

# Analysis of Facial Emotion Detection Using Haar-Cascade Classifier and Convolutional Neural Networks

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**Abstract** - The detection of human face emotions is a difficult task for computer vision. Recently, advances in computer vision and machine learning have made it possible to accurately discern emotion from video or image. In this study, we suggest employing Haar-Cascade to classify face emotion. Convolutional Neural Networks and Classifiers the FER2013 dataset is used in this experiment. We presented seven solutions based on the data acquired for the face expression recognition dataset. facial expression that has been categorized Based on epoch, the CNN model gains MSE and accuracy value. The results revealed that when the epoch value increased, the MSE value decreased, would be acquired, as well as an increase in the accuracy value. As a result, the projected CNN's algorithm has been shown to be successful at detecting facial emotion.

**keywords** - Haar-Cascade, Convolutional Neural Networks, FER etc

## I. INTRODUCTION

Computer vision is an interdisciplinary logical field that arrangements with how Computer Vision can acquire a high level comprehension of advanced pictures or video handling [4]. Computer vision can address undertakings utilizing strategies for obtaining, handling, dissecting, and separating high-layered information from pictures, video, text, and others. Sub-domains of computer vision include scene reconstruction, image compression, image restoration, vehicle detection, and facial emotion recognition. Facial emotion recognition is the central identifier for human expressions. Emotions can be expressed in many varieties such as facial expressions, voices, text, and others.

At present, this exploration approaches basically the classifier strategy utilizing Haar-Cascade and the deep learning technique utilizing Convolution Neural Network. Facial detection utilizing Haar include based Cascade classifier is a viable item recognition strategy [5]. The deep neural network has a similar sort as CNN in high organization profundity and calculation process. The essential idea of CNN practically equivalent to with Multilayer Perceptron, nonetheless, every neuron in CNN will be executed utilizing a two-layered shape. CNN must be utilized for picture and voice recorder information which has a two-layered construction. CNN has many layers of realizing which are utilized to peruse an input a component in light of the attribute of the info. The layers are as number vectors. This element extraction layer comprises of a convolution layer and a pooling layer. In the convolution layer, the result of neurons will be determined, every one of which works out their weight and until the pictures with little size are associated into input volume.

The manuscript will focus on seven facial expressions based on the training dataset, which are angry, disgust, fear, happy, sad, surprises, neutral. The proposed model is trained using the FER2013 dataset. In the next section will be presenting about Related Work or Literature Review, Methodology, Haar-Cascade Classifier, and CNN. The last section will discuss the results and conclusions.

## II. LITERATURE REVIEW

In this part, we will portray and introduce the most recent examination about CNN in digital image processing. All humans have facial expression to show their emotional mood. The facial expression has many tools for use in many fields such as robotics, medicine, unmanned aerial vehicle, and lie detectors. In view of information look as follows angry, fear, happy, sad, disgust, neutral, and surprise. As of late, Ninad and their gathering research present facial feeling acknowledgment utilizing Convolutional Neural Networks, and they partition it into two parts [1]. The initial segment to eliminating the background from the pictures and the subsequent part is on the part of vector extraction from the images. They utilized the administrative information from the put away data set of 10,000 pictures and 154 faces. The outcomes show assuming the exactness is around 96%, utilizing an expressional model with 24 values. In their paper present whenever utilized more than 750k dataset of pictures there are Cohn-Kanade, Caltech, CMU, and NIST face data storage [1].

## III. RESEARCH METHODOLOGY

### Data Acquisition

We utilize the fundamental emotion in facial emotion recognition and characterized into 7 class of expression, specifically angry, disgust, fear, happy, sad, surprise, as well as neutral. Besides, we use CNN to perceive various expressions or emotions. In fig 1 determine much facial emotion based on dataset FER2013.



Figure 1. Variety Facial Emotion Detection

**Data storage**

The dataset utilized in this exploration is Facial Emotion Recognition 2013 (FER2013). The training set comprises of 28,709 models, and the testing set comprises of 7179 models. The information comprises of 48 x 48 pixels grayscale pictures of the face. The appearances have been naturally enrolled with the goal that the face is less or then again less focused and involves about a similar measure of room in each picture. Then again, the test informational collection comprises of 70 models.

**CNN for facial expression detecting**

Fig 2 describes the architecture of CNN. CNN has 6 convolutional layers, 2 subsampling layers, 12 convolution layers, and 2 subsampling Neural Network.

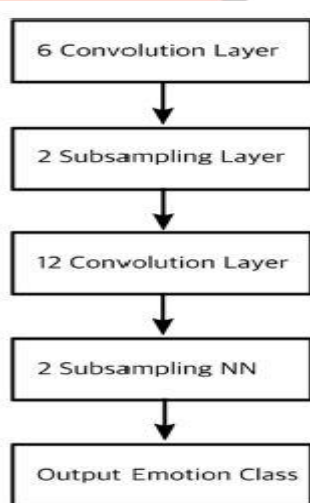


Figure 2. The Diagram for CNN for Facial Expression Detection

**Haar Cascade Classifier**

Object detection using Haar feature-based cascade classifier is an object detection method by Paula Viola and Michael Jones. In 2001, they proposed a paper name “Rapid Object Detection using a Boosting Cascade of Simple Features”. Haar cascade is a set of Haar Like Features that are combined to form a classifier. The component is the pixel esteem in the compose deducted from the pixels esteem in the clear region. The foundation of the face locator is 24 x 24. From that base face finder, there around 160k conceivable Haar-Like Feature. Notwithstanding, not these highlights are utilized.

**IV. Experimental Results**

We led tests utilizing a preparation dataset and testing informational collection continuously by a video camera. Fer2013 dataset has 28,709 pictures and we involved everything in our examinations. As we can find in table 1, we varied epochs and get an alternate outcome in MSE and Accuracy. From the experiments we can that there a significant decreasing means square error as the epoch of training data raises. A few testing information we are proposed every articulation has multiple times to test continuously

**Table 1. MSE and Model Accuracy of CNN**

Epoch	Num of Training Data	Num of Testing Data	MSE	Model Accuracy
30	28,709	70	0,8652	67%
50	28,709	70	0,6754	75%
75	28,709	70	0,5214	81%
100	28,709	70	0,4192	85%
150	28,709	70	0,3356	89%
200	28,709	70	0,2912	92%

Table 1 presents the result of the experiment, we use a variety of epoch to training and testing the data. The results present that the higher the epoch value so the MSE value is getting lower value. Likewise, model accuracy was present more accurately when the epoch higher. These works are showed the CNN method is great for testing and training images.

**Table 2. Facial Emotion Detection Classification**

Epoch	Angry	Happy	Disgust	Sad	Neutral	Surprise	Fear
30	60%	70%	50%	60%	60%	60%	60%
50	70%	70%	70%	70%	70%	70%	70%
75	70%	80%	70%	70%	70%	70%	70%
100	80%	90%	80%	70%	70%	80%	70%
150	80%	100%	80%	80%	80%	80%	80%
200	90%	100%	80%	80%	90%	90%	80%

By measuring the facial emotion in seven classes, the accuracy rates for each epoch is different. The problem when we test using video were the facial expression model is still cannot distinguish between fear and sad expression, happy and surprise expression.

**CONCLUSION**

We proposed a Convolutional Neural Network (CNN) engineering for facial emotion detection. There are seven classes of facial feelings, we test information progressively utilizing Haar-Cascade Classifier to give the feature in the round of face. We utilized the FER2013 information base and we train then, at that point, make perceptions that the more noteworthy worth of the age, as needs be the mean square error has a small value, nonetheless, the exactness of the model will be expanded.

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