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Facial Expression Detection using Viola-Jones Algorithm

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Abstract

An important topic in the field of Computer Vision and Artificial Intelligence is facial expression recognition. There are two medium of communication one is verbal and another is non-verbal. Among verbal and non-verbal means of communication, facial expression is a non-verbal means of communication. Facial expression plays a vital role which helps human to express their emotions, express their feelings, mental health, perspective etc. Understanding becomes easier when human and computer interact with one another if computer can response to non-verbal communication of human which is nothing but emotions expressed. In this paper, an algorithm is presented for object detection based on Viola-Jones Algorithm. This algorithm is widely used in object detection and the main property of this algorithm is that it's training is slow but detection is fast.

Keywords; *Computer Vision, Emotion Recognition, Facial Expression, Image Processing.*

I. INTRODUCTION

Image processing is the analysis and manipulation of digitalized image so as to improve its quality. It is the technique of changing an image into digital or computerized form and perform different tasks so as to upgrade or enhance the image and obtain useful data from it. In purpose of obtaining enhanced digital images various types of computer algorithms are used.[9]

Basically, Communication can be done in two ways: verbal communication and non-verbal communication. A very essential mode of communication is human facial expressions and this comes under non-verbal mode of communication. Face expression detection is the way toward characterizing assortment of looks of feelings or emotions such as sad, happy, anger, surprised etc. When there is a smile on human face, it shows their happiness which can also be expressed in an eye by having a curved shape. The sad expression is the inclination of detachment which is ordinarily communicated as rising slanted eyebrows and frown. The anger on human face is identified with horrendous and disturbing conditions which can be expressed with squeezed eyebrows, slender and stretched eyelids. [5]

II. METHODOLOGY

The facial expression detection system consists of the following steps as shown in the figure 1:[8]

a.Input: The input images are either obtained manually or the data are gathered from the internet.

b. Pre-processing: This is the second step where the input images are converted from RGB to Gray scale image and if there is presence of any kind of noise then it is removed in this step only.

c. Feature Extraction: In this step, a specific facial feature is extracted that is used for the identification of the given facial expression in the input image and also are used for training the model.

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d. Classification: Various classification techniques are used here in order to classify the given extracted feature in its appropriate class.

e. Output: This is the final step where the classified expressions are assigned to a category of facial expression.

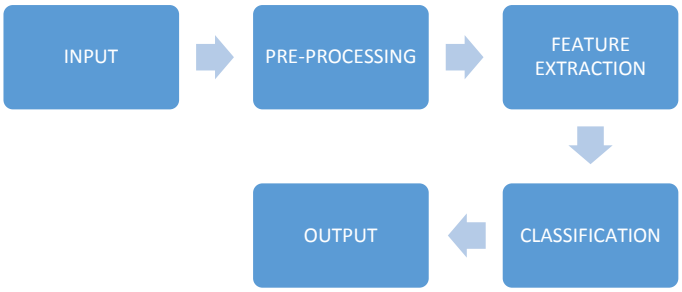

fig 1: Facial Expression Detection System Architecture

III. PROPOSED ALGORITHM

In this paper, we will be demonstrating Viola-Jones Algorithm to detect facial features. Steps for face detection in given the set of images are:

Step 1: An image is passed as an input image and based on this image the features are extracted.

Step 2: In this step, the faces are detected from the given input image, using parameters like Position, Line width, Line style and Edge color.

Step 3: In this step, the nose of each face is detected from the given input image, using parameters like Position, Line width, Line style and Edge color.

Step 4: In this step, the mouth of each face is detected from the given input image, using parameters like Position, Line width, Line style and Edge color.

Step 5: In this step, the eyes are detected from the given input image, using parameters like Position, Line width, Line style and Edge color.

The demonstration of the project detects face, nose, mouth and eyes using the MATLAB built-in class and function. This demonstration is done based on Viola-Jones face detection algorithm. The toolbox contains visionCascadeObjectDetector System Object which detects objects based on above mentioned algorithm.

Step 1: An image is passed as an input image and based on this image the features are extracted.

fig 2: Input Image

Step 2: In this step, the faces are detected from the given input image, using parameters like Position,Line width, Line style and Edge color.

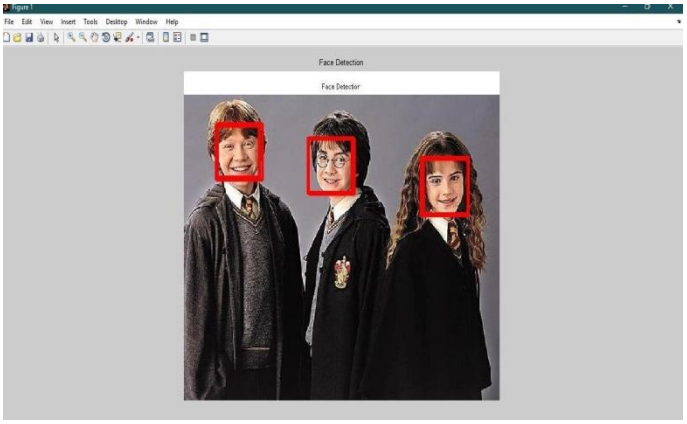

fig 3: Face Detection

Step 3: In this step, the nose of each face is detected from the given input image, using parameters like Position,Line width, Line style and Edge color.

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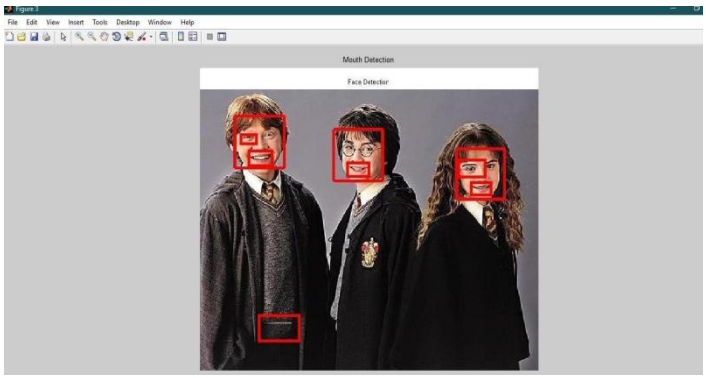

fig 4: Nose Detection

Step 4: In this step, the mouth of each face is detected from the given input image, using parameters like Position, Line width, Line style and Edge color.

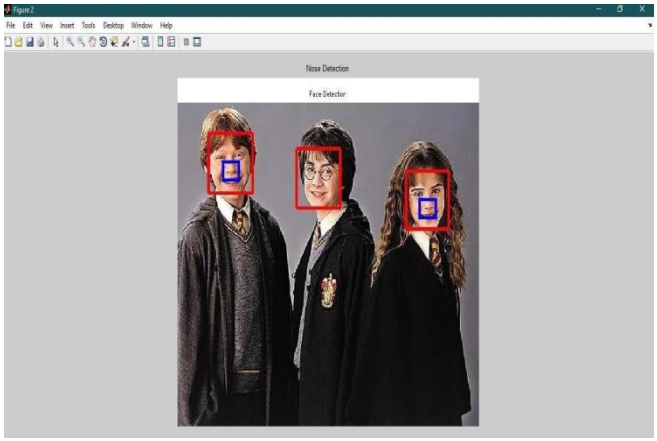

fig 5: Mouth Detection

Step 5: In this step, the eyes are detected from the given input image, using parameters like Position, Line width, Line style and Edge color.

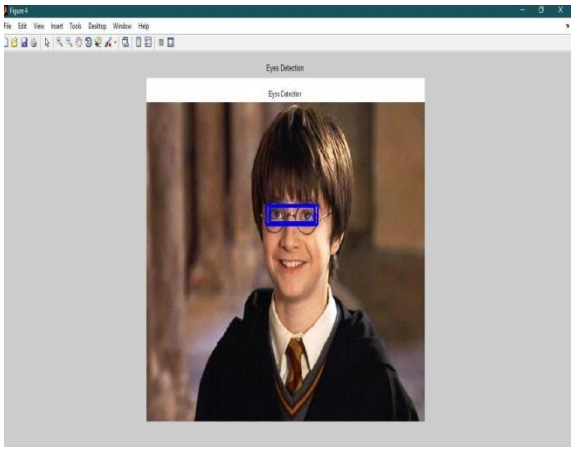

fig 6: Eyes Detection

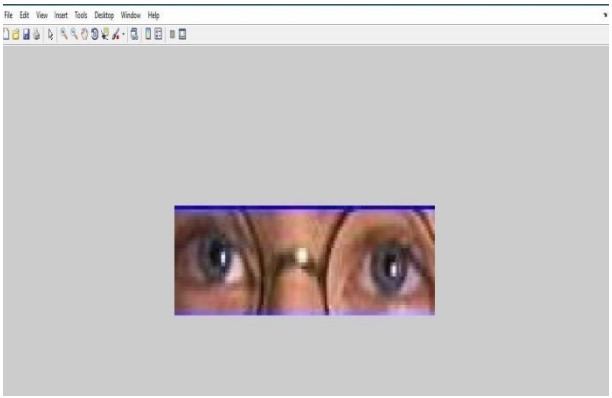

fig 7: Eyes Detection

IV. RESULTS AND DISCUSSION

S.No.	Steps	Result Obtained
1.	Step 1: Read Image	The input images which is nothing but the target and reference images were loaded.
2.	Step 2 : Face Detection	The faces were detected from the given input image, using parameters like Position, Line width, Line style and Edge color.
3.	Step 3 : Nose Detection	The nose of each face was detected from the given input image, using parameters like Position, Line width, Line style and Edge color.
4.	Step 4 : Mouth Detection	The mouth of each face was detected from the given input image, using parameters like Position, Line width, Line style and Edge color.
5.	Step 5 : Eyes Detection	The eyes of each face were detected from the given input image, using parameters like Position, Line width, Line style and Edge color.
6.	Step 6: Detect another face	Similarly, other faces were detected using the above mentioned steps.

Table 1: Results and Discussion

V. CONCLUSION

There are large number of techniques used in recognizing and segmenting objects today. In this paper, the proposed algorithm provided good detection results and was effective in detecting the

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facial features in the given sample images. However, most sophisticated techniques can be used for object recognition and segmentation such that they deal with occlusions and luminous effects and give better results. Algorithmic techniques can be improved in the future if we work upon reducing their complexities and can also be used in hardware implementation.

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