

Emotion Recognising System-Crowd Behavior Analysis

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Abstract - When it comes to expressing, the first thought in mind is Face. Facial expressions say a lot about a person's personality and behavior. In this paper we promote a system prototype that works on Machine Learning and Image Processing to find out these expressions and depending on them tell us about the emotion behind the expression and further work in the area of human safety. The system works in three stages: 1. Face Detection 2. Feature extraction and Emotion Recognition 3. Sending Alert based on results. Algorithm used here is Haar Cascade Algorithm for detection of face. Image processing is done by converting colored images into grey images. Emotions covered in this project are: Happy, Sad, Anger, Disgust, Surprise, Fear and Neutral. Alert messaging is done by Twilio-an open source web messaging service platform for 'Anger' emotion i.e analysis of crowd. Storage is done for log report purposes.

Key Words: Image Processing, Facial Expression, Machine Learning, Python Programming, OpenCV

1. Introduction

Face and emotion feature detection is the currently very active area of research in the computer vision field as different kinds of face detection application are currently used such as image database management system, monitoring and, surveillance analysis, biomedical image, smart rooms intelligent robots, human-computer interfaces and drivers alertness system[1]. A similar approach is made by us but for different applications. What is an emotion? Emotion is a way humans express their thought without using words. When you see a person with a wide smile we can say he/she is happy, when seen with tears or lowered lips we can say a person is sad, when eyes too wide and eyebrows raised we can say it's anger. Thus we don't need words at such scenarios to identify what a person is feeling or trying to express. A lot can be said by facial features. Keeping that in mind our proposed system is trying to achieve Analysis on Crowd depending on Facial characteristics. The crowd is nothing but more than one face. The concept of crowd refers to gathering many people in one place, such as train stations, airports and subways, as well as gatherings sports, religious special crowds Hajj and Umrah became highly congested areas.[2]. Our System works in three stages: 1. Locating faces in the crowded area. 2. Extracting facial features from the detected face region and analyzing the motion of facial features and/or the changes in the appearance of facial features and classifying this information into some facial expression. 3. Sending an alert to the official authorities by checking 'Anger' emotion value.

2. FACE DETECTION AND EMOTION RECOGNITION

2.1 Camera Interfacing

Initially, a Python connected PC is used. Python 3 version is used. Python Libraries used are Numpy, Mathplotlib, OpenCV, Scikit learn. A Logitech camera is used for video surveillance. (Web camera may also work as USB port number for both is same). In this stage as the only face is the main purpose of detection only face classifier is passed as CSV file so that n number of faces are detected. No other items say bottle, tree, etc will be detected even if present in the camera frame. Frame size is set and this stage returns coordinates of face to form a rectangular frame which will be used in the next stage of emotion recognition. Video surveillance goes on and screenshots are saved. In this stage, Haar Cascade Classifier is used.

2.2 IMAGE PROCESSING

Image processing can be performed on both colored and grey images. When thought in the perspective of matrices, a colored image as it contains red, green, blue (RGB) factors it forms a 3D matrix, whereas when a grey image is considered as it has only black and white as factors so it is a 2D matrix. Performing image processing on 2d matrix is less complicated than on the 3D matrix. So we convert all are images in grey scale and perform image processing on them.

2.3 EMOTION RECOGNITION

After getting facial features deep learning-CNN Algorithm is used. The trained model is trained by providing 100 images of sad, happy, anger, fear, etc so that it recognizes those faces and their features. Each emotion is recorded of each face in seconds.

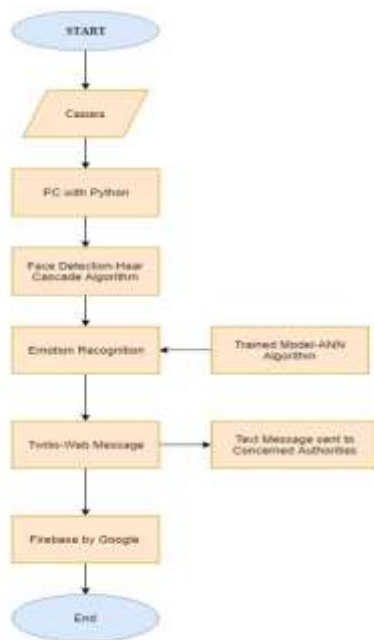


Fig. 1. System Flow

3. LITERATURE SURVEY

A. Novel Approach for Crowd Behavior Representation: Normal and Abnormal Event

In this paper, there are two levels for analyzing the crowd i.e, 1.Individual and 2.Crowd approach[2]. Basically, the crowd approach is implemented in global level to recognize the abnormal behavior and thereby avoiding unwanted activity in public areas. For crowd behavior approach, K means clustering and Expectation Maximization techniques are used for detecting the maximum likelihood parameter. This paper is based on the predefined data set of Hajj and Umrah. Wide Area Surveillance (WAS) is used for continuous streaming of video in crowded area. Further, the road map Surveillance system is divided into 4 parts- 1.Object Detection, 2.Object Tracking, 3.Object Classification, 4.Activity Recognition. After studying this paper we had cleared idea about different kind of facial structures, expressions and features which can be studied further for emotion recognition among crowd approach.

B. Real Time Emotion Recognition based on Image Processing and Machine Learning

In this research paper, the basic idea is how to extract the emotions[4]. So, the process is being categorized into 2 parts i.e, Face Detection and Feature Extraction. While detecting anything, it should accurately detect whether it is an object (for Eg:-Bottle) or a FACE. So detecting face becomes a complex process. And, extracting different features or characteristics from the human face is the second process. The final stage is to classify the emotion with the help of the Naive Bias Classifier. In a broader view, image processing,

facial expression and, Machine Learning techniques are achieved[6].

C. Human Face Detection Algorithm via Haar Cascade combined with three additional classifiers

In this paper, A Haar cascade classifier along with three weak classifiers i.e, skin tone histogram, detecting eye and, mouth detection is used[3]. The system is provided with ample of positive and negative images to recognize and hence with trained data set it can discernate the positive images. And this proposed idea improves the execution of the system. With the help of the skin hue histogram, the proportion of negative human face is removed. A human face detection is simple to implement with OpenCV and other supporting libraries. Overall the paper is focusing on the Haar-like features in emotion recognition and some cascade classifiers.

4. METHODOLOGY

With Python3 Idle and Camera port we have implemented following activities:

1. Camera Video Surveillance
2. Face detection
3. Emotion Recognition
4. Alert Messaging

1) Camera port by default '0' port is been used in the system. According to the application, port numbers can be added and changed as well. As for our application, port 0 is sufficient enough to get satisfactory results.

2) Face detection using Haar cascade frontal classifier is done. This classifier focuses on the frontal face feature attraction.

3) Coming to System's GUI-Graphical User Interface, flask and HTML are cascaded. Web page cascading is possible using the "extends" command.

4) The layout is created initially with block contents that can be updated accordingly known as JINJA Templating. The home page consists of the system start button.

5) Get frame() function having result value 1 indicating that video capturing is successfully done.



6) Functioncall-getframe rectangle format is with the coordinate points as $(img,(x,y),(x+w,y+h),(255,0,0))$ For face detection starting points with height and width are considered.Using color contrast of $(255,0,0)$ rectangle is drawn with thickness of 2mm.

7) Frames received are divided by 255 to reduce its size. Size reduction is done so that feature extraction speed can be increased. This process is known as Normalisation of frames.

8) Flask is an API in python that allows us to build up web applications. In our system, we are importing flask as it is an inbuilt library already available. The basic function of the flask is lightweight, faster, and also it is easier to learn because it has less base code to implement for the web application.

9) Another library that we are using is Keras for fast prototyping. We are importing the Keras library file into our system. The main function of Keras is fast prototyping. Importing cv2 from Keras helps to acquire certain features.

5. ALGORITHMIC DESCRIPTION

Object Detection using Haar feature-based cascade classifiers is an effective object detection method proposed by Paul Viola and Michael Jones. In this system face classifiers are used.

1. Collection of a data set of images. We have classified 7 emotion classes: anger, disgust, fear, happiness, sadness, surprise, and neutral.
2. Pre-processing of images.
3. Detection of the face from each image.
4. The cropped face is converted into grayscale images.
5. Emotion is recognized using the Haar Cascade Classifier file.

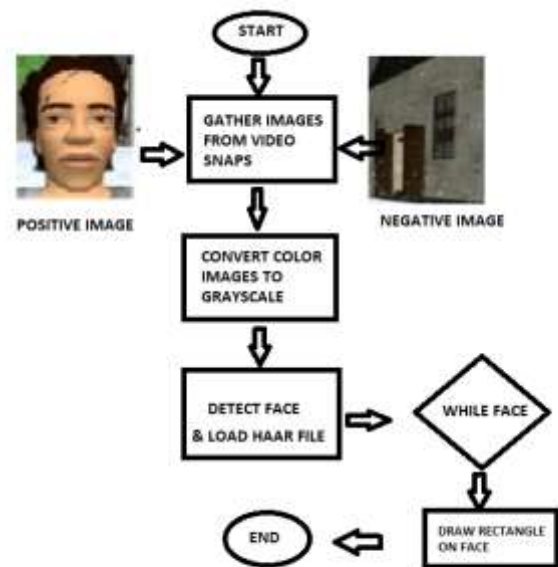


Fig. 3. Algorithm Usage

6. RESULTS

1) Analysis 1:The system can detect single as well as many faces as provided. By default initial value for faces is given as 5, which can be changed as it is the user's choice. The proposed system can differ face from other objects say tree, bottle, etc. Haar cascade file importing is successful.

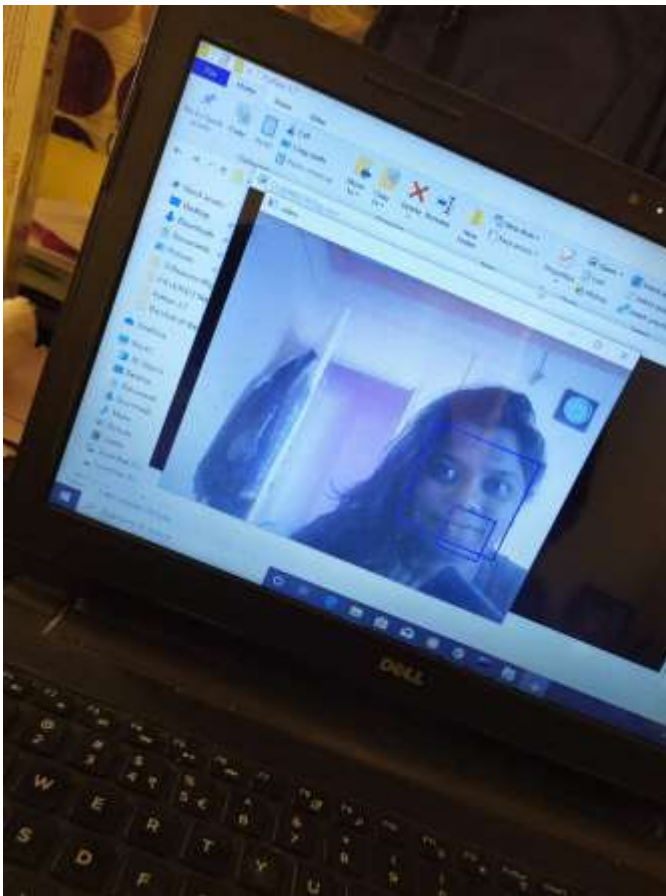


Fig.4. RESULT:- DETECTION OF ONE FACE

2) Analysis 2: Rendering function as imported by python works efficiently. Images obtained from video surveillance are 3D colored images. Rendering them into a 2D grayscale image is done properly with no pixel problem, quality issues and no change in emotion result[7].

3) Analysis 3: Emotion recognized shows maximum accuracy. All emotions are detected and using max function aggregate maximum result is acquired to reach a final emotion. Emotion might change frame-wise. So each frame result is considered and a decision is not taken based on one frame.



Fig. 5. RESULT: EMOTION RECOGNITION

4) Analysis 4: Twilio provides with an account number and a token. Using its messaging to saved official authorities' contacts is sent successfully.

7. CONCLUSION

We present a thorough review of the implementation of our system "Emotion Recognising System" based on crowd behavior. It's Image processing And Machine Learning based system where the human emotions are detected using their facial expressions where six universal facial expressions (i.e Angry, Sad, Happy, Disgust, Neutral, Fear) takes place but we focus on the "Angry" expressions. The algorithm Haar Cascade is a classifier that classifies the features of the face and detects the face of human and CNN architecture the type of Neural Network detects the facial expression on the classified feature. Which analyses the emotion and gives the rate of each emotion and if the rate of "Anger" emotion is high the further process takes place. Finally after the rate of "Anger" emotion is high the system will send an alert message to the different official organizations regarding something unwanted activity is going to take place. This result's in the safety and security of people in the crowd. The main motivation is to maintain peace in crowded areas, occasional and functional events where no such (i.e riot, fray, dispute) the unwanted activity takes place. This system can be further useful in many other applications depending on User's choice.

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