**Facial Emotion Detection**

### A Project Work Synopsis

*Submitted in the partial fulfilment for the award of the degree of*

# BACHELOR OF ENGINEERING

### IN ARTIFICIAL INTELLIGENCE AND

### MACHINE LEARNING

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**7 SEPTEMBER, 2022**

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**ABSTRACT**

In the last few years, a great deal of interesting research has been achieved on automatic facial emotion recognition (FER). FER has been used in a number of ways to make human-machine interactions better, including human center computing and the new trends of emotional artificial intelligence (EAI). Researchers in the EAI field aim to make computers better at predicting and analyzing the facial expressions and behavior of human under different scenarios and cases. Deep learning has had the greatest influence on such a field since neural networks have evolved significantly in recent years, and accordingly, different architectures are being developed to solve more and more difficult problems. This article will address the latest advances in computational intelligence-related automated emotion recognition using recent deep learning models. We show that both deep learning-based FER and models that use architecture-related methods, such as databases, can collaborate well in delivering highly accurate results.

**Keywords: facial detection, Neural Network**

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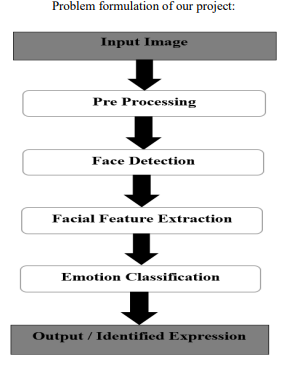
# INTRODUCTION

A human face has significant and distinguishing characteristics that aid in the recognition of facial expressions. FER is defined as a change in facial expression caused by an individual’s internal emotional state. It is used in a wide range of human-computer interaction (HCI) applications, such as face image processing, facial video surveillance, and facial animation, as well as in the fields of computer vision, digital image processing, and artificial intelligence. Automatic facial expression recognition is a difficult topic that has piqued the interest of many researchers in recent years. In FER, the stage of feature extraction is critical. Alek et al. [1] demonstrated in the literature that facial expression accounts for 55% of total transmission while vocal and spoken communication contributes 38% and 7%, respectively.

There are two primary techniques for designing a FER system. As an initial step, some systems employ a sequence of images ranging from a neutral face to the peak level of emotions. In comparison, some systems use a single image of the face to recognize related emotions, and because they have access to less information, they often perform worse than leading approaches [2,3]. Apart from the approach type modeled by a FER system, another classification is based on the type of features employed in the recognition process, with a FER system utilizing one or both of these feature categories. The first set of traits is obtained from the facial organs’ posture and the skin’s texture. The second type of feature is geometric features, which hold information about various positions and points on the face and are used to analyze a static image or a sequence of photos by utilizing the movement of the positions and points within the sequence. Using face landmarks as a starting point for extracting geometric features is one way. Landmarks are significant places on the face that provide useful information for facial analysis. Numerous studies have been undertaken on the subject of facial landmark identification; however, they are outside the scope of this work. This work employs the *Python* module dlib to detect these points [4].

* 1. **PROBLEM DEFINITION**

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 these metrics to evaluate customer interest. Healthcare 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 months old, 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.

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* 1. **PROJECT OVERVIEW**
* Facial emotion detection will help in monitoring the change in emotions of the user.
* The database for the Facial emotion detection will be taken from Kaggle.
* The life cycle which I will be following includes Input Sample Image, Processing And Noise Removal, Image Segmentation, Facial Feature Extraction, Apply Classification Algorithm, Experimental Analysis And Output.
* It will be able to classifying the seven fundamental human facial expressions such as: (Anger, Contempt, Disgust, Fear, Happiness, Sadness, Surprise).
* The emotion expression patterns more effectively and used deep learning CNN algorithm along with Keras, Tensorflow and retraining concepts. With these techniques, it was possible to identify emotions, type of emotion in the real image. To delineate the result and procedures more visually and this has also introduced decision tree techniques which helps to decide which emotions percentage is high and which emotions percentage is low. Now the high percentage of emotions get the most possible accurate emotions. And the low percentage of emotions get the low chance of existence.
  1. **HARDWARE SPECIFICATIONS**
     1. **PC**

A pc is a personal computer that can be used for multiple purposes depending on its size, capabilities, and price. They are to be operated directly by the end-user. Personal computers are single-user systems and are portable. Our web application program will be installed on the pc for our clients to use it. This makes it feasible for individual use.

* 1. **SOFTWARE SPECIFICATIONS**

**1.4.1Jupyter Notebook:**

Jupyter Notebook is a web-based open-source application that is used for editing, creating running, and sharing documents that contain live codes, visualization, text, and equations. Its core supported programming languages are Julia, R, and Python. Jupyter notebook comes with an IPython kernel that allows the programmer to write programs in python. There are over 100 kernels other than IPython available for use.

**1.4.2 Atom Text editor**

Atom is a text and source code editor which works across all operating systems. It speeds up find-and-replace operations by an order of magnitude and improves loading performance for large, single-line files It’s a desktop application built with HTML, JavaScript, CSS, and Node.js integration.

# LITERATURE REVIEW

In a research field of emotion detection, there is a contribution of several domains like machine learning, natural language, neuroscience, etc. In previous works, they individually rummaged facial expressions, voice features, and textual data as universal indicators of emotions. Emotion can be classified into several static classifications like happiness, sadness, disgust, anger, fear, and surprise. In later works are improved by combining the image, voice, and textual data. The fusion of this data gives the maximum accurate result. This type of fusion can be done in three ways early, late, or hybrid. Other ethos features the elements of emotion and the collaborations between emotional processes and other intellectual procedures.

1. **Emotion Detections Through Facial Feature Recognition**

This work deals with the emotion recognition with the Machine learning using support vector machine (SVM). Some principles are work to detection, extraction, and evaluation of facial expressions of image. These are:

Viola-Jones cascade object detectors and Harris corner key-points to extract faces and facial features from images.

ii) Histogram of oriented gradients (HOG) feature extraction.

iii) Support vector machines (SVM) to train a multi-class predictor for classifying the seven fundamental human facial expressions such as: (Anger, Contempt, Disgust, Fear, Happiness, Sadness, Surprise).

Computers can easily recognize facial expressions and can find out the motive of a person including in entertainment, social media, content analysis, criminal justice, and healthcare. Here is discussed mainly two-approach such as: (Zhang's approach and Gabor wavelet coefficients). Zhang has shown that lower resolution (64x64) is adequate, we will resize the extracted faces to 100x100 pixels.

When using the HOG and SVM classifier only, the accuracy for detection is 81%, much better than a Fisher's face. Only approach. When using the dual-classifier method, the accuracy is the same as HOG only at 81%, but the testing process is 20% faster.

**B. SVM Point-based Real-time Emotion Detection**

This work deals with the emotion recognition with Machine learning using a cascade of a multi-class support vector machine (SVM) and a binary SVM. This algorithm is developed to extract emotions based on the movement of 19 feature points. These feature points are located in different regions of the countenance such as the mouth, eyes, eyebrows, and nose. It mainly works non-changeable. rigid points on the nose. Its divide into facial recognition and action unit (AU). Computers can easily recognize facial expressions and can find out the motive of a person. including in entertainment, social media, content analysis, criminal justice, and healthcare.

A final suggestion for improvement is the fact that in the real-time application the user needs to stay on the same distance concerning the camera from which the neutral frame was taken. Otherwise, the theory behind the displacement ratios is no longer valid. Rescaling the neutral distances based on the movement of the user can be a solution to this problem.

* 1. **Proposed System**

# This project mainly focuses on developing a system that can detect Facial Emotion

* Data wrangling (Data profiling, missing value treatment, exploratory data analysis) will be performed.
* To treat the unbalanced data, majorly three different techniques will be used i.e Random under-sampling, Random oversampling, and Synthetic minority over-sampling.
* We will be working on Classification, Pandas, Matplotlib, Model Training

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| --- | --- | --- | --- |
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| **Article Title** | Automatic facial expression recognition  Using facial animation parameters and  Multistream HMMs | Facial expression recognition Using Machine learning | Appreciation of Customer Satisfaction through Analysis Facial Expressions and Emotional Recognition |
| **Purpose of the study** | The performance of an automatic facial expression recognition system can be significantly improved by modeling the reliability of different streams of facial expressions information utilizing multistream hidden Markov models (HMMs). | The first method is based on image processing (for example, histogram equalization, thresholding, color conversion, morphological operations, etc.) and the second one used the Dlib library to detect facial landmarks. We examine each feature descriptor by considering two classifications methods such as Support Vector Machine (SVM) and the Multi-layer Perceptron (MLP) | This aims to predict the satisfaction of a customer through his emotions. This system must predict customer's behavior in the decision-making process. For this end, first we extract geometric features form customer's emotional faces, captured from local camera placed near the products. Then, to predict customer satisfaction, we have classified these features using adapted SVM classifier. The kinds of customer's satisfaction are satisfied, not satisfied and neutral. |
| **Tools/Software used** | * Jupyter Notebook | * Jupyter Notebook | * Jupyter Lab |
| **Comparison of techniques done** | 1. Animation Parameters(FAPs) 2. Multistream hidden Markov models(HMMs) | 1. Support Vector Machine (SVM) 2. The Multi-Layer Perceptron(MLP) | 1. Support Vector Machine (SVM) |
| **Evaluation parameters** | * Model Accuracy | * Model Accuracy | * Model Accuracy |

Table 2.1: Literature review summary

# PROBLEM FORMULATION

* Anonymous emotion detection for online education is an ideal way to analyze the online student journey and improve it where necessary. Assess schools course materials, teaching styles, structure and layout by way of emotional feedback as student’s go through each module in real-time. Use true facial responses and engagement levels to find points of interest or course stumbling blocks and make optimizations.
* An industry that’s taking advantage of this technology is health care, with AI-powered recognition software helping to decide when patients need medicine, assess their emotional response in clinical trials or to help physicians in deciding how to best triage their patients.
* Video games are designed with a specific target audience in mind and aim to evoke a particular behavior and set of emotions from the users. During the testing phase, users are asked to play the game for a given period and their feedback is incorporated to make the final product. Using facial emotion recognition can aid in understanding which emotions a user is experiencing in real-time. This is a great addition to verbal feedback as it provides a more complex review of the gaming experience.
* The automotive industry is also applying emotion recognition technology, as car manufacturers around the world are increasingly focusing on making cars more personal and safe for people to drive. In their pursuit to build smart car features, it makes sense that car manufacturers use AI to help them understand human emotions. Using facial emotion detection smart cars can alert the driver when he is feeling drowsy and in turn help to decrease road casualties.

# OBJECTIVES

The proposed work is aimed to carry out work leading to the development of an approach for detecting Facial Emotion. The facial emotion detection system, which is the proposed work will be achieved by dividing the work into the following objectives:

1. Obtain the facial emotion dataset from the web and detect the accuracy related to the emotions of the user and also eventually improve the Deep learning Models.
2. Work on different Deep learning Algorithms
3. Try to develop algorithms based on different models to achieve maximum accuracy.
4. To develop the GUI using flask and deploy the model on AWS.

# METHODOLOGY

The following methodology will be followed to achieve the objectives defined for the proposed research work:

1) Training the public face database with CNN.

2) Extraction of seven probabilities for each frame of the face.

3) Aggregation of single-frame probabilities into fixed-length image descriptors for each image in the dataset.

4) Classification of all images using a support vector machine (SVM) trained on image descriptors of the competition training set.

1. **TENTATIVE CHAPTER PLAN FOR THE PROPOSED WORK**

#### CHAPTER 1: INTRODUCTION

This chapter will cover the overview of Facial Emotion detection, machine learning and deep learning algorithms.

#### CHAPTER 2: LITERATURE REVIEW

This chapter includes the literature available for Facial Emotion detection. The findings of the researchers will be highlighted which will become the basis of the current implementation.

#### CHAPTER 2: BACKGROUND OF PROPOSED METHOD

This chapter will provide an introduction to the concepts which are necessary to understand the proposed system.

#### CHAPTER 4: METHODOLOGY

This chapter will cover the technical details of the proposed approach.

#### CHAPTER 5: EXPERIMENTAL SETUP

This chapter will provide information about the subject system and tools used for the evaluation of the proposed method.

#### CHAPTER 6: RESULTS AND DISCUSSION

The result of the proposed technique will be discussed in this chapter.

#### CHAPTER 7: CONCLUSION AND FUTURE SCOPE

The major finding of the work will be presented in this chapter. Also, directions for extending the current study will be discussed.

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