Intelligent Advertisement System

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Abstract - **Emotion based advertisement system reads the facial expression of the person and displays the advertisement according to the mood of the person. In this paper we have used CNN architecture to recognize the facial expression. Our system works for 5 emotions they are: Happy, Sad, Surprise, Angry and Neutral. We have used fer2013 dataset; we trained our model over 24176 training images. It can be used for making outdoor advertisement (billboard advertisement) more effective and interesting.**

Index Terms - **Deep Learning, Convolutional Neural Network, Facial Expression Recognition, Targeted Advertisement**

1.INTRODUCTION

Facial recognition is one of the important things to be identified now a days, because it is very much hard to identify what is going on in the persons mind, so with the help of facial recognition and emotion recognition one can probably identify the mood of the person and try to make his/her mood happy if is sad.

The advertisement outside on the digital billboards are a bit boring they just show any ads randomly at any time, we can make it more interesting by adding the emotion recognition system to it, so that it will display the ads depending upon the specific persons mood or we can say emotion. So due to this the ads will be more interesting for that person.

Facial recognition is a part of face detection which in recent years has been improved massively. Face recognition is the area of research and interest for more than five decades. As it has many practical applications in the area of biometrics, Information security, access control, law enforcement, smart cards, and surveillance system. (Parmar. D, & Mehta. B, 2014.)

Digital billboards are called "smart" or "intelligent" with their capabilities of recognizing a particular object and display relevant content to it. In contrast to traditional billboards with static messages, digital billboards with more flexibility and up-to-date messages are taking their way of replacing them. This more advanced form of advertising is known as the Digital Out of Home (DOOH). Ref. Tew Jia Yu, 2019 Tew Jia Yu, Chin Poo Lee, Kian Ming Lim et. al. (2019) has used AI technology to improve outdoor advertisement. In this paper the gender and age are identified using facial recognition.

Shervin Minaee et. al. (2019) has tried to identify facial expressions using Convolutional Neural Networks (CNN). They have achieved an accuracy of 70.02%.

Fatemeh Noroozi et. al. (2018) talks about how along with speech and expressions, body language can also be used to detect a person's emotions or sentiments.

Brais Martinez et. al. (2017) talks about how facial expressions are a key feature when it comes to communications. The authors worked on the various stages in building a Facial Expression Analysis that include but are not limited to Pre-Processing, Feature Extraction, etc.

A review paper by Mäntylä et. al. (2018) talks about the rise in sentiment analysis through the years and how it is in a way related to customer feedback. It shows that the customer's sentiment is equivalent to how the product performs in the market.

Lexus has used smart digital billboards to promote the cars by triggering a personalized message to drivers corresponds to the brand, model, and colour of the vehicles. These billboards make use of high rotation cameras to capture all the passing traffic. After recognition, a personalized message is displayed for the that targeted vehicle.

Yahoo smart billboard is using image recognition technology working with cameras to collect data for identification of demographic characteristics. Other than obtaining images, the system of Yahoo also captures sound through the use of microphones to collect keywords spoken by a group.

In this paper we have developed a deep learning-based model to predict the emotions or moods of a person and based on mood it will show the relevant advertisement to the person. CNN (Convolution Neural Network) is used for facial expression recognition. The system is able to recognize five classes of expression namely, Angry, sad, happy, neutral, surprise.
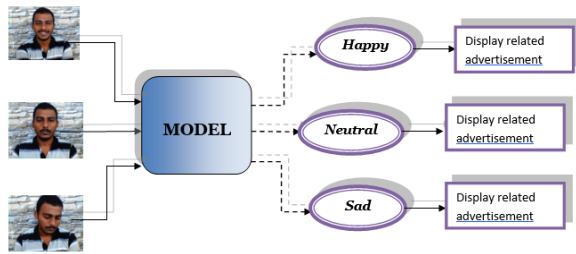
2. PROPOSED SYSTEM

Fig. (1) Overview of the proposed system

Currently the advertisement we see around us are mostly static (Banner). Once they are assembled, they just show only one advertisement till it is removed. Apart from static we also see digital advertisement on digital boards which just shows the recorded ads one after the other without any logic. In the proposed system, an intelligent advertises display system is proposed, which based on the person's mood. The advertisement is displayed based on person's mood. The overview of the system in shown in figure 1. Convolution neural network (CNNs) are commonly used for image classification and recognition, face recognition and many more.
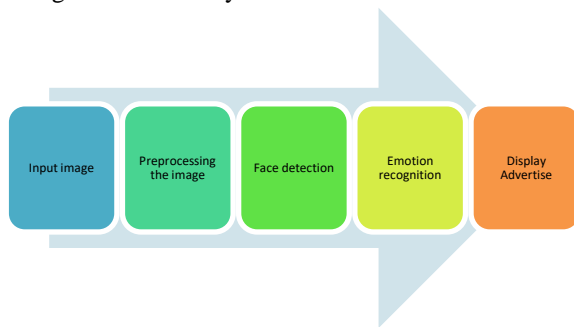

Fig.(2) Block diagram of proposed system

The block diagram of the system is shown in figure 2. The proposed system has major five steps. The image of the person/user is captured using the camera. The captured image is preprocessed. In the preprocessing step, the size of the image is reduced into the required format. The captured image is given as input to the next stage. Haar cascade is used for the face detection. The image is then converted into gray scale image and its size reduced to 48 X 48. This will help in fast processing.

Then it is then passed to the CNN model, where the emotion is predicted. After the prediction of the emotion/mood of the person, it will show relevant advertisement based on the person's predicted mood. Also, the same preprocessing is done on the images in the dataset for training the model like rescale, zoom range, width shift, height shift, horizontal flip, etc. We have used VGG16 architecture for emotion recognition.

VGG16:

VGG16 is a convolutional neural network architecture which stands for Visual Geometry Group and it is also known as OxfordNet. It was proposed in the paper "Very Deep Convolutional Networks for Large-Scale Image Recognition" by Karen Simonyan and Andrew Zisserman from the University of Oxford.
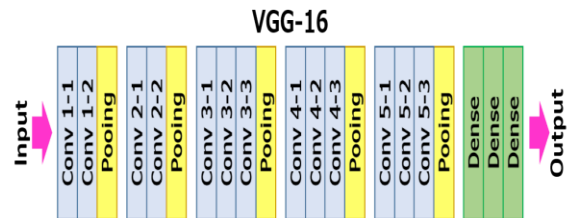

Fig. 3 Convolutional Network for Classification and Detection (Ref. Neurohive VGG16)
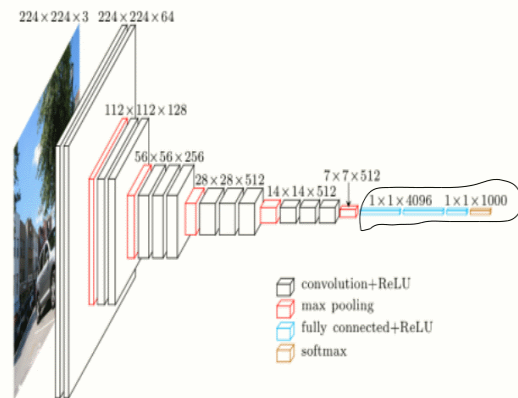
The architecture depicted below is VGG16:

Fig .4 Convolutional Network for Classification and Detection (Ref. Neurohive VGG16)

VGG16 is considered as one of the best model architectures till date. It follows this arrangement of Convolution and Max Pool layers consistently

throughout the whole architecture. In the end it has 2 Fully Connected layers followed by a softmax for output. The 16 in VGG16 refers to 16 layers that have weights. The system detects 5 facial emotions. They are: Happy, Neutral, Sad, Angry, Surprise.

System Specifications: The proposed model was trained on Lenovo V110 with the following specifications: Intel core i5 7th Generation Processor, 4GB RAM, Python 3.6, Spyder (Anaconda) and Home Operating System.

Libraries used: Keras, Opencv-python, Numpy and Pillow.

Dataset used: The fer2013 dataset which we has used has images of 48x48 dimensions images in grayscale, it has over 24176 training images and 5937 validation images

3. RESULTS

The proposed model can successfully predict the five facial emotion categories: Happy, Sad, Surprise, Neutral and Angry. The proposed system gives 72.3% accuracy with epocs. The proposed system is compared with sate of art systems as shown in Table 1. The recognized emotions/ moods are shown in figure 4. The Figure 5 shows the advertisement to the user after predicted the emotion/ mood:

Table:1 Comparison of proposed model with other models

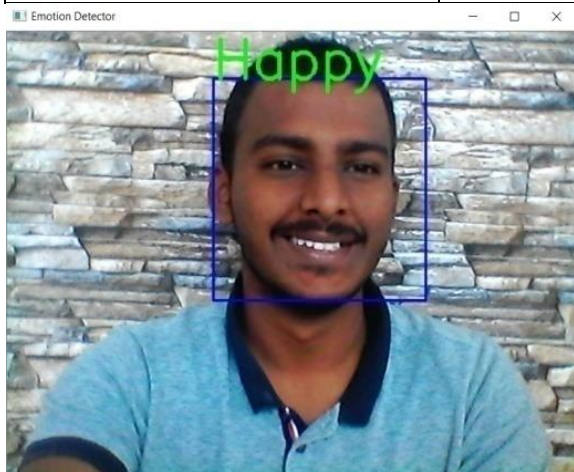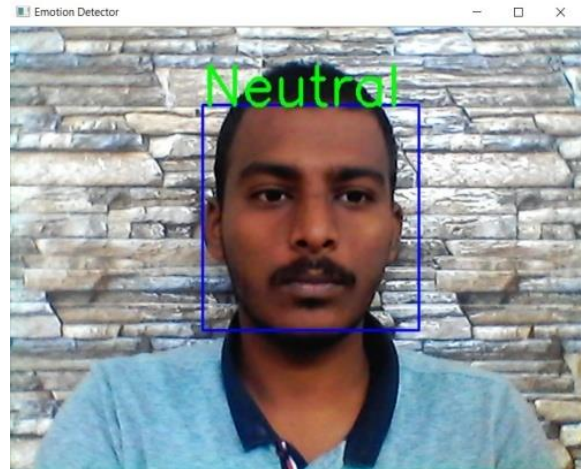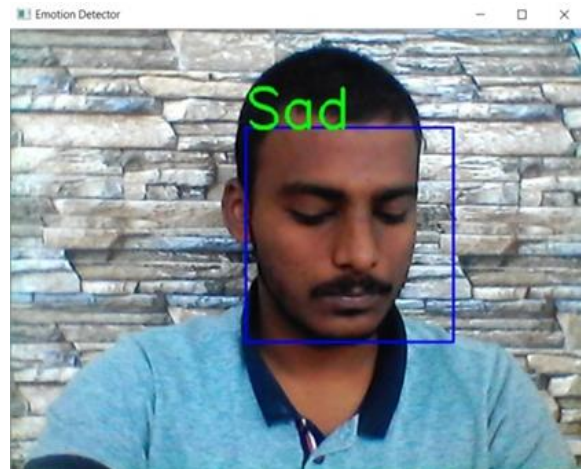| Model name	Accuracy
VGG (Ref. Pramerdorfer et al (2016))	72.7%
Res-Net (Ref. Pramerdorfer et al (2016))	72.4%
Inception (Ref. Pramerdorfer et al (2016))	71.6%
DeepEmotion (Ref. Minaee et al (2019))	70.02%
Proposed Model	72.3%

Fig. (4b)

Fig. (4c)

Fig. (4d)
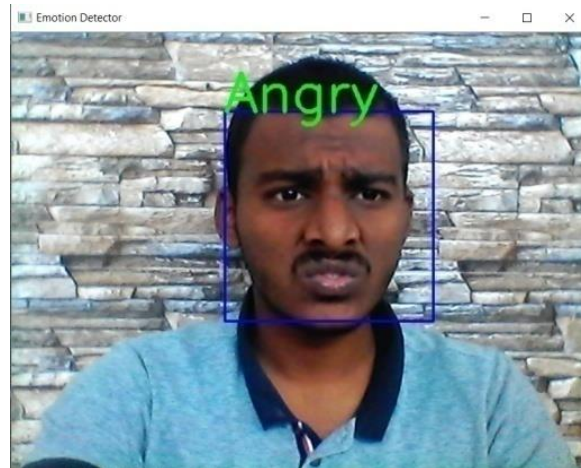
Fig. (4a)

In Fig (4a) – A Happy Face has been detected
In Fig (4b) – A Neutral Face has been detected.
In Fig (4a) – A Sad Face has been detected.
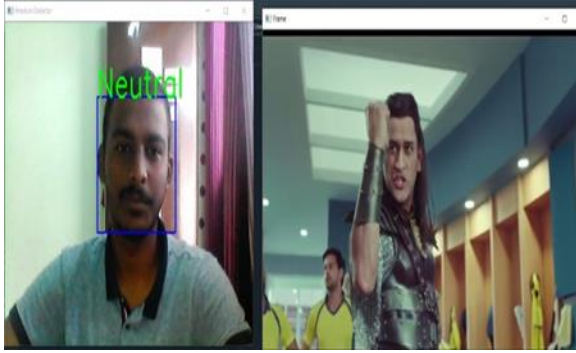In Fig (4b) – An Angry Face has been detected

Fig .(5)

In fig (5), the system has predicted the neutral emotion and according to that the system has displayed the advertisement.

4. CONCLUSION

The intelligent advertise display system is proposed in this paper. We have implemented a deep learning model which recognizes the emotion/ mood and displays the relevant advertisement to the user. The proposed system performs well and able to identify five emotions Happy, Neutral, Sad, Angry and Surprise. The proposed system will be useful to the advertiser and the audience. The advertisers can show customized advertisement and audience can will see only advertisements that will be relate to them.

The proposed system only detects five emotions nevertheless the system and further extends to more emotion / mood categories also.

The aim of this paper is to provide a better advertising experience. With the ability of system to display targeted advertise, it could be useful for both, the advertiser, and the audience. It will benefit the audience because they will see only advertisements that will be related to them.

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