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Emotion Based Music Player

Nikhil Zaware
B.E. Computer, Department of Computer Engineering, Pune, India
Tejas Rajgure
B.E. Computer, Department of Computer Engineering, Pune, India
Amey Bhadang
B.E. Computer, Department of Computer Engineering, Pune, India
D. D. Sapkal
Professor, Department of Computer Engineering, Pune, India

Abstract:
Facial expression provides current mind state of person. The most natural way to express emotions is using facial expressions.Human often use nonverbal cues such as hand gestures, facial expressions, and tone of the voice to express feelings in interpersonal communications.
It is very time consuming and difficult to create and manage large playlists and to select songs from these playlists. Thus, it would be very helpful if the music player itself selects a song according to the current mood of the user. Thus, an application can be developed to minimize these efforts of managing playlists. In this paper, we will study about how to automatically detect the mood of the user and present him a playlist of songs which is suitable for his current mood. The image is captured using webcam and that image is passed under different stages to detect the mood or emotion of the user. The application is thus developed in such a way that it can manage content accessed by user, analyze the image properties and determine the mood of the user. The application also includes the facility of sorting songs based on mp3 file properties so that they can be added into appropriate playlists according to the mood.

Key words*: Image processing Opencv, Haar classifiers, Facial detection*

1. Introduction

Facial expressions give important clues about emotions. Computer systems based on affective interaction could play an important role in the next generation of computer vision systems. Face emotion can be used in areas of security, entertainment and human machine interface (HMI). A human can express his/her emotion through lip and eye.

The work describes the development of Emotion Based Music Player, which is a computer application meant for users to minimize their efforts in managing large playlists. Generally people have a large number of songs in their database or playlists. Thus to avoid trouble of selecting a song, most people will just randomly select a song from their playlist and some of the songs may not be appropriate for the current mood of the user and it may disappoint the user. As a result, some of the songs are not matching to the user's current emotion. Moreover, there is no commonly used application which is able to play songs based on the current emotions of the user. The proposed model will extract user's facial expressions and features to determine the current mood of the user. Once the emotion Is detected, playlist of songs suitable to the mood of the user will be presented to him. It aims to provide better enjoyment to the music lovers in music listening. In the model, following moods are included: Happy, Sad, Stressed, surprised. The system involves the image processing and facial detection processes. The input to the model is still images of user which are further processed to determine the mood of user.

The system will capture the image of the user at the start of the application. The images are captured using webcam. The image captured previously will be saved and passed to the rendering phase. The mood of the user may not be same after some time; it may or may not change. Thus the image is captured after every decided interval of time. And then that image will be forwarded to the next phase.

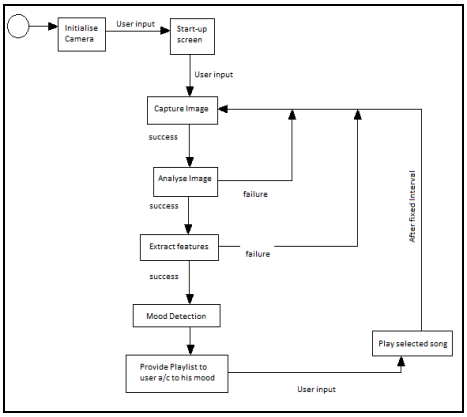

Figure 1: Implementation Flowchart

For the purpose of analyzing the image first of all, the images are converted from RGB format to binary format. For that the average value of RGB for each pixel is calculated and if the average value is greater than 110, it is replaced by white pixel and otherwise it is replaced by black pixel. Then efforts are done to find the forehead from the binary image.
The paper is organized as follows. Section II gives the introduction about the OPENCV library, in section III and IV; introduction to the facial detection using haar classifier is given. In section V we give brief description on the music player and then we proceed to concluding section with expected results and future scope along with references in the end section.

2. Open CV

2.1. What is Open CV

Open CV (*Open Source Computer Vision Library*) is a library of programming functions mainly focused on real-time computer vision. The library is cross-platform. It mainly aimed at real-time image processing. The performance of library can be accelerated if Intel's Integrated Performance Primitives is installed on the system. It happens because of the presence of proprietary optimized routines

2.2. Use of Open CV

Open CV provides multiple numbers of functions for face recognition and facial detection. Open CV comes with a trainer as well as detector. If you want to train your own classifier for any object like mobile, pen etc. you can use Open CV to create one.

3. Facial Detection using Haar Cascade

Object Detection using Haar feature-based cascade classifiers is an effective object detection method. It is a machine learning based approach. In this approach a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. First of all, lot of positive images (images of faces) and negative images (images without faces) are used to train the classifier. Then features are extracted from it. For this, haar features shown in below image are used. They are just like our convolutional kernel. Each feature is a single value obtained by subtracting sum of pixels under white rectangle from sum of pixels under black rectangle.

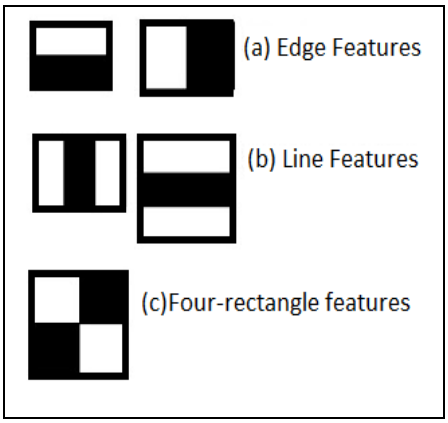

Figure 2: Common Haar Feature

Now all possible sizes and locations of each kernel are used to calculate plenty of features. But among all these features we calculated, most of them are irrelevant. In the figure below top row shows two good features. The first feature selected seems to focus on the

property that the region of the eyes is often darker than the region of the nose and cheeks. The second feature selected relies on the property that the eyes are darker than the bridge of the nose. Common haar features are as shown in Fig. 2.

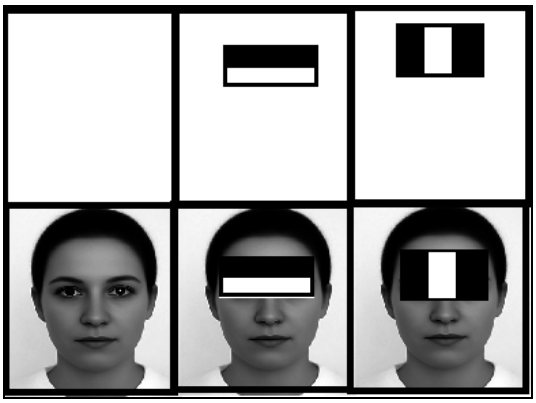

Figure 3: Feature Extraction from Face

Each and every feature on all the training images is applied. For each feature, it finds the best threshold which will classify the faces to positive and negative. But obviously, there will be errors or misclassifications. The features with minimum error rate, which means they are the features that best classifies the face and non-face images are selected.
After this the concept of Cascade of Classifiers is introduced. Instead of applying all the 6000 features on a window, group the features into different stages of classifiers and apply one-by-one. (Normally first few stages will contain very less number of features). If a window fails the first stage, discard it. We don't consider remaining features on it. If it passes, apply the second stage of features and continue the process. The window which passes all stages is a face region. The extraction of facial features like eye and forehead is as shown in Fig. 3.

4. Module Description

4.1. Extracting Effective Features
In this module, first System will capture the image from webcam or suitable device. Then the input image is first checked for the facial features. In case if the image does not contain human features, then it does not detect it. If the input image contains Human features, then it detects the features. Face is detected from image as shown in Fig. 4.

Figure 4: Face Extraction

4.2. Feature-Point Detection
In this module, the feature points are detected automatically. For face detection, first we convert binary format image from RGB format 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 next stage is to find the forehead from the binary image. System will start scan from the middle of the image, after that it will look for continuous white pixels after a continuous black pixel. In this we want to find the maximum width of the white pixel by searching vertical both left and right site. Then, if the new width is smaller half of the previous maximum width, then we break the scan because in that case we will reach to the eyebrow. Then we cut the face from the starting position of the forehead and its height will be 1.5 multiple of its width. In this processed image we will only have eyes, nose and lip. Then we will cut the RGB image according to the binary image. This stage can also be achieved using Haar Cascades Technology provided by Open CV. Haar Cascade Handle this with much more optimized and efficient way. Lower face is extracted from face as shown in Fig. 5.

Figure 5: Lower face

4.3. Lip Feature Detection

Up till now we will have an image which contains lip portion of the face. Now the next step is to extract the expression features from lip .To extract the feature we just have to measure the distance between upper lip & lower lip. Also the system will consider the position of contour points of lip. By lip feature we can significantly determine two features happy & surprise mood.The lip from lower face is detected as shown in Fig. 6.

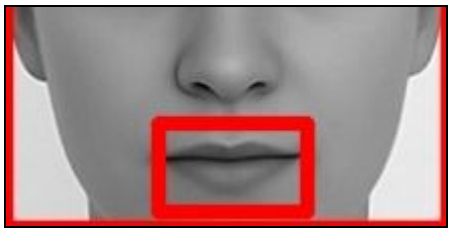

Figure 6: Lip Detection

4.4. Eye Feature Detection

Even with an upper face we can obtain certain facial feature like sleepy and surprised. For this again we have to calculate distance major axis and minor axis considering that eye as an ellipse. The eye is detected as shown in Fig. 7.

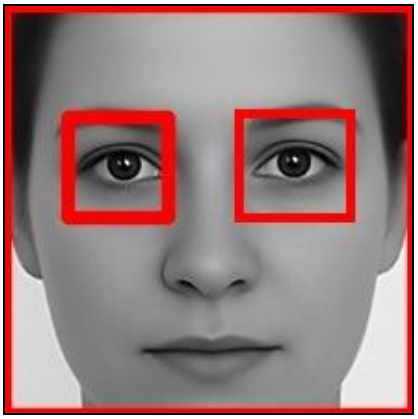

Figure 7: Eye Detection

5. Music Player and Playlists

Music Player is developed in java language. It is a simple Music player which includes the functions of pausing the song, next song, previous song and it provides user the facility of managing the database of songs (addition of new songs, Updation of playlists, Deleting song from playlist, etc). Playlists will include songs of different categories like the playlist of songs to be played if mood of user is happy or sad or stressed, etc.

6. Conclusion

Thus the application developed will reduce the efforts of user in creating and managing playlist. It will provide better enjoyment to the music listeners by providing the most suitable or appropriate song to the user according to his/her current emotion. It will not only help user but also the songs are systematically sorted.

Future Scope for Implementation:

- Facial recognition can be used for authentication purpose.
- Android Development.
- Can detect sleepy mood while driving.
- Can be used to determine mood of physically challenged & mentally challenged people.

Advantages and Shortcomings

6.1. Advantages

- Ease of use,
- No trouble of troublesome selection of songs,
- Can be used in vehicles

6.2. Shortcomings

- Camera captured images depend highly on the amount of luminescence.
- Mixed mood detection is not provided by the application. It is able to judge only one mood at a time.

7. References

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