

Emotion Recognition using Image Processing

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Abstract - Humans can easily identify emotions but this is not an easy task for a computer. A computer detects emotions by analyzing images. But a human can identify emotions with pitch, volume, tone facial expressions. In this paper we will detect user's emotion using his facial expressions. We can use preexisting image in memory or we can also feed the images via a camera.

This work is implemented using Python 2.7 and OpenCV. In this paper we are identifying the emotions in a scanned image.

Keywords - Emotion detection, Image processing, OpenCV, python

I. INTRODUCTION

The two main forms of communication widely used by all the humans are verbal and nonverbal communication. Communication is important to complete everyday tasks in one's life. One of the important forms of communication is the expressions of our face. It is a type of non-verbal communication. It's still a big mystery to read human minds.

Emotion recognition is what we humans do naturally but computer technology has to be trained. Understanding emotions for a human being is a very easy and inherent task but for a machine to understand human's emotion accurately is a difficult task at present. Various researches are going on to identify the emotions of a human being with a machine.

Facial expressions change the flow of conversation (1) and it also tells us how to communicate information and facts to the other person involved. A lot of things can be conveyed to listeners with our gestures even if we don't speak anything. According to P. Carrera-Levillain and J. Fernandez-Dols (2) if the facial expression and our spoken words are different that is if both convey different things then what we convey with facial expressions is only considered by others.

Earlier the computing designs were computer centered but nowadays designs are human-centered designs (3). Humans communicate information mostly through expressions. Traditional Human Computer Interaction (HCI) based systems were just made according to the input given by user but nowadays so many software works according to user's behavior. For example all the shopping websites features the items checked by the user on his system according to search history. So in future humans will be interacting with machines through their behavior more as compared to physical inputs. (4).

This is one of the main reasons that computer research community is showing a lot of attention in analyzing

emotions and expressions. There are several application areas where emotion recognition can be used like education, entertainment, medical applications, websites, e commerce and many more which are yet to be discovered.

Facial expressions are studied since ancient times because it is one of the most significant medium of non-verbal communication (5). Aristotle and Stewart were first to identify facial expression. Ekman had proposed six basic emotions in 1971.

II. LITERATURE SURVEY

A. Facial expression - In everyday interaction, humans interact only 7% with the help of language, 38% via body language and 55 % via facial expression (6). So we can conclude that facial expression constitutes the most important way of communication. That's why we are going to identify the outlook of students through facial expression using image processing.

B. Ekman - Ekman had proposed six basic emotions or expressions (7) which are happiness, sadness, fear, disgust, surprise and anger. These expressions are called as "universal" as they were found to be present across all humans. This theory of universal emotions has been evolved by Darwin's observations. Darwin said that human emotions have gradually developed from animals. These expressions were untaught and existing from birth in human nature and are essential for our existence. In 1960s, Ekman tried to validate Darwin's theories from his research work.

C. PCA - Face detection algorithm uses PCA which means Principal Component Analysis. Images of face are projected on a face space .A face space is explained or identified by Eigen faces and Eigenvectors (8). For facial extraction input image is converted using Harris and Shi Tomasi corner detector method .Then arithmetic operators are applied so that the image receives a threshold. Then the image is converted from RGB to LAB color. Then we plot a rectangle so that the image gets detected. Then the image is divided into blocks. Apply transformation and extract the facial features facial feature and map the image. This algorithm fails under varying conditions.

D. Face Recognition - Face Recognition is two-step process (9) .The first step is initialization step. Here we will capture face images which are called as training set. Then we will keep high Eigen values and frame Eigen faces form it. Then M Dimension weight space is formed by keeping face image on face space. The second step is Recognition step where we will project input image on M Eigen faces and calculate set of weights. After this we will determine whether the image is known image or unknown image.

E. Scilab - Scilab is open source software for numerical computation (10).It is based at IITB and founded by MHRD. It can be used to develop GUI based application for image processing with the help of SIM toolbox. Scilab works easily with Scilab java, .Net module, Scilab MySQL, Scilab Remote Access Toolbox. It is powerful, quick and easy to work in SIP toolbox.

F. OpenCV - OpenCV means Open Source Computer Vision Library (11). It is having around 2000-3000 optimized algorithms which can be used for computer vision, image processing and machine learning.

G. Fisherface Classifier - Fisherface classifier without pre-processing loses its accuracy if the light is too low. Fisher face with pre-processing achieves accuracy of 0.8667 in higher lightning conditions. At intensity of 0, no pre-processing Fisherface achieves accuracy of 0.55 (12)

III. OPENCV FACE RECOGNIZER

OpenCV has made emotion recognition a very easy process. There are basically three steps involved:-

1. Data gathering - Gather images of face to identify.
2. Extract the face.
3. Create the training set and the classification set.

IV. EMOTION RECOGNITION USING OPENCV AND PYTHON

Before starting the emotion recognition using OpenCV we need following software modules and packages:

A. Cv2 - OpenCV module is used to work with python for face detection, identifying emotions and face recognition. OpenCV supports various high level programming languages like C, C++, Python, Java and is widely available on various platforms like Windows, Linux, OS X, Android, iOS etc. (13)Due to this feature our program can work on a wider area.

B. Numpy - Numpy is package which is used for mathematical and scientific computing along with Python language. Numpy has various powerful functions and tools to integrate and work with C and C++ code. It is a library for numeric operations. Its syntax is like MATLAB. (14)

OpenCV has ‘facerecognizer’ classes and we will be using those classes for emotion recognition. These classes use various different techniques, of which I will be using the Fisher Face. We created our own dataset and extracted it. For this all the images are kept in one folder “image”. There is one txt file which has encoding for 6 basic emotions for example

6=neutral,1=sad,2=happy,3=contempt,4=disgust,5=sad,6=su rprise.Keep all the txt files in one folder named emotion and images in folder images..

Next we create an empty folder for all the emotions and label it as sad, happy etc. After this we had run python code where

We are selecting any two images of each person.

The next step is to extract the face where we are using HAAR filter to find a face from an image. The selected face is cropped and converted to gray scale with the help of another python program and saved in a folder .In the last we are training our classifier how each emotion looks like with a python program. Once we run this the empty emotion folder will be loaded with their respective images.

V. RESULTS

We were able to identify the emotions with the help of python snippet. Following are some of the results. The empty folders had various images after running the python snippet.

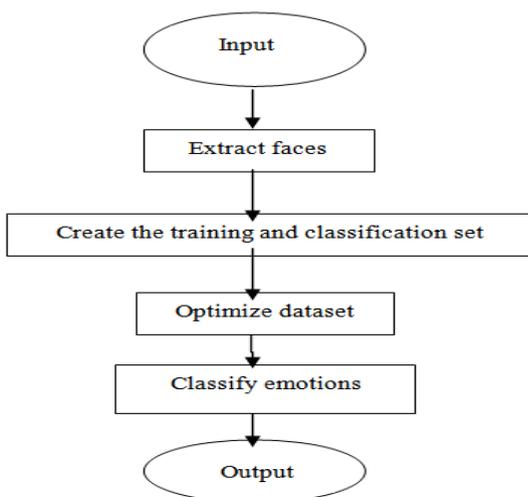


Figure 1: Emotion Recognition Flowchart



Figure 2: Results

VI. APPLICATIONS AND FUTURE SCOPE

Emotion recognition is still in developing stage. A lot of research is going in this area. There will be wide applications using emotion recognition which will be emerging in the future. Some of the applications of emotion detection are-

A. Medicine - It helps in monitoring of the patients. In the field of counseling emotion detection is used to understand human's emotional state. We can identify patients feeling about the treatment. Emotion detection can widely be applied in the treatment of autism and Alzheimer.

B. Learning or Education - Emotion detection can detect the state of students. It can be widely used in education where we can understand whether our students have understood the concept. This can create better learning environment and also provide feedback of the learning.

C. E commerce - Emotion detection can also be applied in e commerce. Emotion is vital in making purchasing decisions of the product and can also help in giving a feedback.

D. Entertainment - We can recognize moods and emotions of the user, and then we can play games, music or videos according to the user's requirement.

VII. CONCLUSION

In the coming future computers will start recognizing the emotions on our faces. Then with these emotions it can play music of your choice, set air conditioner to your mood and the day is not far when it will even order food according to your mood.

The accuracy was approximately 77%. In this work of identifying human emotions we have used python 2.7, OpenCV and a database (I used my own data). This program works efficiently with CK and Ck+ database. We as a human can also fail to understand emotions sometimes, then a machine can obviously make mistakes.

VIII. REFERENCES

- [1] P. Bull. State of the art: Nonverbal communication. *Psychologist*, 14:644,647, 2001. 2, 14
- [2] P. Carrera-Levillain and J. Fernandez-Dols. Neutral faces in context: Their emotional meaning and their function. *Journal of Nonverbal Behavior*, 18:281,299, 1994. 2, 14
- [3] M. Pantic and I. Patras. Dynamics of facial expression: recognition of facial actions and their temporal segments from face profile image sequences. *IEEE Transactions on Systems, Man, and Cybernetics*, 36:433,449, 2006. 38, 24
- [4] Z. Zeng, M. Pantic, G.I. Roisman, and T.S. Huang. A survey of affect recognition methods: Audio, visual, and spontaneous expressions. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 31:39, 58, 2009
- [5] N. Ambady and R. Rosenthal. Thin slices of expressive behaviors predictors of interpersonal consequences: A metaanalysis. *Psychological Bulletin*, 11(2):256-274, 1992. 2, 14
- [6] A. Mehrabian [Communication without Psychology] 1968
- [7] P. Ekman. Universals and cultural differences in facial expressions of emotion. In *Nebraska Symposium on Motivation*, pages 207-283. Lincoln University of Nebraska Press, 1971

- [8] Er L Singh, E M Joshi "Face Detection Using Scilab Image Processing Tool" *International Journal of Engineering Technology and Computer Science* Volume 3 Issue 3 May-June 2015
- [9] Y V Lata, C K B Tungathruthi, H R M Rao, Dr A Govardhan, Dr L P Reddy "Facial Recognition using Eigen Faces by PCA" *International Journal of Recent Trends in Engineering*, Vol 1, No 1, May 2009
- [10] S Verma "Image processing using SIM Toolbox" *International Journal of Innovations & Advancements in Computer Science* Vol 3, Issue 2 April 2014
- [11] <http://opencv.org/about.html>
- [12] Ma Ralph, A Mohamed "Image Processing pipeline for facial expression recognition under variable lighting"
- [13] opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_tutorials.html
- [14] www.numpy.org
- [15] Van Gent, P. (2016). Emotion Recognition with Python, OpenCV and a Face Dataset. *A tech blog about fun things with Python and embedded electronics*. Retrieved from: <http://www.paulvangent.com/2016/04/01/emotion-recognition-with-python-opencv-and-a-face-dataset/>

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