# Face Emotion Detection Using Sentimental Analysis

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***Abstract-*** *Recognizing human emotions from images is one of the most powerful and challenging research subjects in social communication. Emotion recognition based on deep learning (DL) provides better performance than traditional methods that use image processing. This project presents the design of an artificial intelligence (AI) system that can recognize emotions through facial expressions. Describes the process of emotion recognition. It basically consists of three main steps: face recognition, feature extraction, and emotion classification. This project proposes a convolutional neural network (CNN) -based deep learning architecture for emotion recognition from images. The performance of the proposed method is assessed using two datasets, the Facial Emotion Recognition Challenge (FERC2013) and the Japanese Female Facial Emotion (JAFFE). The accuracy achieved with the proposed model is 70.14 and 98.65 percent for the FERC 2013 and JAFFE datasets, respectively. One of the success factors in deep learning is to train neural networks using examples. Multiple FER databases are now available for researchers to perform this task. Each is different in number and size of images and videos,, and variations. Of lighting, population, face poses.*

## I. INTRODUCTION

Recognizing human expressions and emotions has drawn the attention of researchers, as the capability of recognizing one's expressions helps in human-computer interaction, to right advertising campaigns, and crowning with an augmented and enhanced human communication ,by amending the emotional intelligence ("EQ") of humans. There are many ways to inspect the recognition of human expressions, ranging from facial expressions, body posture, voice tone etc. In this paper we have focused on facial expression recognition. Facial Emotion Recognition(FER) is a thriving research area in which lots of advancements like automatic translation systems, machine to human interaction are happening in industries. In contrast the paper focus to survey and review various facial extraction features, emotional databases, classifier algorithms and so on. This paper is organized as follows. Section 2 describes background information about expression recognition, emotion recognition system and applications of emotion recognition. Section 3 explains the Feature selection methods and Image optimization. Section 4 compares various Facial emotional database. Section 5 addresses various classifier algorithms for classifying images according to the expression identified. these emotions are exhibited through facial expressions that are consistently correspondent. This means that regardless of language and cultural barriers, there will always be a set of fundamental facial expressions that people assess and communicate with. After extensive research, it is now generally agreed that humans share seven facial expressions that reflect the experiencing of fundamental emotions. These fundamental emotions are anger, contempt, disgust, fear, happiness, sadness, and surprise [1][2]. Unless a person actively suppresses their expressions, examining a person's face can be one method of effectively discerning their genuine mood and reactions.The universality of these expressions means that facial emotion recognition is a task that can also be accomplished by computers. Furthermore, like many other important tasks, computers can provide advantages over humans in analysis and problem-solving. Computers that can recognize facial expressions can find application where efficiency and automation can be useful, including in entertainment, social media, content analysis, criminal justice, and healthcare. For example, content providers can determine the reactions of a consumer and adjust their future offerings accordingly.

## II. METHODOLOGIES

### SCOPE OF THE PROJECT

Locating faces in the scene (e.g., in an image; this step is also referred to as face detection), Extracting facial feature 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), Analyzing the motion of facial features and/or the changes in the appearance official 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 (dis) liking or ambivalence, etc.(this step is also referred to as facial expression interpretation).

### A. EXISTING MODEL

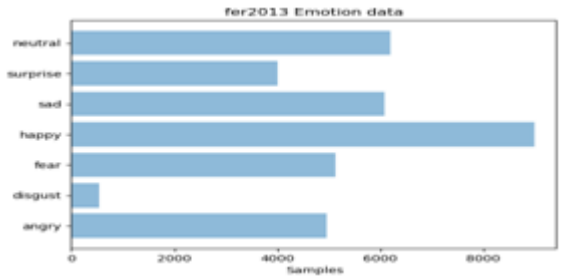
There are few models on the open market, and among all of them, there is no model that properly describes the sensation of the human face based on the facial expressions that appear on the human face like the feature-based approach Feature-based models use geometric information for feature extraction, and template-based models use 2D and 3D head and face models as templates for representational information extraction. Facial feature detection and tracking uses active infrared lighting to provide visual information under a variety of light and heat movements. Classification is performed using a dynamic Bayesian network (DBN).It is performed by comparing the generated similarity spaces. Neural networks (NNs) have been developed to perform facial facial expression recognition. The feature used is either the geometric position of a set of datum points on the face, or a set of multiscale and multi-orientation Gabor wavelet coefficients extracted from an image of the face at the datum points .

**B.PROPOSED MODEL**

The suggested Face detection and image recognition system has been built and is separated into three modules: face detection, sentimental analysis, and a simple Graphical User Interface that allows users to access the system's capabilities. We recognize faces in real time and then evaluate various facial expressions or sentiments. All of the emotions are based on various facial traits and activities. Lip movement is one of the most important features of a face. The distance between your eyes is measured in millimetres .Nose forms come in a variety of shapes. A movement of the jaw. We have used haar cascades for classification and feature extraction. It has wide range of canvas for coming days. After implementation, we are able to extract two sentiments features (‘Happy’ or ‘Neutral’ and ‘Sad’) from human faces and in future other feature also can be extracted.

**C.DATABASE**

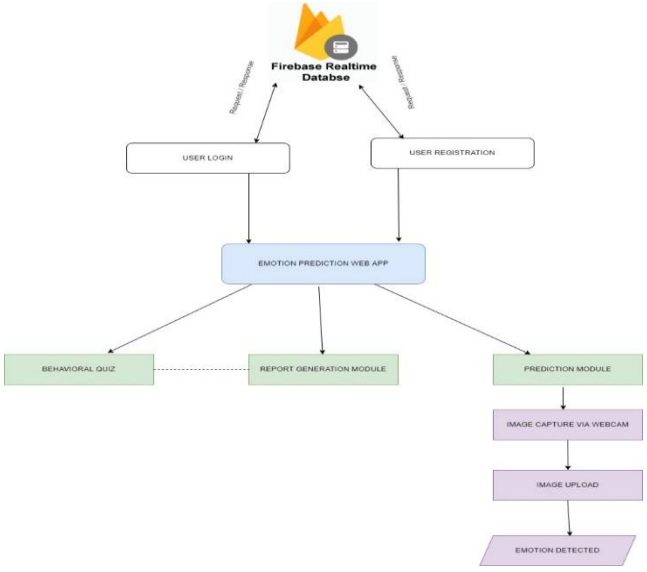
The dataset, used for training the model is from a Kaggle Facial Expression Recognition Challenge a few years back (FER2013). The data consists of 48x48 pixel gray scale images of faces. The faces have been automatically registered so that the face is more or less centered and occupies about the same amount of space in each image. The task is to categorize each face based on the emotion shown in the facial expression in to one of seven categories (0=Angry, 1=Disgust, 2=Fear, 3=Happy,4=Sad,5=Surprise, 6=Neutral).




**III. RELATED WORK**

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 the semetrics to evaluate customer interest. Health care 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.

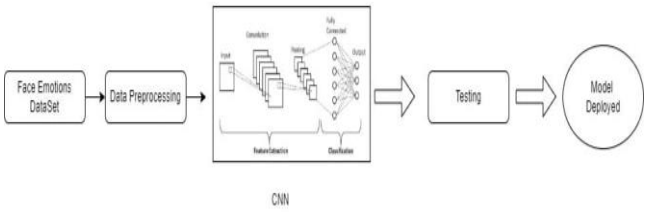
Humans are well-trained in reading the emotions of others, in fact, at just 14 month sold, babies can already tell the difference between happy and sad. But can computers do a better job than us in accessing emotional states? To answer the question, We designed a deep learning neural network that gives machines the ability to make inferences about our emotional states. In other words, we give them eyes to see what we can see.



**A. ARCHITECTURE**

The Firebase Realtime Database is a cloud-hosted database. Data is stored as JSON and synchronized in real time to every connected client. the email and password is stored in firebase database and authenticated for each login. The frontend is developed with Fast API it is a modern, fast (high-performance), web framework for building APIs with Python, This webapp consist of 6 submodules such as user Login , user registration , behaviorial quiz module , report generation module , and prediction module.

**B.SUB ARCHITECTURE**




CNN

This module focuses on behavioral theory and is an introduction to observing and measuring behavior. By the end of this module, you should be able to: Describe the rationale and importance of behavior support Define and identify elements of basic behavioral theory including three-term contingency, reinforcement, punishment and extinction .Define and describe the function of behavior

***C.* MODULES**

The user's emotion will be detected via facial expressions in this project. These expressions can be extracted from a live feed captured by the system's camera or from any previously captured image accessible from memory Human emotions can range from mild to severe. In the field of computer vision, it is well-known and has a wide range of applications a field in which various studies have previously been conducted .Python, an open source programming language, was used to complete the project. NumPy and the Computer Vision Library (OpenCV). The scanned documents .The image (testing dataset) is compared with the training dataset .As a result, emotion is expected. The purpose of this work is to further develop a system that analyses images and predicts facial expressions of the individual The research shows that this approach is feasible and yields reliable results

**FEASIBILITY STUDY**

A feasibility analysis is a research project that determines whether or not a proposed method is viable. It entails putting the application through its paces in Application.

**IV. TESTING**

Testing is the stage of implementation, which is aimed at ensuring that the works accurately and efficiently before live operation commences. Testing is the process of executing the program with the intent of finding errors missing operations and also a complete verification to determine whether objectives are met and the user requirements are satisfied. The ultimate aim is quality assurance. Tests are and the results are compared with the expected document.

**TRAINING AND TESTING DATABASE**

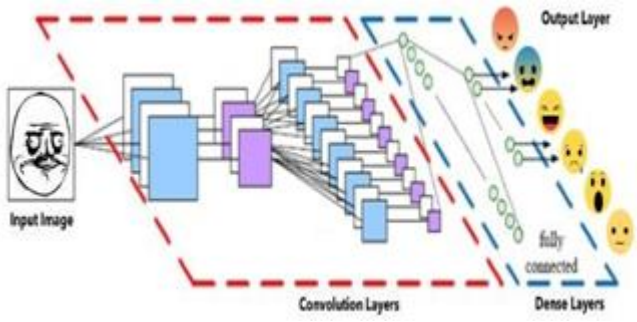
In machine learning, the study and construction of algorithms that can learn from and make predictions on data is a common task. Such algorithms work by making data-driven predictions or decisions, through building a mathematical model from input data. The data used to build the final model usually comes from multiple datasets .In particular, three data sets are commonly used in different stages of the creation of the model. The model is initially fit on a training dataset, that is a set of examples used to fit the parameters (e.g. weights of connections between neurons in artificial neural networks) of the model. The model(e.g. a neural net or a naive Bayes classifier)is trained on the model.

In practice, this means that the failure tracks not only the error, but also the contribution of each weight and bias in the model to the error. After measuring the loss, we can use backpropagation to find the gradients of the loss with respect to each model parameter.

**MODEL EVALUATION:**

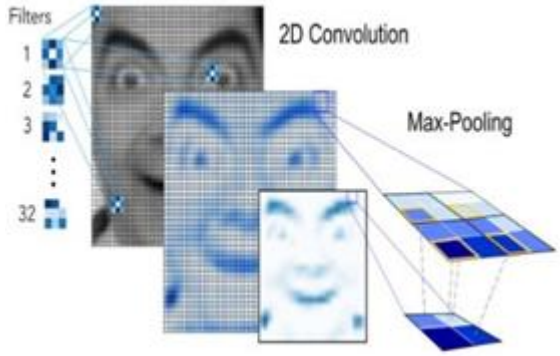
Deep learning is a popular technique used in computer vision. We chose Convolutional Neural Network (CNN) layers as building blocks to create our model architecture. CNNs are known to imitate how the human brain

works when analyzing visuals. We have used a picture of Mr. Bean as an example to explain how images are fed into the model, because who doesn't love Mr. Bean? A typical architecture of a convolutional neural network contain an input layer, some convolutional layers ,some dense layers(aka. fully-connected layers),and an output layer. These are linearly stacked layers ordered in sequence .In Keras, the model is created as Sequential()and more layers are added to build architecture.



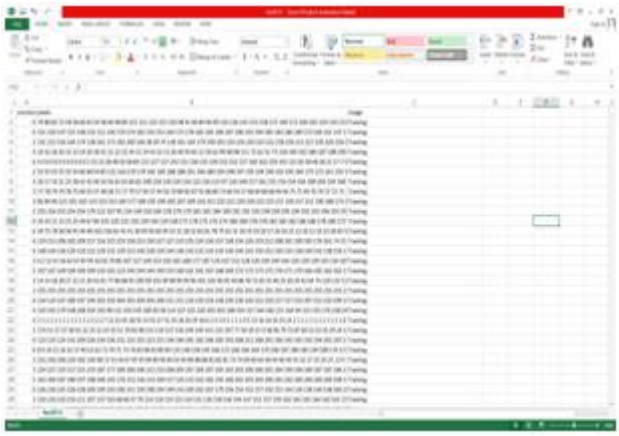

**CONVOLUTIONAL LAYERS:**

The numpy array gets passed into the Convolution2D layer where we specify the number of filters as one of the hyper parameters. The set of filters (aka .kernel) are unique with randomly generated weights. Each filter (3,3) receptive field, slides across the origin a image with shared weights to create a feature map. Convolution generates feature maps that represent how pixel values are enhanced, for example, edge and pattern detection. A feature map is created by applying filter 1 across the entire image. Other filters are applied one after another creating a set of feature maps.



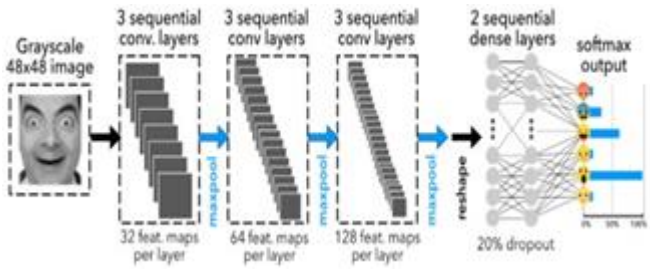

The model performs really well on classifying positive emotions resulting in relatively high precision scores for happy and surprised. Happy has a precision of 76.7% which could be explained by having the most examples (~7000) in the training set. Interestingly, surprise has a precision of 69.3%having the least examples in the training set. There must be very strong signals in the surprise expressions.

Model performance seems weaker across negative emotions on average. In particularly, the emotion sad has a low precision of only 39.7%. The model frequently misclassified angry, fear and neutral as sad. In addition, it is most confused when predicting sad and neutral faces because these two emotions are probably the least expressive (excluding crying faces). Frequency of prediction that misclassified by less than 3 ranks.



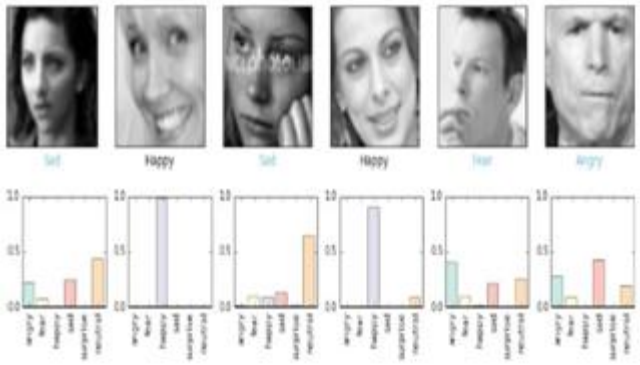
Instead of using sigmoid activation function, we used soft max at the output layer. This output presents itself as a probability for each emotion class. Therefore, the model is able to show the detail probability composition of the emotions in the face. As later on, you will see that it is not efficient to classify human facial expression as only a single emotion. Our expressions are usually much complex and contain a mix of emotions that could be used to accurately describe a particular expression.

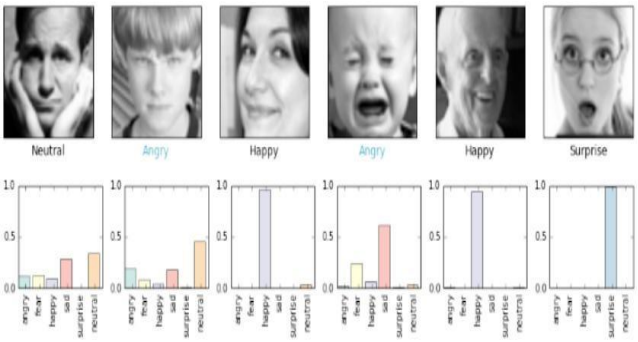
Deep Learning we built a simple CNN with an input, three convolution layers, one dense layer, and an output layer to start with. As it turned out, the simple model performed poorly. The low accuracy of 0.1500 showed that it was merely random guessing one of the six emotions. The simple net architecture failed to pick up the subtle details in facial expressions. This could only mean one thing.

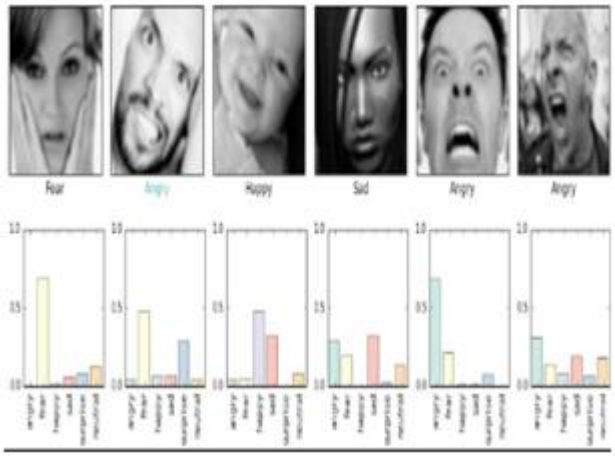


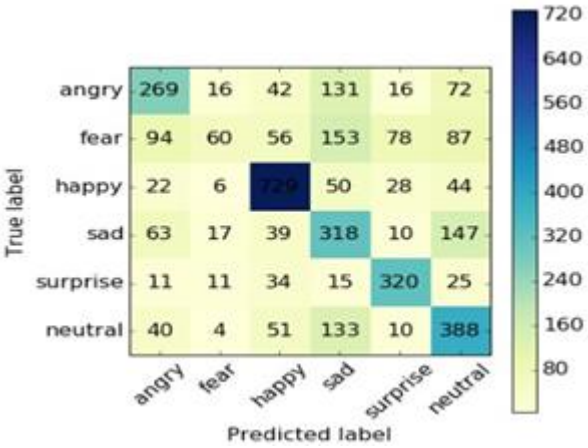
## MODEL VALIDATION

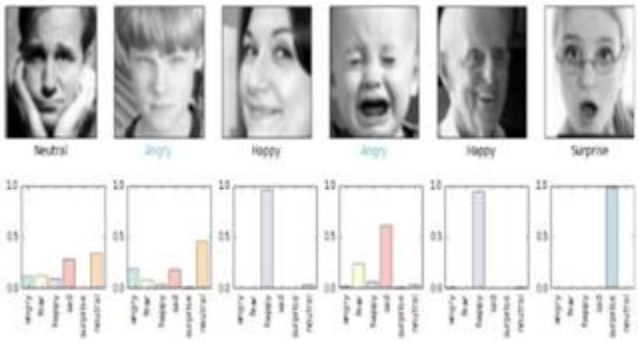
Performance As it turns out, the final CNN had a validation accuracy of 58%. This actually makes a lot of sense. Because our expressions usually consist a combination of emotions, and only using one label to represent an expression can be hard. In this case, when the model predicts incorrectly, the correct label is often the second most likely emotion as seen in figure below.






Computer Vision as result, the feature maps become increasingly abstract down the pipeline when more pooling layers are added. This gives an idea of what the machine sees in feature maps after 2ndand 3rdmax-pooling.

## V. CONCLUSION

Thefacialexpressionrecognitionsystempresentedinthis researchworkcontributesaresilient 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 property bases are alienated as exposed and hidden category in genetic algorithmic genes. The gene training set evaluates the expressional uniqueness of individual faces.

## VI. FUTURE ENHANCEMENT

It is important to note that there is no specific formula to build a neural network that would guaranteed well different problems would required different network

architecture and a lot of trial and errors to produce desirable validation accuracy.

This is the reason why neural network are often perceived as “Black box algorithms”. In this project we got an accuracy of almost 70% which is not bad at all comparing all the previous models , But we need to improve in specific areas like- Number and configuration of convolutional layers , dense layers and drop out percentage in dense layers .

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