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# Emotion Classifier: A MachineLearning Application

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***ABSTRACT***
*These Human facial expressions convey a lot of information visually rather than articulately. Facial expression recognition plays a crucial role in the area of human-machine interaction. Automatic facial expression recognition systems have many applications including, but not limited to, human behavior understanding, detection of mental disorders, and synthetic human expressions. Recognition of facial expression by computer with high recognition rate is still a challenging task. Two popular methods utilized mostly in the literature for the automatic FER systems are based on geometry and appearance. Facial Expression Recognition usually performed in four-stages consisting of pre-processing, face detection, feature extraction, and expression classification. In this project we applied various deep learning methods (convolutional neural networks) to identify the key seven human emotions: anger, disgust, fear, happiness, sadness, surprise and neutrality.*
***Keywords****: Expression Recognition, Emotion Classifier, CNN, Tensorflow, OpenCV*

## I. INTRODUCTION

- Image processing is the field of signal processing where both the input and output signals are images. One of the most important application of Image processing is Facial expression recognition. Our emotion is revealed by the expressions in our face. Facial Expressions plays an important role in interpersonal communication. Facial expression is a non verbal scientific gesture which gets expressed in our face as per our emotions. Automatic recognition of facial expression plays an important role in artificial intelligence and robotics and thus it is a need of the generation.
- Some application related to this include Personal identification and Access control, Videophone and Teleconferencing, Forensic application, Human-Computer Interaction, Automated Surveillance, Cosmetology and so on.


## II. PROBLEM STATEMENT

In real life, people express their emotion on their face to show their psychological activities and attitudes in the interaction with other people. The primary focus of this project is to determine which emotion an input image that contains one facial emotion belongs to. Because human face is complex to interpret, emotion recognition can be specifically divided into classification of basic emotion and classification of compound statement.

## III. NEED FOR EMOTION CLASSIFIER

Emotion classification has received significant attention, especially during the last few years. Recently it gains special importance because of its strong need in few application areas. There are at least two causes for this development:
The first is the wide range of commercial and mobile applications. Second is the availability ofpractical

technologies after 30 years of research.Facial expression recognition has substantial potential in two areas:

- It is used in psychological studies to detect the patient‟s emotions. For example, Stress or Pain detections.
- It is used in Human behavior recognition.

However, automated facial expression recognition can be used in a lot of areas other than Human behavior recognition and psychological studies, such as computer entertainment and customized computer-human interaction. The interest for automated facial expressions recognition and a number of applications will most likely increase even more in the future. This could be due to increased penetration of technologies, such as digital cameras and the internet. Facial expression recognition has become one of the most challenging tasks in the pattern recognition. Issues for face recognition are addressed in detail in the previous report. In the generation of face recognition system, the existing sparse representation based classification technique is a method which leads to misclassification. The further geometric descriptor model is uncovered only for primary-level categories, they cannot capture the detailed visual features for sub-categories. So a new technique was developed based on dense graph mining algorithm for face detection, and SVM classification algorithm for face recognition, which classifies the test image. The proposed work is the extended part of the face recognition. Here the face expressions are identified after the detection and recognition of face from the video files.

The main objective of our project is

- To detect and track face from the video sequenceand to extract features from video frames.
- To recognize the person and his/her facial expression usingSVM classification technique

## IV. EXISTING SYSTEM

Like every other classification problems, the emotion recognition problem requires an algorithm to complete feature extraction and categorical classification. In order to classify an emotion, we need to extract certain feature from data and build an model that can classify the input based on the feature. The existing system consists of steps like data pre-processing, feature extraction, model construction andresult generation.


## V. LITERATURE SURVEY

As per various literature surveys it is found that for implementing this project four basic steps are required to be performed.

i. Preprocessing
ii. Face registration
iii. Facial feature extraction
iv. Emotion classification

Description about all these processes are given below-

- Preprocessing : Preprocessing is a common name for operations with images at the lowest level of abstraction both input and output are intensity images. Most preprocessing steps that are implemented are –

a. Reduce the noise
b. Convert The Image To Binary/Grayscale.
c. Pixel Brightness Transformation.
d. Geometric Transformation.

- Face registration : Face Registration is a computer technology being used in a variety of applications that identifies human faces in digital images. In this face registration step, faces are first located in the image using some set of landmark points called “face localization” or “face detection”. These detected faces are then geometrically normalized to match some template image in a process called “face registration” .

Facial feature extraction : In this feature extraction step, a numerical feature vector is generated from the resulting registered image. Common features that can be extracted are :

a. Lips
b. Eyes
c. Eyebrows
d. Nose tip

- Emotion classification : In the third step, of classification, the algorithm attempts to classify the given faces portraying one of the seven basic emotions.

Different approaches which are followed for FacialExpression Recognition:

**Neural Network Approach :**
The neural network contained a hidden layer with neurons. The approach is based on the assumption that a neutral face image corresponding to each image is available to the system. Each neural network is trained independently with the use of on-line back propagation.

**Support Vector Machine :**

In machine learning, support vector machines (SVMs, also support vector networks) are supervised learning models with associated learning algorithms that analyze data used for classification and regression analysis. Given a set of training examples, each marked as belonging to one or the other of two categories, an SVM training algorithm builds a model that assigns new examples to one category or the other, making it a non-probabilistic binary model (although methods such as Platt scaling exist to use SVM in a probabilistic classification setting). An SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible. New examples are then mapped into that same space and predicted to belong to a category based on which side of the gap they fall.

In addition to performing linear classification, SVMs can efficiently perform a nonlinear classification using what is called the kernel trick implicitly mapping their inputs into high-dimensional feature spaces.

When data are not labeled, supervised learning is not possible, and an unsupervised learning approach is required, which attempts to find natural clustering of the data to groups, and then map new data to these formed groups. The support vector clustering algorithm created by Hava Siegelmann and Vladimir Vapnik, applies the statistics of support vectors, developed in the support vector machines algorithm, to categorize unlabeled data, and is one of the most widely used clustering algorithms in industrial applications.

**Various facial datasets available online are:**
1. Japanese Female Facial Expression (JAFFE)
2. FER
3. CMU MultiPIE
4. Lifespan
5. MMI
6. FEED
7. CK

## VI. PROPOSED WORK

This section details the data used for training and testing, how the data was preprocessed, the various models that were used, and an evaluation of each model.

**MODULES**:
- Detection of human face recognition (Module-01)
- To capture the face expressions (Module-02)
- To train a given dataset by CNN model (Module-03)
- Classification of human facial expression throughthe given input image (Module -04)
- Classification of human facial expression throughreal-time video captures (Module-05)

**Module - 01:** Detection of human face recognition Ongoing face discovery includes the recognition of a face from a grouping of edges from a video taking pics gadget.
While the equipment necessities for such a framework are a long way increasingly rigid, from a PC vision angle, ongoingface identification is a far easier gadget than distinguishing aface in a static photo.

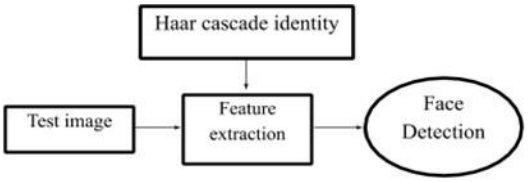


**Fig. Detection of Human face**

**Module - 02:** To capture the face expressions

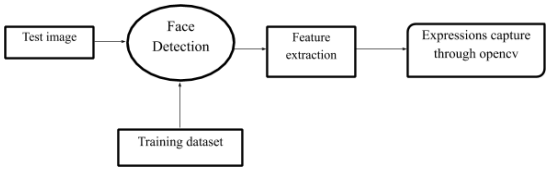


**Fig. Detection of Human facial Expression**

**Module - 03 :** To train a given dataset by CNN model

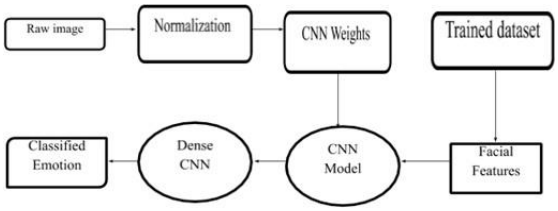


**Fig. Training a Dataset of the Model**

**Module - 04 :** Classification of human facial expressionthrough the given input image

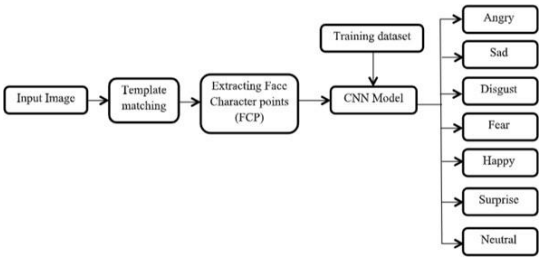


**Fig. Classification of Human facial Expression**

**Module-05 :**

Classification of human facial expression through real-time video captures For outward appearance acknowledgment issues, the acknowledgment technique is isolated into two stages, one is face portrayal, and other one is classifier development. In the face portrayal step, highlights identified with outward appearance are taken from pictures. A portion of the capacities are hand-planned, though others are found out from tutoring pictures. At that point, the dimensionality of the highlights is diminished to encourage a proficient kind and decorate the speculation usefulness and the standard articulations which are referred to in normally outrage, appall, dread, euphoria (or joy), bitterness, and shock, while a few scientists include unbiased as the seventh articulation. The classifiers are structured based absolutely at the disentangled capacities to group each articulation as one of the six (or seven) articulations. Notwithstanding, Convolutional Neural Network (CNN), a sort of profound learning approach, can take in highlights from training information. CNN learns works through a blend of convolutional layers and subsampling layers, and regularly followed by a rigid of totally related layers. CNN is getting progressively well known in the most recent years as a result of its green execution.

## VII. CONCLUSION & FUTURE WORK

This project proposes an approach for recognizing the category of facial expressions.Face Detection and Extraction of expressions from facial images is useful in many applications, such as robotics vision, video surveillance, digital cameras, security and human-computer interaction.

This project's objective was to develop a facial expression recognition system implementing the computer visions and enhancing the advanced feature extraction and classification inface recognition system.

It is important to note that there is no specific formula to build neural network that would guarantee to work well. Different problems would require different network architecture and a lot of trail and errors to produce desirable validation accuracy. This is the reason why neural nets 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 layersnumber and configuration of dense layers dropout percentage in dense layers**

But due to lack of highly configured system we could not go deeper into dense neural network as the system gets very slowand we will try to improve in these areas in future.

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