A review – Face Expression Detection Techniques

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Abstract : Image processing is a method to convert an image into digital form and perform some operations on it. With the advancements in artificial intelligence (AI), the field of human behavioral prediction and analysis, especially human emotion, has evolved significantly. The most standard methods of emotion recognition are currently being used in models deployed in remote servers. These Human facial expressions convey a lot of information visually rather than articulately. Facial expression recognition plays a crucial role in the area of human-machine interaction. Automatic facial expression recognition system has many applications including, but not limited to, human behavior understanding, detection of mental disorders, and synthetic human expressions. Recognition of facial expression by computer with high recognition rate is still a challenging task.

Keywords- AI

1. INTRODUCTION

To understand the behavior of a human being, expression plays the most important role. In the present era a huge research work is going on in the field of digital image and image processing. The way of progression has been exponential and it is ever increasing. Image Processing is a vast area of research in present day world and its applications are very widespread. Various surveys have already been done to understand different components that play major roles in understanding human emotions. The outcome of those surveys concluded that non-verbal components, facial expressions, play the most important role during interpersonal communication.

Research in the field of emotive facial recognition has gathered attention in the last couple of decades, as the applications are not only limited to computer science but can be implemented in the field of affective computing, computer animation, cognitive science, and perceptual sciences etc.. The major mode of exchanging feelings and emotions in daily life is facial expressions. Small facial gestures are strong enough to pass on the message to another person about one's feelings.

Facial emotion is more important than verbal communication, as the emotions are an actual spontaneous reflection of a person's feelings. Lots of research is being carried out to develop such robots that are capable of understanding the facial emotions of human beings and could understand different moods of people. To automate the facial emotion recognition system, various techniques have been used.

With the help of such systems, facial expressions can be detected and the system has been applied during interviews, for surveillance systems, and for detection of aggression. When it comes to computer vision and artificial intelligence, facial emotion recognition is one of the most important topics. For detection of facial emotions, various sensors can be used but facial images are more important because they carry enough information to understand interpersonal communication.

Various research has been conducted over the last couple of years, out of which deep-learning-based FER approaches along with detailed algorithms have been proposed. In addition there are various hybrid and deep-learning approaches that are a combination of convolutional neural networks that combine the spatial and temporal features of frames.

Our aim is to work in the real time in which we detect the emotions from images that has been captured by live webcam. Now the webcam will be running a video and the faces are going to be detected in the frames according to the facial landmarks which will contain the eyes, eyebrows, nose, mouth, corners of the face. Then the features were extracted from these facial landmarks (dots) faces which will be utilized for the detection of the facial emotions. After the emotions are identified, we look for anydiscomfort in the emotions through image processing techniques

.   Facial emotion recognition systems have gained popularity over the decades because of their diverse applications, and the majority of those applications are applicable in real-world activities like smart supervision for suspicious activities, marketing, group emotion analysis, etc. In the same field, a cost-effective system has been proposed by Muhammad Sajjad et al. that will help to implement a smart security system for law enforcement.

This system has been proposed using Raspberry-Pi with Pi-cam, that also makes it cost effective and compact. With the advancement of technology and the availability of various compact devices like Raspberry-Pi, it becomes easy to equip police and security officers with compact systems that can detect facial images in real-time. In addition to that, with the development of cloud-based technology, the captured images can be sent to cloud for future action. Such a cloud-assisted facial recognition framework has been proposed by Muhammad Sajjad et al. that can help to identify criminals and provide ease for police and security people to identify criminals quickly and easily with this proposed framework.

A. OBJECTIVE

The objective of this is to develop Automatic Facial Expression Recognition System which can take human facial images containing some expression as input and recognize and classify it into seven different expression class such as :
1. Neutral
2. Angry
3. Disgust
4. Fear
5. Happy
6. Sadness
7. Surprise

B. PROBLEM DEFINITION

Human facial expressions can be easily classified into 7 basic emotions: happy, sad, surprise, fear, anger, disgust, and neutral. Our facial emotions are expressed through activation of specific sets of facial muscles. These sometimes subtle, yet complex, signals in an expression often contain an abundant amount of information about our state of mind. Through facial emotion recognition, we are able to measure the effects that content and services have on the audience/users through an easy and low-cost procedure. For example, retailers may use these metrics to evaluate customer interest. Healthcare providers can provide better service by using additional information about patients' emotional state during treatment. Entertainment producers can monitor audience engagement in events to consistently create desired content. Humans are well-trained in reading the emotions of others, in fact, at just 14 months old, babies can already tell the difference between happy and sad. But can computers do a better job than us in accessing emotional states? To answer the question, We designed a deep learning neural network that gives machines the ability to make inferences about our emotional states. In other words, we give them eyes to see what we can see.

C. FEATURE EXTRACTION

Feature extraction is a process of dimensional reduction by which an initial set of raw data is reduced for some processing purpose. Features define the behavior of an image. Basically features refer to a pattern found in an image such as a point or edge. The process of feature extraction is useful when you need to reduce the number of resources needed for processing while retaining the important and relevant information. The amount of redundant data can be reduced by feat features for classifying and recognition of images.. The first feature selected focuses on the property that the region of the eyes is darker than the region of nose and cheeks. The second feature selected focuses on the property that the eyes are darker than the bridge of the nose. But the same windows applying on cheeks or any other place is irrelevant.

2. CONVOLUTIONAL NEURAL NETWORK

Convolution Neural Network or CNN/Conv-Net is an algorithm of Deep learning. An input image is feed for the algorithm to assign learnable weights and biases and try to find importance to various characteristics in the picture provided, these networks helps to differentiate each characteristic from one another. The important feature of CNN is that pre-processing needed in this is much lower when compared to another algorithms (classification). The network neurons architecture in Convolutional Neural Network is somewhat similar to patterns that human brain cell has while connecting to each other. The Receptive Field which is the visual field of the restricted region where single neurons respond to stimuli. The whole area (visual) is covered with a collection of such fields which overlaps.
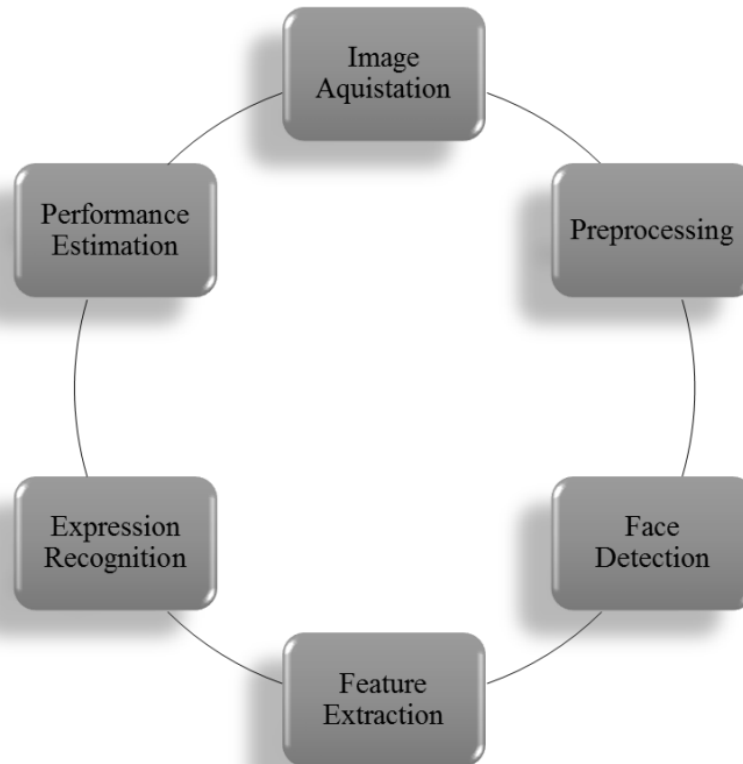
For implementing this project four basic steps are required to be performed.
i. Preprocessing
ii. Face registration
iii. Facial feature extraction
iv. Emotion classification

Preprocessing

Preprocessing is a common name for operations with images at the lowest level of abstraction both input and output are intensity images. Most preprocessing steps that are implemented are –
a. Reduce the noise
b. Convert The Image To Binary/Grayscale.
c. Pixel Brightness Transformation.
d. Geometric Transformation.

Face Registration

Face Registration is a computer technology being used in a variety of applications that identifies human faces in digital images. In this face registration step, faces are first located in the image using some set of landmark points called "face localization" or "face detection". These detected faces are then geometrically normalized to match some template image in a process called "face registration".

Facial Feature Extraction

Facial Features extraction is an important step in face recognition and is defined as the process of locating specific regions, points, landmarks, or curves/contours in a given 2-D image or a 3D range image. In this feature extraction step, a numerical feature vector is generated from the resulting registered image. Common features that can be extracted area.
a. Lips
b. Eyes
c. Eyebrows
d. Nose tip
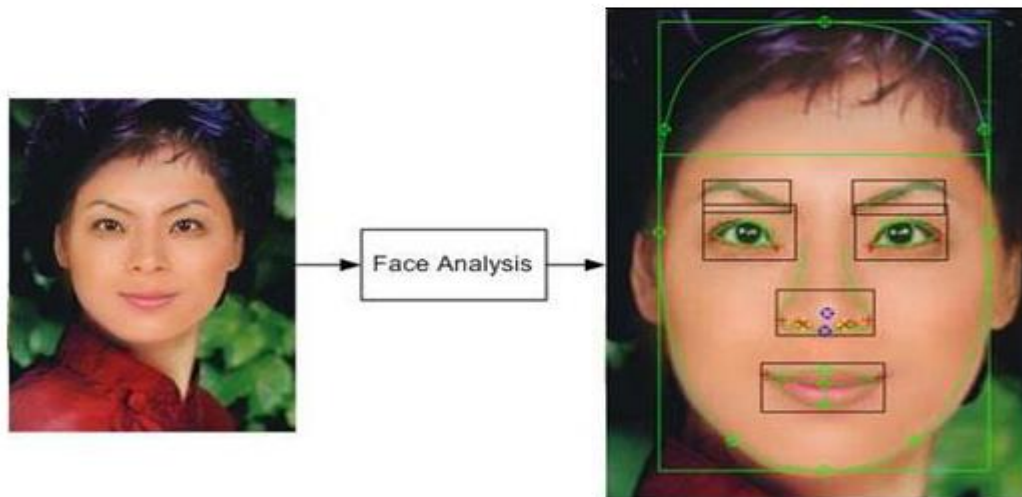
Emotion Classification

In the third step, of classification, the algorithm attempts to classify the given faces portraying one of the seven basic emotions.

Facial expression recognition is a process performed by humans or computers which consists of:

1. Locating faces in the scene e.g., in an image; this step is also referred to as Face detection.

2. Extracting facial features from the detected face region (e.g., detecting the shape of facial components or describing the texture of the skin in a facial area; this step is referred to as facial feature extraction.

3. Analyzing the motion of facial features and/or the changes in the appearance of Facial features and classifying this information into some facial-expression interpretative categories such as facial muscle activations like smile or frown, emotion (affect)categories like happiness or anger, attitude categories like disliking or ambivalence, etc. this step is also referred to as facial expression interpretation.

CONCLUSION

The facial expression recognition system presented in this research work contributes a resilient face recognition model based on the mapping of behavioral characteristics with the physiological biometric characteristics. The physiological characteristics of the human face with relevance to various expressions such as happiness, sadness, fear, anger, surprise and disgust are associated with geometrical structures which restored as base matching template for the recognition system. The behavioral aspect of this system relates the attitude behind different expressions as property base. The result obtained from the proposed model gives the estimated sentiment prediction of the subject based on the video information.

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