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MASKED FACE SENTIMENT ANALYSIS: A NOVEL FRAMEWORK

Naga Durga Saile. K, Assistant Professor, Dept. of CSE-AIML & IoT VNR Vignana Jyothi Institute of Engineering and Technology.
Dr. Venkatrama Phani Kumar S, Associate Professor Dept. of CSE Vignan's Foundation for Science, Technology & Research University.

Abstract

Corona Virus also names as COVID-19 created a havoc in the world. To avoid the spread of the virus the World health organization have given guidelines to all the countries to follow the preventive measures by using sanitizers, social distancing and using face masks. Sentiment Analysis also known as opinion mining is the identification of emotions-based on speech, text, facial gestures, micro emotions etc. Using facial masks, it has been a tough job to identify the emotions and expressions of an individual. In this paper, a model is demonstrated to identify the expressions and emotions of people with face mask, and thereby analyzing its corresponding sentiments using machine learning and deep learning.

Keywords: COVID-19, Sentiment Analysis, Emotion, Deep Learning.

INTRODUCTION

COVID-19, is a pandemic that emerged in Wuhan, CHINA [1]in December 2019 leading the entire world to a panic situation. It is identified that the virus spreads by getting in contact with the droplets of the infected person. The world health organization (WHO) has issued precautionary measures to safeguard one's health is by personal hygiene, social distancing, and wearing masks [2]. Though lockdowns have been imposed all over the world for a certain period, to overcome the economic crisis, the lockdowns are dissolved with few regulations and slowly people are getting back to their regular work by wearing masks. Sentiment analysis [3] also known as opinion mining is the approach to study the opinion of an individual over an entity. The opinions are gathered from different classes [4] like text, speech, video, and the analysis are performed on these, to categorize the sentiment as positive, negative, and neutral. Sentiment Analysis is helpful for many brands to know the opinion of an individual for a product.

Identifying the facial emotions of an individual is one of the techniques [5] to know the opinion. Though there are speech, text, face, and other mediums, the face is one of the finest media of generating an expression. Facial expressions help in generating [6] many important features of emotion recognition. In recent times, deep learning and Convolutional Nets gave wide scope for identifying the facial expression recognition techniques. Using the parts of the faces and few identifications on the face we can predict the emotion of an individual. Some of the emotions like contempt, happy, disgust, sad, anger, a surprise is shown below Figure 1.

Figure 1: Emotions

The emotions on the face are identified based on the feature's landmark detection on the face, each by providing a different action. These actions [7] that are performed by an individual are called action units (AU). In this paper, we propose an architecture with a handcrafted attentional convolutional network, which helps to identify the sentiment of an individual with a masked face image.


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LITERATURE REVIEW

Sentiment analysis is the process of performing an analysis of the opinions of an entity [8]. The sentiment is defined as the opinion or thought about an object [9]. Sentiments are classified as positive, negative, and neutral. There is huge research ongoing in this area of sentiment analysis. In, this chapter, we shall walk through the research conducted in sentiment analysis using different facial emotion recognitions and face detections.

The [10] Convolutional networks are used to process the image and attentional nets to remove the unnecessary parts of the face, which helps to concentrate on the features of what is necessary. The emotions of the individual can be identified from human gestures. The emotions can be found in user-generated videos with the help of context-dependent technique,[11] which also helps in multimodal sentiment analysis. With the help of Expnet, we can generate emotion, using 3D-face emotion recognition [12]. Facial expression recognition with attentional networks helps in producing the necessary features of the face[13]. There are many psychological traits in identifying the emotion based on the expression generated by the individual, which are called action units (AU).[7] describe the different Action units, the features of the face like raised eyebrows, frowning, winking, brow furrow, lip pucker, smirk, etc. There are many numbers of micro expressions on the face that can be generated. Each Micro expression gives several ways to identify the facial emotion of an individual. Categorizing the sentiments to positive negative and neutral can be done with the help of these micro-expressions.

All the research works are working accurately with images, where the face has no mask. Now, the major challenges which are underlying are face identification and emotion recognition with masked faces.In the next, chapter we shall discuss the proposed model for detecting the emotions on the face and classify their sentiments by taking into consideration the insights of the related research work on face detection, emotion detection using Convolutional Neural Networks and Attentional Networks.

PROPOSED ARCHITECTURE

Sentiment analysis (SA) on a masked face is a challenging job. To perform sentiment analysis there are many steps involved from gathering data, processing the data, and analyzing it to get the results. In this chapter of the paper, we shall discuss the proposed model to perform sentiment analysis on masked faces. From the related work, it is observed that convolutional neural networks(CNN) are of the best methods to perform processing on images and attentional nets have gained importance in recent times.

A. Deep Learning

Deep Learning is a subset of machine learning which is a subset of Artificial Intelligence. In recent years, machine learning and deep learning algorithms brought a great change in the analysis of data in various areas. To perform analysis on the data using deep learning mechanisms Figure 2 shows the steps involved.

1. Data gathering: There is a huge amount of data available worldwide. Identifying or creating the appropriate dataset makes the job easier.
2. Data Pre-Processing: A good amount of pre-processing is done on the data using the different techniques of machine learning and deep learning.
3. Create a model: Deep Leaning mechanisms help to create the network models that will be appropriate for the problem statement.
4. Training: Train the model with different corpora. A huge amount of training is required to have better accuracy.
5. Prediction: A well-trained model always leads to better-predicted values.

The above are the basic steps performed for any machine learning or deep learning.

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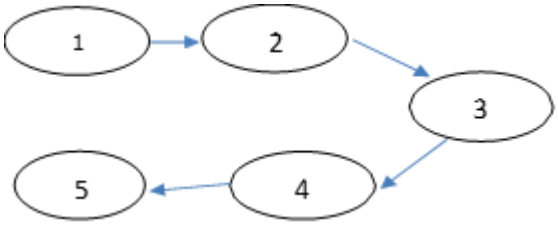

Figure 2: Steps involved in Deep Learning

1)Data Gathering 2) Data Pre-processing 3) Create a model 4) Training 5) Prediction

B. Emotion Detection

The main motto of the paper is to present a model for sentiment analysis with the help of facial emotion detection. We take the [14] attentional neural networks and convolutional networks into consideration.

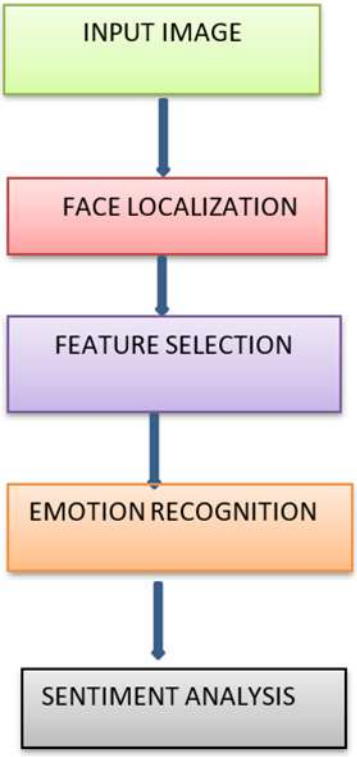

Figure3: Process for Sentiment analysis

Convolutional Networks are used for processing the image with n layers of convolutional kernels and Relu, where the image is undergone fine-tuning and processing of the data sets. Attentional Neural networks are the best for feature extraction from the input images. Figure 3 describes the process for sentiment analysis. There are two main steps to go ahead before creating a neural network for emotion recognition which are 1) Face Localization 2) Feature Selection.

In face localization, since our algorithm deals with, masked faces, we need to identify the individual faces with masks and the features that feature selection. Feature selection deals with identifying the different features on the face such as eyes, nose, lips, chin, cheek, etc. The handcrafted feature mechanism help in extracting the required features.

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Figure 4: Individual with Masked face

To perform feature selection facial landmarking plays a very important role. Since we are dealing with masked faces, the features to be selected are forehead, eyebrows, and eyes. These three are the parts of the face through which the emotion recognition can be done. While selecting the features the attentional networks to be considered. Figure 5 shows that Convolution networks are used for performing the processing of facial emotion recognition and generating the output. Res-Net CNN can be used in the processing of images. The Res-Nets have a huge number of layers of 152, where we can adjust the number of layers depending upon the image classification and feature generation. Figure 5 describes ResNet[15] ConvNet for processing the images. In our proposed model we are using 2 layers of ResNet ConvNet.

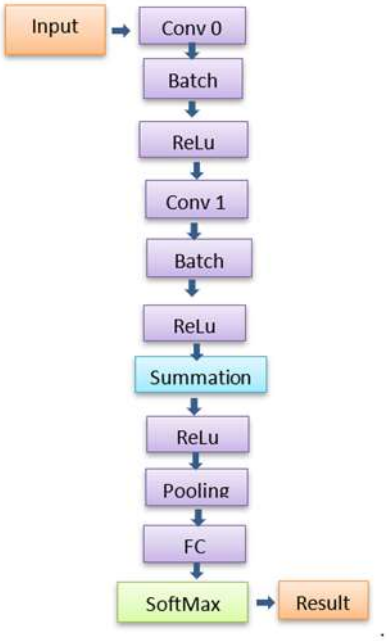

Figure 5: Resnet Conv

The architecture for the proposed model is shown in Figure 6, in which from the input image the facial feature selection is done using handcrafted feature selection (HFS) [16] technique, and further the processing is done using the 2 layered convolutional networks. The values are pooled and passed to a fully connected layer. The softmax activation function is used for the result generation.

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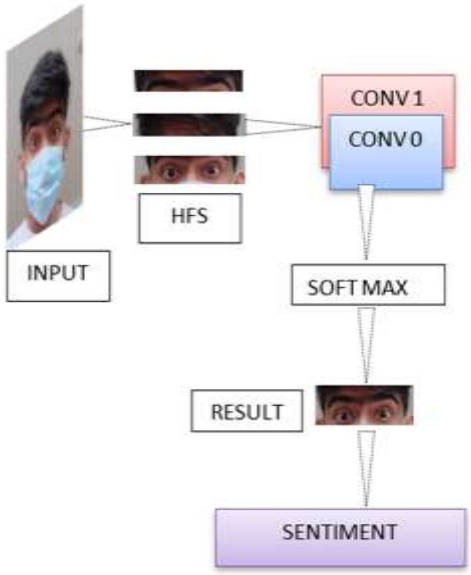

Figure 6: Architecture for proposed Model

C. Sentiment Analysis

After the emotions are recognized, we need to classify them based on sentiments. As discussed earlier, the features that are selected on a masked face are forehead, eyes, and eyebrows. Based on the micro-expressions on the face we can categorize them as positive negative and neutral sentiments. Micro expressions are the smallest facial expression that lasts for about only0.5 seconds to 4.0 seconds. There are 7 micro- expressions that a face can generate, which are namely Surprise, Fear, Disgust, Anger, Happy, Sad, Contempt/Hate. Each of these expressions haS different features on the face. Based on the feature of attention that is the forehead, eyes, and eyebrows, the following table gives you a view of how an emotion can be mapped with the features of the face. Table 1 discusses the mapping of micro expressions with emotions.

S.NO	**Micro Expression**	**Emotion**
1	Eyebrows are raised and curved, Skin below the eyebrow is stretched., Horizontal wrinkles across the forehead. Eyelids are wide opened	Surprise
2	Eyebrows are raised and drawn together, usually in a flat line. Wrinkles in the forehead area in the center between the eyebrows, Upper eyelid is raised, but the lower lid is tense and drawn up	Fear
3	Narrow Eyes, Wrinkles on the upper part of the nose	Disgust
4	Vertical lines appear on the forehead, eyes are hard stare, Eyebrows are lowered	Anger
5.	Crow’s feet near the outside of the eyes.	Happy

6.	Eyebrows are drawn in and then up, Skin below the eyebrows is triangulated, with inner corner up.	Sad
7.	Eyebrows flattened	Hate

Table 1: Mapping Micro Expressions with Emotions

The attentional of the neural networks is mainly on the forehead, eyes, and eyebrows, which are the visible parts of the face with an individual with a mask. Based on the emotion of the face they can be classified into positive and negative sentiment. The following Table2 gives the mapping of the emotion to the sentiment traits

S.NO.	Emotion	Sentiment
1	Surprise	Positive
2	Fear	Negative
3	Disgust	Negative
4	Anger	Negative
5.	Happy	Positive
6.	Sad	Positive
7.	Hate	Negative

Table 2: Categorizing the emotions to sentiments

D. Data Sets

As of now there is a lot of research going on face recognition on masked faces during the pandemic. The number of datasets available is very less. However, there are very few datasets available on the web for academic research, where the masked images are created using HCI. The user can always create his corpora to perform the sentiment analysis by gathering masked images using different ways.

CONCLUSION

In, this paper we have discussed a convolutional neural network model to perform sentiment analysis of a person with a masked face. Due to the COVID-19 pandemic, the mask has become an integral part of one's life. The model which we have discussed concentrates on the feature extraction on masked images. The micro expression generated helps to make a feature extraction of the basic visibility of the masked image. With the help of handcrafted Attentional Conv, we can identify the emotion and perform sentiment analysis on an image. There is a huge requirement for datasets and we are in the process of creating the corpora and working on the practical implementation of the technique which will be communicated in our future work.

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