

# An Overview on Automated Emotion Recognition System

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**Abstract** - This paper aims to measure brief information about applications and requirements of recognition of facial expressions. This paper presented six emotional states based on facial expressions. KNN (K-Nearest Neighbor) algorithm is implemented to perform classification of facial expressions. This paper also includes facial expression system, applications, phases of automated emotion recognition and classification of proposed algorithm.

**Key Words:** Emotion recognition, Facial Expression, Automated emotion recognition, Classification of KNN for emotion recognition.

## 1. INTRODUCTION TO EMOTION RECOGNITION

Everyone have high level of emotion intelligence. It helps to identify the behavioral aspects of human during communication. It is an approach of identifying emotion of human from verbal expressions which comes naturally by human. It is an essential factor of human communication to identify an intension of human. Through emotion recognition, during discussion if emotions of group/team are not positive then leader or person can change the discussion by identify their interest.

In today's generation people have different behavior and their thinking is also different, at that point it is to recognize by opposite person [1]. This big confusion can be overcome in the easiest manner with emotion recognition because there will be less people (approx. 5-7%) who can control on their natural emotions.

To classify certain emotion, there are three categories: knowledge-based, statistical, hybrid.

### 1.1 Knowledge-based Approach

This is an approach which is used very commonly in emotion recognition. Dictionary-based approach will maintain initial list of emotions and it find emotion seed word in stored list. Sometimes it searches for synonyms and antonyms for the given seed word. Where as in corpus-based approach, there will be a huge database of different emotions and searches for other words with context-specific characteristics due to which performance varies according to different word seeds.

### 1.2 Statistical Approach

This approach majorly focus on machine learning algorithms to learn and predict the types of emotion. Majorly it uses supervised learning method of machine learning such as Support Vector Machine(SVM), K-Nearest Neighbor(KNN), Naive Bayes. It trains the dataset using algorithms to recognize a given emotion. It also uses some unsupervised algorithms.

### 1.3 Hybrid Approach

Hybrid approach is a combination of knowledge-based and statistical approaches to exploit characteristics from both the approaches [2]. Hybrid approach has many benefits compare to all other approaches because it follows the principles of both the remaining approaches.

## 2. INTRODUCTION TO FACIAL EXPRESSION

A facial expression is motions or positions of the muscles beneath of the face. Facial expression of an individual person in an emotion state is in nonverbal communication form. There are seven emotional states of facial expressions to perform emotion recognition [3]. Man's face are the most exposed part of the body which uses computer vision to analyze the face image for recognizing emotion. Conditions and changes of head muscles are the main factors that affect the quality of the system using cameras. Especially sensitive for these factors are methods based on 2D image analysis. Methods in which 3D face models are implemented are more promising [4].

A set of characteristic points of the face registered in 2D space is shown in Fig. 1.



Fig.1: Characteristic points on the face.

There are six states of facial expressions as Anger, Disgust, Fear, Happiness, Sadness, Surprise as per modern psychology.

**Table 1:** The dominant features for each state of facial expression.

Expression	Dominant features
Anger	Eyebrows, Mouth
Disgust	Eyes, Eyebrows, Nose, Mouth
Fear	Nose
Happiness	None
Sadness	Mouth
Surprise	Eyes, Eyebrows, Mouth



**Fig. 2:** Six basic facial expressions.

### 3. AUTOMATED EMOTION RECOGNITION

This is mostly used and user reliable emotion recognition system, as it is an automated approach it requires direct connection with the cameras. From cameras it receives the direct image of current scenario and through image processing technique it accepts an image, that image will undergo with image processing. I have applied an algorithm on that image that is KNN algorithm.

#### 3.1. Phases of Automated Emotion Recognition

##### 3.1.1. Image Acquisition

This is a first phase of automated recognition system which receives input image from the camera. It can recognize 2-D gray scale facial image recognition [5]. It also receives 3-D facial image to process. Color image equipments are of high cost but due to demand it will be low cost after few years. For image acquisition, digital devices like camera, cell phone, etc. can be used.

##### 3.1.2. Pre-processing

This phase will start process of an image which is received through image acquisition. To perform this phase I have make use of pandas. It enhances the quality of input image of facial expression and locates interest of the data by removing unused things and makes an image smooth. To perform this, pre-processing includes normalization and filtering of image.

##### 3.1.3. Segmentation

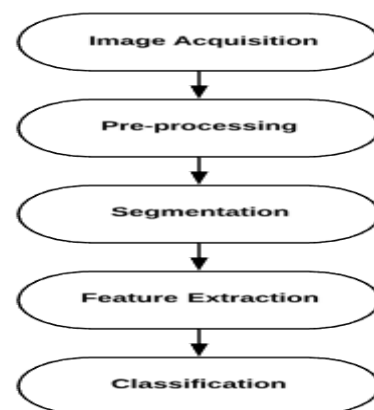
An input image maybe of any size. Hence, it takes time to process an image if the size of big and the performance of the system will be decrease. To overcome that problem this stage is implemented. In this phase, the image will be divided into some small components and those small components will be given to be proceed because components takes less time so that the performance of the system will be faster.

##### 3.1.4. Feature Extraction

This phase is to extract an image. It extracts information of shape, color, motion of facial image. It also extracts the meaningful information from the image. It gives advantage in storage.

##### 3.1.5. Classification

Classification is the final phase of automated emotion recognition system which classifies only important and useful contents from an image. The result of classification is depending on the operations which are performed in all the above phase.



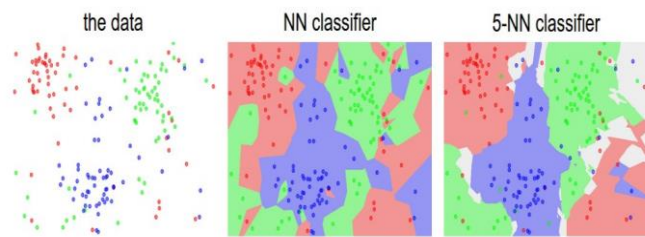
**Fig. 3:** Phases of automation emotion recognition system.

### 4. KNN CLASSIFICATION

Classification analysis of facial expression is important. Hence, to perform classifications of an image we have make use of machine learning algorithm. Among machine learning algorithms I have perform classification using K-nearest

neighbor (KNN) classifier algorithm. The reason to choose this algorithm, is simplest than all the algorithms.

KNN algorithm takes input image from camera as we already discussed above, then it trains and test the data which is received [6]. Then it assumes the value of k and based on that it goes for searching the nearest value from its neighbor and it recognize that value and likewise it follows until whole image is not recognized, after recognizing whole image based on values finally it returns the result of particular emotion of image.



An example of the difference between Nearest Neighbor and a 5-Nearest Neighbor classifier, using 2-dimensional points and 3 classes (red, blue, green). The colored regions show the **decision boundaries** induced by the classifier with an L2 distance. The white regions show points that are ambiguously classified (i.e. class votes are tied for at least two classes). Notice that in the case of a NN classifier, outlier datapoints (e.g. green point in the middle of a cloud of blue points) create small islands of likely incorrect predictions, while the 5-NN classifier smooths over these irregularities, likely leading to better **generalization** on the test data (not shown). Also note that the gray regions in the 5-NN image are caused by ties in the votes among the nearest neighbors (e.g. 2 neighbors are red, next two neighbors are blue, last neighbor is green).

**Fig. 4:** Sample KNN classifier.

#### 4.1. Process

The process to perform KNN classification for automated emotion recognition system is:

- i. Choose K objects from N data objects as initial cluster center;
- ii. Repeat;
- iii. Assign each of the remaining objects to the nearest cluster represented by the center;
- iv. Select randomly a non-center object —Orandom;
- v. Calculate of the total cost of E, using Orandom instead of Oj
- vi. IF  $E < 0$ , THEN replace Oj with Orandom, forming a new set of K neighbor points

This algorithm is suitable only for small amount of data and to overcome this issue while giving image of big size I have gone by utilizing a phase “Segmentation”.

#### 5. APPLICATIONS

Now a days technologies are improving rapid ly, in this situation it is very critical to maintain the security [7]. For

this they will make use of this automated emotion recognition system. Some applications are:

- Social robot.
- Alert system for driving.
- Feedback system.
- Understanding human interest.
- In Interviews.
- Monitoring.
- In ATM system.

#### 6. CONCLUSION

In this paper, I have presented an automatic approach to recognize emotion from facial expression, also performed classification of image and working process of KNN classifier such as the fiducial locations in the human face from where the filter responses are sampled should be extended. The effectiveness of extraction expression feature is completely dependent on the effectiveness of pre-processing of the raw image. The objective of this research paper is to give brief introduction towards techniques, application and challenges of automatic emotion recognition system.

#### REFERENCES

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## **BIOGRAPHY**



Nihar Sukhadia is a student of department of Computer Science and Engineering, Malla Reddy Engineering College, Hyderabad, Telangana, India. His current interests include artificial neural networks, machine learning, deep learning.