ABSTRACT

A crucial need in developing a system within a computing environment is the implementation of an interface for the user. Facial expressions recognized as a natural and effective mode of communication is considered as potential inputs for these interfaces. This thesis is mainly focusing on creating model that identify face emotion. This can be viewed as a specialized form of a pattern recognition problem, showing us the list of available techniques. Implementing these resources we aim to utilize pre-defined algorithms as initial components of our system. Hence this involves identifying the optimal approach of algorithms. To achieve this we segmented the system into three modules: preprocessing of data, Feature Extraction from image, and Classification of image. For each module several methods are implemented and the best result is determined by its performance with different combinations. Pred-defined algo assume the image to be a single variable function of an defined class label. However, in the domain of face recognition, the actual face's appearance is shaped by multiple factors such as identity, expression and more.

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1. CHAPTER

INTRODUCTION

In the rapidly evolving field of artificial intelligence, emotion detection has emerged as a significant application of computer vision and machine learning. Emotion Detection through Face Recognition, considers advanced methods to analyze facial expressions and determine emotional states. Using facial images the system detects and classifies emotions such as happiness, sadness, anger and surprise. In our previous project on image caption generation, this project explores the relationship between human expressions and computational analysis. The main goal of this project is to develop an efficient and accurate emotion detection model hence can be implemented in applications in fields like mental health assessment, user experience, and real-time emotion detecting.

1.1 Project Objective

The main objective of our project is to develop a model for detecting facial expression.

Facial expressions are critical for human interaction and while earlier systems recognize six basic emotions (joy, fear, sadness, anger, disgust, and surprise) they may fall short in capturing the full expressions. Challenges like face configuration, orientation and feature extraction are reflected in this project.

By utilizing deep learning the system classify seven basic emotions including “neutral” using facial muscle activations. Applications include healthcare where recognizing a patient’s emotional state can improve treatment and user experience providing low-cost and efficient way to measure audience response.

2. CHAPTER

LITERATURE REVIEW

Author (Publisher Name)	Date (Published Year)	Description
Ekman, P.[1]	1992	Paul Ekman et al. introduced the six basic emotions (happis, sads, angry, fears, surprised) and their expression through facial muscles. their research papper has helped for modern facial expression analysis and emotion detection systems.
Viola, P. & Jones, M. (IEEE)[2]	2001	Viola-Jones algorithm is a fast method for real-time face detection using Haar-like features. This algorithm became a cornerstone for detecting faces in video streams and still images essential for emotion recognition systems.
Shan, C. Gong, S. & McOwan, P. (Image and Vision Computing Journal)[3]	2009	They presented a facial expression recognition system using Local Binary Patterns for extracting feature of image. Their work showed significant improvements in speed and accuracy making it applicable for real-time emotion detection tasks.
Zhang, Z. Luo, P. Loy, C.C. Tang, X.[4]	2014	Developed a deep learning framework for facial expression recognition system, presenting deep convolutional networks for extraction of feature and classification. Their defined work show accuracy and significantly improving the detection of subtle emotions.
Cootes, T.F. Ionita, M.C. Lindner, C. Sauer, P.[5]	2018	They use Rf to cast votes for landmarks locations based on local images patch with Haarkasting-like features. Many methods refine an initial guess of the landmarks locations iteratively the first guess/initialization is thus critical.
N. Mehendale[6]	2019	On face emotion detection, include the dataset features and the face emotion recognition study. Visual features of images are detected and some of the methods are discussed and are helpful in the inspection of the methods of emotion recognition.

Author (Publisher Name)	Date (Published Year)	Description
S. R .N .S. M. A. H .Akhand,[7]	2021	Ekman et al. gives 7 basic emotion, as they are of culture in which a human with the 7 expressions (angry, feared, happyi, sad, disgust and surprised). Adapting the deep study on face emotion recognition including the dataset features and the face emotion recognition classifier.

3. CHAPTER

METHODOLOGY

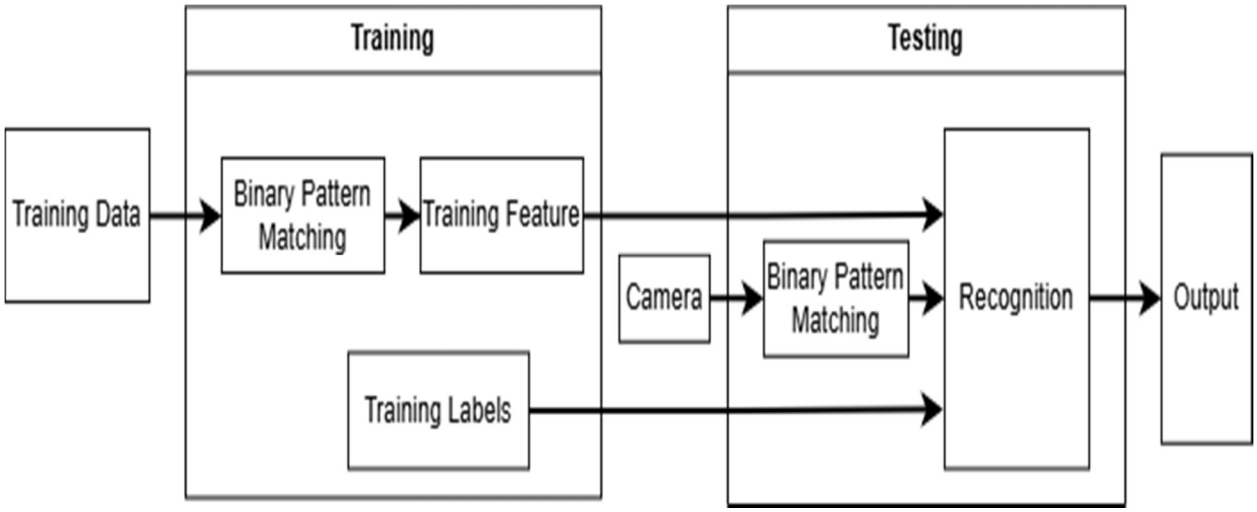

Fig: 3.1 proposed model

The given proposed model represents the step-by-step process involved in the emotion detection system. Each block highlights the workflow described as follows:

1. **Training Data:** Inserting raw images of different emotions with labels.
2. **Preprocessing:** Enhances the image by resizing, normalizing, or converting to grayscale.
3. **Binary Pattern Matching:** Identifies and isolates the face region using detection algorithms.
4. **Extraction of Features:** Extracting facial emotion from the dataset that is essential for emotion detection.
5. **Labels Finding:** finding and assigning labels to every emotions of images.
6. **Final Output:** It displays the result and highlights frame on the face.

3.1 CNN : Convolutional Neural Networks

Convolutional Neural Networks play an important role in image pattern and serving as powerful tool for extracting meaningful features and many patterns from images. Hence CNN are used to analyze the visual content before finding results. Usually a pre-trained CNN model such as VGG16, ResNet or Inception are used for extracting feature from the input image. These features stores important elements forming a meaningful representation of the image.

3.2 OpenCV

OpenCV is an open-source python based Computer Vision library. It provides many tools and algo for image processing. It supports multiple programming languages including Python, C++ and Java and compatible with various operating systems. Main features of OpenCV includes images and Videos Processing, Detection of Object and Recognition, Real-Time Processing.

For detecting emotion OpenCV can be used to preprocess images and detect faces using Haar cascadez and extract features essential for emotion classification.

3.3 Digital Image Processing

The DIP works to prepare advanced pictures by the methods for computerized PC. Advanced pictures are made out of a limited number of components and each of this has a specific area. These components are called pixels.

RESULTS & DISCUSSION

This implemented emotion detection system successfully recognizes and classifies human emotions based on facial expressions captured through a webcam. The system uses OpenCV for face detection method and Sequential deep learning model for emotion classification.

In the example shown below in Fig. 4.1, the system detects a face within the input frame and identifies the displayed emotion as Happy. The detected face is enclosed within a lined box, and the identified emotion is displayed as a label above the box.

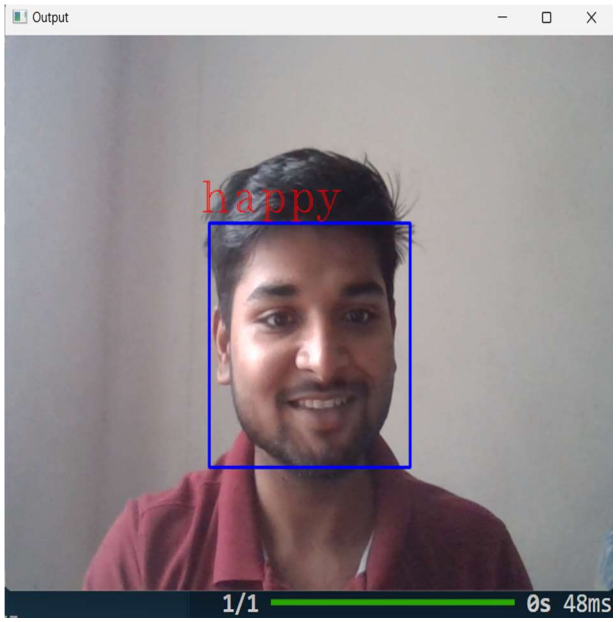

Fig. 4.1

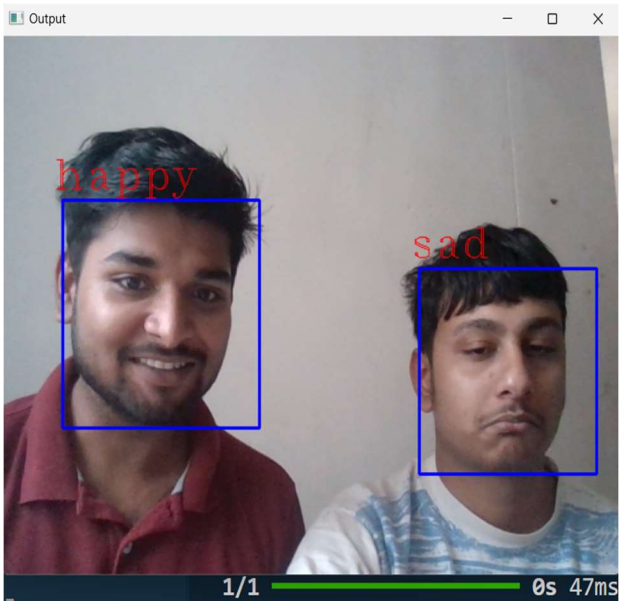

Fig. 4.2

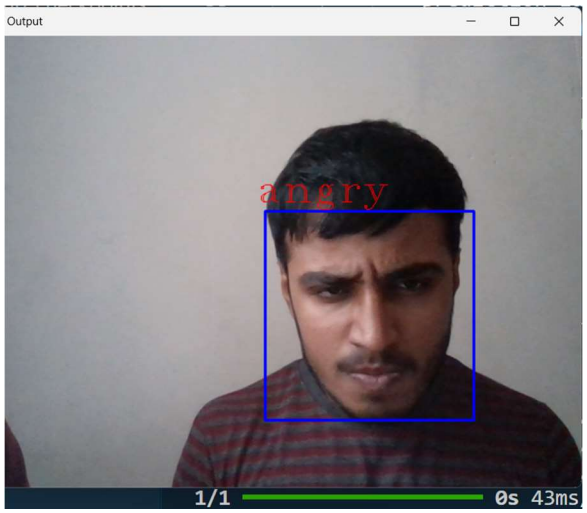

Fig. 4.3

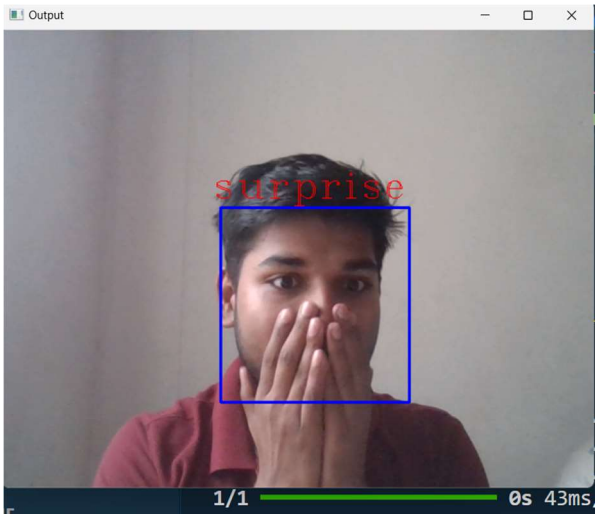

Fig. 4.4

The result of the model correctly identifies the face in the webcam frame and the classifier model classifies the facial expression into predefined categories (happy, sad, surprise, etc.) that is in the trained model. Our model processes video input in real-time hence defining efficient implementation of face detection and emotion recognition algorithms.

The result verifies the efficiency of the model in detecting emotions with high accuracy rate providing a foundation for applications in user interaction systems, behavioral analysis and healthcare monitoring.

CONCLUSION

This emotion detection project has successfully integrated computer vision with deep learning techniques for the classification of human emotion based on facial expressions. The designed system detects faces using OpenCV, classifying the detected emotions using a Sequential model; hence it proves to work successfully in real time.

It follows that the model is capable of stated emotions like happiness, sadness, anger, and surprise, opening its potential applications for research in the field of mental health care, human-computer use, and user define analysis. This work would, therefore, serve to present the premise for analysis of higher-end implementations of emotion recognition technology.

FUTURE SCOPE

This project is recently popular for developing technologies like image caption, face detection of facial emotion recognition. The main goal is to increase the model's emotional range. This can handle more complex emotions. With the use of machine learning and deep learning technology. We can implement in the corporation industry to monitor the stress level of employees. We can also use in hospital management for service feedback for hospital service benefit. With the use of other complex emotion we can understand culture.

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