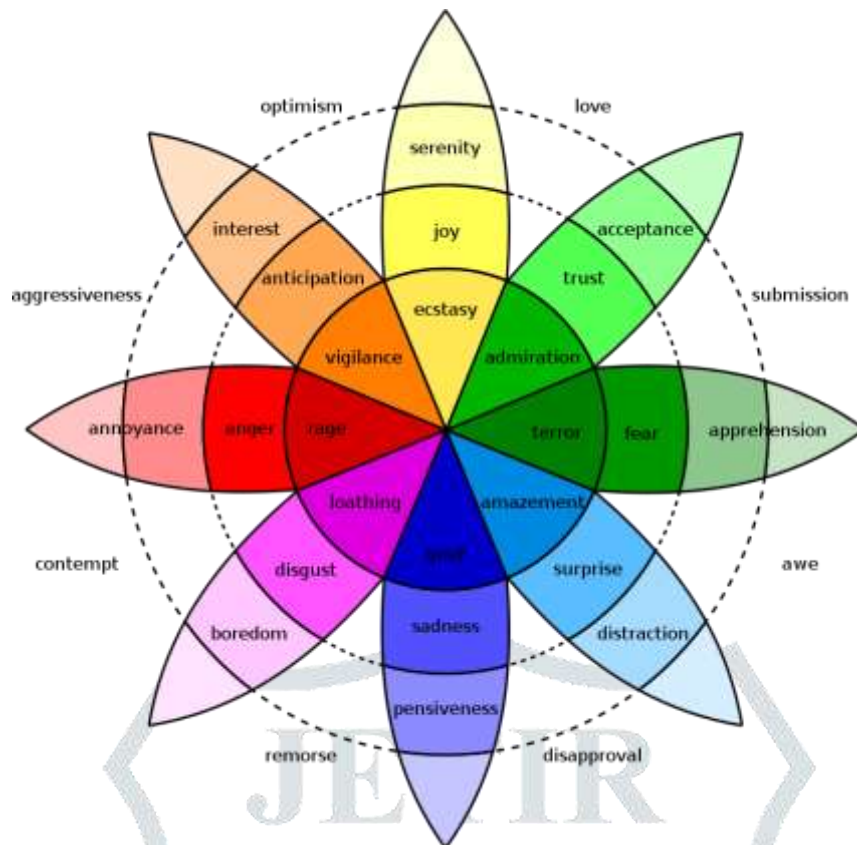Negative Emotions- sadness, fear, disgust, surprise.

**Fig. 1**. Plutchick's Wheel of Emotion

Plutchik likewise speculated 24 "Essential", "Auxiliary", and "Tertiary" dyads (an inclination made out of two feelings). The manners in which the feelings can be matched up are recorded here:

Essential dyad = one petal separated = Love = Joy + Trust

Auxiliary dyad = two petals separated = Envy = Sadness + Anger Tertiary dyad = three petals

separated = Shame = Fear + Disgust

Inverse feelings = four petals separated = Anticipation ≠ SurpriseWe have also taken the reference of Fuzzy Rule. Fuzzy means "uncertain" or not precisely defined. Hu- mans don't feel a single basic emotion, but have more complex emotional states. The fuzzy module will be used in the feedback analyzer, where we will create some fuzzy rule base, and that will help in the generation of the signature pattern.

## 2    Literature Survey

Emotions can be defined as physiological states of mind that affect  the thinking and behavior of a person. The term 'sentiment' refers to a specific emotion. An atti- tude, thought, mental decision or judgement prompted by a feeling are  also referred by sentiment. Any kind of positive emotions such as joy, anticipation or negative emotions such as sorrow, anger to a particular situation could also be referred using the term sentiment. The exact meaning of each terms are a bit different, though these all have potential towards the different domains of same genre. Here, we have briefly described some of the research that has taken place in this domain but ended up with some limitations:

In the year 2019, Gupta et al. [1] in the paper "Review of Various Sentiment Analysis Techniques of Twitter Data" stated that for analyzing the behavior of user and different parameters of user input data on sentiment analysis perspective N-gram method has been used. The N-gram model is used to divide the entire data set into different clusters. Logistic Regression technique has been applied as a classification technique to distinguish the behaviors of the users. During the classification of data using SVM classifier, several classes are produced. Maximum Entropy Algorithm is used to make sure the semantic and synthetic features. *Limitations*- This process re- quires complicated network structure for scoring sentences review purpose. The sen- tence correlation became the while retrieving the final results. Rupinder Kaur et al.(8, August 2019) [2] in the paper "Sentimental Analysis on Facebook Comments using Data Mining Technique" discussed that the domain of sentiment analysis can be re- ferred as a exertion of content order whose primary goal is how to provide stamp writings with a predefined set of data. Huge amount of comments or surveys are post- ed by people in general every day. So to distinguish the assessment of open towards a particular post is by physically analyze and discover each comment. Support vector machine are learning algorithms that analyses data used for regression analysis and classification. *Limitation*-With sentiment analysis, emotions are categorized into hap- py (positive), unhappy (negative) and emotionless. As a case

study, a problem on an inspection results is posted and results of students' responses are resolute. This study is momentous of enabling the stakeholders such as administrators and businessmen to monitor any discussion dispute for enhancing their facilities. Chaithra Shree U S et al.(June 2019) [3] in the paper "Generating music from literature using sentiment analysis and topic extraction" stated that the data for sentiment score sequence for each sentence is generated as as series of signals by sentiment analysis module. The generated signals can be projected with the plot structure in a sensible way. The char- acteristic features of the text can be related and compared with the audio generated by the system through signals. The results help in determining and analyzing diffent opinions on a particular subject. This also helps in determining determining a person's attitude, various mental states and change in behavior with respect to various topics. *Limitation-* To implement this process various algorithms need to be assembled. Deepu S.Nair et al. (2017)[4] in "Comparison of Statistical Approaches for Senti- ment Analysis - Malayalam Film Review" stated this work has the potential to extract the sentiment from Malayalam film review. The domain of sentiment analysis can fall under cognitive science domain. Machine learning method, semantic orientation method and rule based approach- these three are the most widely used methods for analyzing sentiment. Here two statistical methods were compared for sentiment anal- ysis from Malayalam movie review reports. The two methods are- SVM and CRF. This study shows that SVM works better than CRF. Though this would help to get popularity of films but it doesn't have the capability of finding the rating of the overall film as well as the individual fields. Also it can be extended for different areas like customer reviews or some reading material reviews. Shri Bharathi et al. (April, 2017)

[5] in the paper, "Sentiment Analysis for Online Stock Market News Using RSS Feeds" discussed the topic by creating predictive model structure for analyzing and predicting the sentiment behind stock news. In the primary stage, the real time and relevant stock news was filtered from Arab Bank (ARBK) Company. In the next stage the data have been analyzed for predicting the sentiment score values and tried to polarize it in such a way that the positive, negative and neutral data can be distin- guished. It can be an efficient process for investors while taking decisions. The senti- ment polarity result is capable enough to take decisions regarding the trading. *Limita- tion-* The system cannot evaluate the impact of negotiation which may lead to de- crease in accuracy and efficiency. In 2016, Hiranmayi Ranganathan et al. [6] in their work "Multimodal emotion recognition using deep learning architectures" has pro- posed similar approach for human authentication.

# 3     Overview of the framework

Usually we don't face any problem with the recognition of the physical entities and social association of a person. The physical entities can be easily quantified and the social associations are specific to a particular person. As a result, the main complica- tion lies with the behavioral and cognitive nature that entirely depends on the emo- tional state of a person.

There is a wide range of human emotions, which often appears in combination. Hence, it is very difficult to detect the emotional state of a person by a normal analy- sis. Therefore, this model can be used to examine a human being in terms of his emo- tional state to authenticate his behavioral or cognitive nature. We have taken Pluckchick's eight standard emotional parameters along with the combinations of them, to identify the emotional state of a person in a particular period of time, after watching the medias that is randomly provided by the system.

Emotion recognition was previously done using face detection but the drawback is that, it will be costlier. Therefore, we want to design a system in which we can track how the emotion of a person varies and hence a signature pattern will be generated.
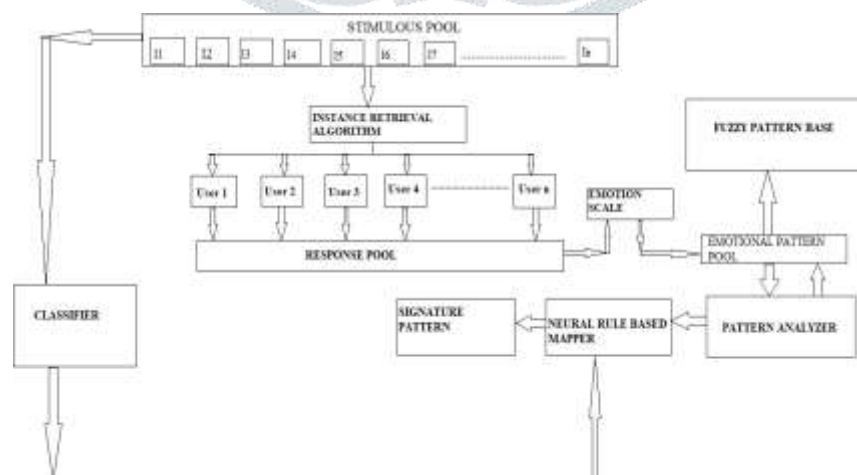


**Fig. 2.** Modular description of EMOFY

The stimulus pool consists of the instances that we shall consider in our system. The instance retrieval algorithm is the data acquisition algorithm that consists of the algorithms which we shall deploy behind this system, such as randomness of the im- age, text, audio, video in the portal, etc. The user's response will be then stored in the response pool. Emotion scale is basically the data that we shall get from the range slider in the feedback page. The emotional pattern pool consists of the emotional pat- tern for specific users. The classifier will classify the instances based on the emotional parameter. Then the emotion of the particular user will be mapped for the correspond- ing

instance. If the user has some irregular patterns then it will be stored in the fuzzy pattern base and then the signature pattern will be generated.

### 3.1 Portal View

In the landing page, the user needs to provide the username and then he clicks on the login button. The next page is where the actual mechanism takes place. We can see that there are 8 set of emotions along with their corresponding range sliders. The user will see four different types of media which includes audio, video, image and text and he will provide the values for each of the emotion by using the range sliders. The medias will appear in a random manner. After providing the values for each of them he will be redirected to another page where he will get a button known as 'Check authentication percentage'. By hitting this button the user will get to know whether he has successfully authenticated or not and by the exact percentage
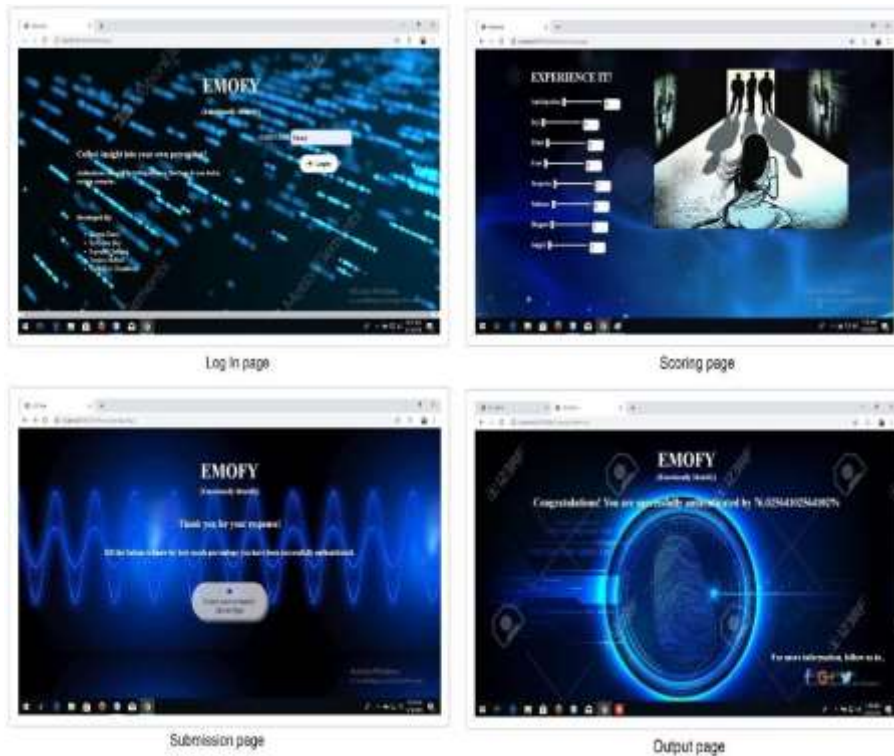


**Fig. 3.** Portal view of Emofy

### 3.2 Stimulus Pool and Classifier

The stimulus pool refers to the repository consisting of all the media (including images, video, text and audio). The classifier basically classifies the media in the repository, with respect to a particular category of emotion (i.e., anticipation, joy, angry, sadness, surprise, trust, fear, disgust).

### 3.3 Database and Instance Retrieval Algorithm

In this project we are using MySql database. In the database the table consists of the following attributes:

- User_Id - The User_Id is specific to a particular user in a particular session.
- User_Name - When the user enters the User_Name in the landing page of the portal, and hits the login button, the User_Name of the particular user is directly stored in this column.
- Session – When a particular user re-enters the portal with a new session, the val- ue of the session increments by 1.

- Content-This column will consist of the content id for which the user is providing the response.
- Anticipation – This column will consist of the value that the user provides for the Anticipation, in the feedback page, using the range slider.
- Joy - This column will consist of the value that the user provides for the Joy, in the feedback page, using the range slider.
- Trust- This column will consist of the value that the user provides for the Trust, in the feedback page, using the range slider.
- Fear- This column will consist of the value that the user provides for the Fear, in the feedback page, using the range slider.
- Surprise- This column will consist of the value that the user provides for the Sur- prise, in the feedback page,

using the range slider.

- Sadness- This column will consist of the value that the user provides for the Sad- ness, in the feedback page, using the range slider.
- Disgust- This column will consist of the value that the user provides for the Dis- gust, in the feedback page, using the range slider.
- Anger- This column will consist of the value that the user provides for the Anger, in the feedback page, using the range slider.

With reference to the Architecture, the response pool is the Database, where all the responses of the user is stored with the corresponding media to which he/she has re- acted.

### Instance Retrieval Algorithm

The instance retrieval algorithm is basically the data acquisition algorithm, which includes all the algorithm that is deployed behind the system for the acquisition of the data, i.e., the responses from the user. It includes the randomization of the image, audio, video or text when it appears in the portal.

**Step1**: Specify the path of each instances in separate variables var I1="./IMAGES/I1.jpg";
var I2="./IMAGES/I2.jpg"; & so on. Var
V1="https://www.youtube.com/embed/sNQGhV9QK5I?autoplay=TRUE"; var
V2="https://www.youtube.com/embed/P7qIihOQ1eY?ecver=1";
And so on.

**Step2**: Create an array of variables which contains the path of variables var variables=[I1,I2,……In];
var videos=[V1, V2,.….Vn];
**Step3**:

var playerDiv = Fetch the element random-player by its id & document ob- ject.
var player = Create an element "IFRAME" by document object. var index=Math. floor(Math. random() * videos. length);
var index1=Math. Floor(Math. random() * variables. length); randomVideoUrl =
videos[index];
var vari=variables[index1] player.setAttribute('src', randomVideoUrl);
document. getElementById('urrl').value= vari;

**Time complexity: O (m\*n2),** where **m**=no of character in each binary string, n=no of binary strings

## 4     Generation of the Emotional_Signature_Pattern

Ayan Chakraborty et al. in 2011[5] portrayed an examination of human explicit signa- ture emotional response dependent on meetings inside controlled stimulus settings. The proposed engineering is including a stable and versatile example the executives diagram and sound factual computational ability. This structure is profoundly intense to be used as a successful and amazing arrangement towards the client validation convention other than CHAP or PAP.

When the user hits the button, "Check authentication percentage", all the data for all the sessions of the particular user is fetched from the database. Then, the responses for each content are converted into binary string and stored into a list. A longest common substring algorithm is employed in the list to generate the longest common signature pattern of that particular user. Each time the user enters into the portal and provides his response, the signature pattern gets updated.

In the current session, we get the responses of the instances in four distinct binary strings. Each of them are compared with the signature pattern and as a result  we get four separate percentages which basically signifies that by how much percent- age the string is similar to the signature pattern of the user. At the end, the mean  of the percentages is generated and shown as the final result of authentication of the  user.

With reference to the architecture of the system, the **response pool** consists of the responses of specific user with their corresponding stimulus. Then the emotion of the particular user will be mapped for the corresponding instance. If the user has some irregular patterns then it will be stored in the **fuzzy pattern base** and then the signa- ture pattern will be generated. For example, the user reacts joy (positive emotion) as well as disgust (negative emotion) to a particular media, which are totally opposite in nature. Such a reaction will be stored under fuzzy pattern base, as it signifies uncer- tain response from the user.

**Result Validation Table:**

| User Name | Percentage Match(%) ($x_i$) | Mean ($\bar{x}$) | Standard Deviation ($\sigma$) | Standard Error ($\sigma$) |
|---|---|---|---|---|
| Tiyas | 1. 62.8582<br>2. 85.61<br>3. 92 | 80.15 | 12.50 | 7.217 |
| Tanima | 1. 76.776<br>2. 88.52<br>3. 94.062 | 86.45 | 7.20 | 4.157 |
| Shreya | 1. 56.42<br>2. 78.5<br>3. 63.55 | 66.15 | 9.20 | 5.312 |
| Sudeshna | 1. 73.32<br>2. 82<br>3. 77.4 | 77.57 | 3.54 | 2.043 |
| Rajrupa | 1. 88.6<br>2. 92<br>3. 72.745 | 84.44 | 8.39 | 4.844 |

**Table 1.** Output validation table

## 5    Future Scope

There are several implementation of this analysis. Some of those are given below.

**Social Networking Analysis:** The programmed calculation and recognition of feel- ings from text is getting one of the profoundly investigated themes, even as far as numerous applications, programmed location of feeling would be considered as an or more point. Despite the fact that, the investigation of feeling started path, thinking back to the 1980s, calculation of feelings is an ongoing field. Feeling investigation on Twitter information present issue of length since the creator attempts to communicate every one of his feelings inside that short length and furthermore the expanding sub- stance of slang builds the pre-handling required. Feeling grouping frameworks utilize managed, unaided or mixture learning procedures to arrange feelings communicated in various types of text into feeling classifications which are characterized by differ- ent mental investigations.

**Advertisement:** A PC framework, a PC actualized strategy, and PC clear media ar- ranged to target promotions dependent on passionate states are given. Publicists de- termine wanted enthusiastic conditions of clients they expect to focus with commer-cials. Promoters likewise give passionate labels having the ideal enthusiastic condi- tion of clients that should see the commercials connected to the enthusiastic labels. Online exercises for clients are acquired and handled to dole out passionate states to the clients. A notice motor chooses promotions that are genuinely viable dependent on the allotted enthusiastic states and the ideal passionate states gave by the sponsors.

**Forensic Analysis:** Visual examination of human movement is at present one of the most dynamic exploration subjects in PC vision. This solid intrigue is driven by a wide range of promising applications in numerous territories, for example, augmented reality, brilliant reconnaissance, perceptual interface, and so on Human movement investigation concerns the discovery, following an acknowledgment of individuals, and all the more by and large, the comprehension of human practices, from picture successions including people.

**Medical Domain:** Tolerant notion investigation is a cycle of examining persistent criticism about your training dependent on the patient's feelings at that point. The examination assists with revealing the feelings, sentiments, and perspectives of pa- tients dependent on what they state about your training. Understanding estimation investigation can help medical care suppliers increase a serious edge over the opposi- tion and improve their administrations dependent on the criticism gave.

## 6    Conclusion

The behavioral or cognitive approach of a person entirely depends upon his/her emo- tional state, which is very complicated to be tracked. Therefore, this technology shall be accepted by numerous sections of people, where one can easily detect that how the emotional sentiments of a person varies with respect to a particular scenario. The world of emotional detection and recognition's technology can easily change the phase of marketing in the years to come. This technology is clearly bringing a huge revolution in marketing. Therefore, I think that everyone should start capitalizing on this opportunity. Emotion detection has a huge impact in psychometric tests where we can easily detect the emotional variation of a person with the help of smart phones, and that can be the greatest success in a human's life. We live in an era where tech- nology is able to read, interpret or rather predict our emotions. This insight has an enormous potential to enrich our lives. The clear idea is to track emotions to some extent and

potentially manipulated.

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