REVIEW OF FACIAL MOOD RECOGNITION SYSTEM DEVELOPMENT

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Abstract- Facial communication plays a vital role in human communication and as we're moving to the era of robots and machines that can directly interact with humans then the importance of understanding the facial expressions for communication is also at the top. Facial expression recognition can also be used in understanding the customer better and their review of the product. The technology is used by many of the tech giants to understand their customers and providing them the better services. The facial recognition system is the future of the HMI systems.

I. INTRODUCTION

The world is getting smarter everyday wherein everything that we use is now turning smart. In this smart world, our technology must give a better experience to our users and facial expression is a great step towards this changing world.

Facial expressions always play a great role in communication. The facial expression not only makes the conversation more interesting but also provides the listener to understand the emotion and get a piece of great extra information about the speaker without uttering a single word. The facial expressions make communication more understandable and easy to deduce. And when the spoken words are not matched by the facial expression of the individual then the importance of facial expression gets more power than the usual.

If we look from the perspective of automatic recognition, a facial expression can be considered to consist of different parts of the face showing different changes in facial expression according to the mood of the individual. One can divide the face into different parts or say in pixels and use a different pattern of pixels in understanding the facial behavior of a person. It's easy to lie verbally then controlling your facial expression and one can understand the person's true intention or behavior by noticing the sudden change in the facial expression of the individual. The look human exchange while talking in a group or by checking the new product or having a new experience is the fastest way to communicate non verbally and in this coming time, this power can also be given to the machines and androids of the future. As technology is rising the task that is done by humans and machines is increasing day by day. And the machine should start understanding the human facial expression to provide better service and also to be more efficient in their work. Systems to form these communication channels are known as human-machine interaction (HMI) systems. And as we're moving to the future the better and better HMI system is coming to existence, the one which does not need human support at all to learn new emotions, the one which can understand human expressions sometimes more efficiently than humans. But there's still a long way to go before machine reach the perfection humans have to understand the behavior. For this work, different algorithms are used. Some algorithms check the position of eyes, nose, and the mouth of the image while some check the position of the eyebrows for predicting the mood of the facial expressions.

The majority of facial expression recognition methods reported yet are focused on recognition of seven primary expressions categories such as happy, neutral, sad, Disgust, Surprise, fear, anger.

II. RELATED WORK

The research on the HMI system (Human-machine Interaction) is at its top right now. Researchers and scientists are trying to make the human-machine interaction better by empowering machines to understand human intentions. So it may be done by the speech recognition system, gesture recognition, or the facial expression interaction system. After several decades of hard work and research, the scientist can understand and improve the system but there's still lots of work to be done in this field.

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Earlier scientists were ignoring the facial recognition system for this but they came to understand that this can play a vital role in their work. Various specific companies are working hard on this, most of which are developing robots for daily household use or to use in sales. The first robot that we can see which is using the facial recognition system in the industry which got successful is SONY AIBO (the robotic dog for daily human interaction) which was introduced in mid-1998.
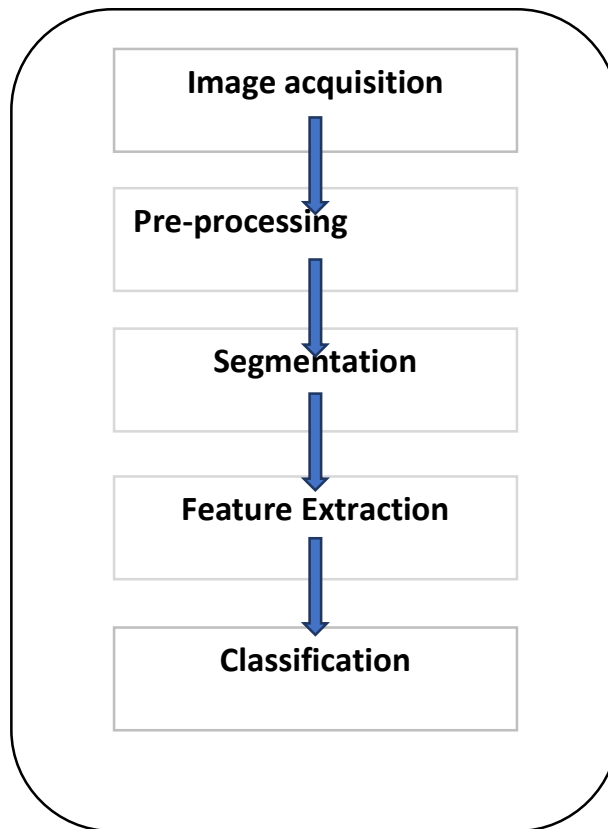
After that, the humanoid robots start coming to market, which uses facial expression and speech recognition system to interact greatly with humans. The most famous humanoid robot is SOPHIA.

SOPHIA is a social humanoid robot developed by the Hong-Kong based company Hanson Robotics. The first appearance of SOPHIA in Texas, USA in 2016 change the world perspective of looking at HMI systems. SOPHIA is proof that human-robot society us not far away.

III. METHODOLOGY

We use the deep learning approach to get the algorithm. The facial recognition system is the system that performs recognition of facial expression. Image processing was used for Facial expression recognition. In this, from image processing, useful information of an image is extracted. Image processing converts the image into digital form and performs some operations on it to extracts useful information from the image.

Following steps are followed for facial recognition system.

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│  Image acquisition      │
│          ↓              │
│  Pre-processing         │
│          ↓              │
│  Segmentation           │
│          ↓              │
│  Feature Extraction     │
│          ↓              │
│  Classification         │
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3.1 Image acquisition

We use static image for facial-expression recognition. The captured image is converted to the 2-D grey scale image which is the most popular for facial recognition system. The algorithm is trained on the dataset prepared by Pierre-Luc Carrier and Aaron Courville, as part of an ongoing research project. The data consists of 48x48 pixel which is in the grayscale2D images of faces. The faces have been automatically registered so that the face is more or less centred and occupies about the same amount of space in each image.

3.2 Pre-processing

It is the first and foremost step of a process and it plays the key role in the speed and accuracy of the project. In pre-processing we remove the redundancy from the data set without damaging the image details. In pre-processing we do the one hot vectorization of data and after that normalization of the data set. In pre-processing filtering of images is also done which produce uniform size of the image. We don't do this while training the dataset because images are pre uniformed but this should be done if images are collected from random sources to uniform the size, rotation and other factors. This will increase the efficiency and speed of final system.

3.3 Segmentation
Segmentation separates the images into meaningful reasons. Segmentation of images is method of dividing the image into homogeneous, self-consistent regions. This can be based on different factors like colour, edge, intensity, texture or anything else. In our project we did it on the basis of edges. First the vertical edges are segmented and then the horizontal one and then both of these are combined.

3.4 Feature extraction

In this step the extraction of important features of image is extracted which is used as a base to identify the image expression. In feature extraction the values near the eye and mouth can be extracted for recognizing and categorizing the mood of images and understand it more carefully. As compare to original image the information of data is reduced significantly- first through segmentation and then by feature extraction. But still all the important information is conserve. This reduced size also gives the advantage in storage of data.

3.5 Classification

It can be seen as output of feature extraction stage. After getting all the important features of image the grouping of image is done based on the similar features and these grouping is used in future to classify the image and recognizing the moods in image. Classification is a tedious and complex process because it may get affected by many factors. While training the data, algorithm recognize the important features for each mood from dataset and classify them into different groups and when the test image come the features are extracted of it and is compared with the group features for classification.

IV. APPLICATION AREA

As the time is changing and technology is in rapid development it is required to build a system which is intelligent to understand the facial expression of human and understand human behaviour better. Some of the signification applications are:
- Alert system for driving
- Human machine interaction system
- Medical help and understanding patient better
- Mental state identification
- Security systems
- Surveillance system
- Understanding the customer review
- Recommending system for movie, songs or product

V. CONCLUSION

Daily hundreds of researchers and data scientist are working on this to get a better and more accurate system because it's a great step towards the robot- human society which is dream of many. Efforts to understanding humans better through their slightest of expression can help society in many ways. Face has maximum number of sense organs and slightest of the activity in brain can trigger this senses in brain. As we refine our algorithm it is important to obtain more data from various sources and to train our system for better, much larger, much diverse facial expressions. These data can be collected on basis of different geographical regions as it is found that different facial changes are seen on people of different countries. The purpose of this paper is to give the brief introduction of mood recognition and where it can be used and how it's changing the world around us.

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