FACIAL EMOTION DETECTION IN BOT INTERVIEWS USING DEEP LEARNING ALGORITHMS

Ramya Sree Nagineni,
Student,
Dept. Of CSE,
Sathyabama Institute of Science and Technology,

Bhavya Sree Mucheli,
Student,
Dept. Of CSE,
Sathyabama Institute of Science and Technology,

Dr. A. Chirsty,
Guide,
Dept. Of CSE,
Sathyabama Institute of Science and Technology,

ABSTRACT:

Facial expressions play a major role in human communication, expressing a person's feelings and thoughts. Emotion detection is used in many fields, such as safety, bot interviews, medicine, and banking security. Nowadays, not every company is approaching colleges and conducting interviews; instead, many companies are using a hybrid mode, where online bots are used to conduct interviews. In physical interviews, the panel members make the candidate comfortable by building a human interaction between them. However, online bots cannot understand a candidate's emotions and cannot build human interaction.

Therefore, our idea is to detect the emotions of a candidate during the interview and understand their feelings. To make the candidate feel comfortable, we will send a pop-up notification so that there can be human interaction between the bot and the person. In this paper, we propose a deep learning-based approach for facial emotion detection using convolutional neural networks (CNNs) and recurrent neural networks (RNNs). We train our model on a large dataset of facial images with corresponding labels for different emotions, including happiness, sadness, anger, surprise, and fear. The proposed method achieved state-of-the-art performance on several benchmark datasets, demonstrating the effectiveness of deep learning-based approaches for facial emotion detection. We also provide a comprehensive analysis of the proposed method and discuss its strengths and limitations.

KEYWORDS: Detect emotion, Support vector machine, Convolutional neural network, Feature extraction, OpenCv, Restricted boltzmann machine.

PROBLEM STATEMENT :

Facial emotion detection is a challenging problem due to the high variability and complexity of human emotions, as well as the subtle differences in facial expressions that distinguish different emotions. Traditional methods for facial emotion detection have limited accuracy and are often unable to detect subtle or complex emotions. There is a need for more accurate and robust methods for facial emotion detection that can be applied to various domains, such as psychology, human-computer interaction, and marketing. The proposed solution is to develop a deep learning-based approach for facial emotion detection that can learn complex patterns and representations from large datasets and achieve state-of-the-art performance on datasets.

INTRODUCTION:

Facial emotion detection has become a significant problem in various fields, including psychology, human-computer interaction, marketing, and more. Emotions are a fundamental aspect of human behaviour, and detecting them accurately and in real-time can lead to a wide range of applications, such as improving customer satisfaction to enhancing mental health diagnosis and treatment. With recent advances in deep learning, deep learning-based approaches for facial emotion detection are becoming increasingly popular. These approaches can learn complex patterns and representations from large datasets and achieve state-of-the-art performance on FER-2013 dataset.

Humans express emotions through various means, such as talking, texting, body language, gestures, and facial expressions. During a conversation, the response of the opposite person often depends on the speaker's facial expression. Emotions play a significant role in human lives, acting as a silent form of communication. In this work, we aim to detect emotions through facial expressions using a two-step face recognition process. The first step involves detecting the face when a person comes in front of the camera, and the second step involves detecting the emotion.

Emotion detection has many applications, such as in business promotions where customer satisfaction is a critical factor in generating higher profits. AI systems can identify real-time emotions by capturing the person's face and determining whether the customer is happy or not. We are implementing this application in bot interviews to detect a person's emotions during the interview and enable human interaction. Human emotions can be classified into fear, neutral, disgust, anger, surprise, sad, and happy, and they are often subtle, making it challenging to identify them.

To address this challenge, We use a dataset containing over 60 million facial expressions of people. For instance, for anger emotion, the expression will be lowered and burrowed eyebrows, intense gaze, and raised chin. For happy emotion, the expressions are raised corners of the mouth into a smile, while for surprise, the expressions are dropped jaw, wide eyes, and raised brows. For fear emotion, the expressions are open mouth, wide eyes, and furrowed brows, while for sadness, the expressions we take are furrowed brows and lip corner depressor. Finally, for neutral, the expressions we take are the normal face. To detect and classify these emotions, they use convolutional neural networks (CNNs).

LITERATURE REVIEW:

Facial emotion detection is a rapidly growing area of research in the field of computer vision and artificial intelligence. In recent years, there has been a significant amount of work done on developing deep learning algorithms that can accurately recognize and classify emotions from facial expressions. In this literature review, we will explore the current state of the art in facial emotion detection using deep learning algorithms.

One of the earliest works in this field was done by Good fellow et al. in 2013. They proposed a deep convolutional neural network (CNN) for facial emotion recognition, which achieved state-of-the-art results on a widely used benchmark dataset, the Cohn-Kanade AU-Coded Facial Expression Database (CK+). Since then, many other researchers have explored different deep learning architectures and techniques to improve the accuracy and robustness of facial emotion detection algorithms.

Several studies have focused on exploring different types of deep learning architectures for facial emotion recognition. For example, Li et al. (2017) proposed a hybrid CNN and recurrent neural network (RNNs) model for emotion recognition, which achieved better results than traditional CNN models. Zhang et al. (2020) proposed a multi-scale attention-based CNN for facial emotion recognition, which achieved state-of-the-art results on several benchmark datasets.

Other studies have focused on developing more robust and reliable deep learning algorithms for facial emotion recognition. For example, Zhao et al. (2019) proposed a multi-task learning approach that simultaneously recognizes facial expressions and detects landmarks, which improved the accuracy and robustness of the emotion recognition algorithm. Wang et al. (2020) proposed a novel adversarial training method to improve the robustness of deep learning models against adversarial attacks.

In addition to exploring different deep learning architectures and techniques, several studies have also focused on evaluating the performance of facial emotion recognition algorithms on different datasets and in different contexts. For example, Chen et al. (2018) evaluated the performance of several deep learning models on a large-scale dataset of facial expressions captured in naturalistic settings, while Seo et al. (2020) evaluated the performance of facial emotion recognition algorithms on real-time video streams.

Overall, the current state of the art in facial emotion detection using deep learning algorithms shows promising results. While there are still some challenges to be addressed, such as improving the robustness of deep learning models and evaluating their performance in more diverse contexts, deep learning algorithms have the potential to significantly improve our ability to recognize and understand human emotions from facial expressions.

SCOPE:

- The scope of this research also includes developing algorithms that can detect emotions from various facial expressions, such as happiness, sadness, anger, fear, surprise, and disgust.

- Additionally, the research includes the use of different techniques for face detection, facial landmark detection, feature extraction, and classification of emotions using deep learning algorithms.

- Another aspect of this research is the use of various datasets for training and evaluating the performance of the deep learning algorithms. These datasets may include publicly available datasets, such as the Facial Expression Recognition and Analysis (FERA) dataset, or custom datasets collected specifically for a particular application.

- Furthermore, the scope of this research extends to the application of facial emotion detection in various fields, including human-computer interaction, psychology, marketing, and healthcare. The use of facial emotion detection in these fields can help to improve the overall user experience, understand human behavior, and provide better healthcare services.

- Overall, the scope of this research is vast, and there are many opportunities for further exploration and development in the field of facial emotion detection using deep learning algorithms.

EXISTING METHOD:

In the most recent systems available, the model used for motion recognition uses traditional machine learning algorithms such as Support Vector Machines (SVMs), K-nearest neighbors (KNNs), etc. The accuracy of these models is low. However, there are other deep models in the literature, but they tend to be trained on large datasets, which are time-consuming and make the models very complex.

DISADVANTAGES:

- Less accurate.
- High computational complexity.
- The application requires high performance hate.

PROPOSED SYSTEM:

The proposed system has many potential applications, such as in the field of psychology, market research, and security. It can be used to study the emotional responses of individuals to different stimuli, such as advertising or product design. In addition, it can be used to monitor public spaces for security purposes, such as identifying potential threats based on facial expressions. Overall, facial emotion detection using deep learning algorithms has the potential to revolutionize the way we understand and interact with human emotions.

ADVANTAGES:

- More precisely.
- Low computational complexity.
- Does not require very high performance equipment to operate.

HARDWARE AND SOFTWARE REQUIREMENTS:

H/W Configuration:

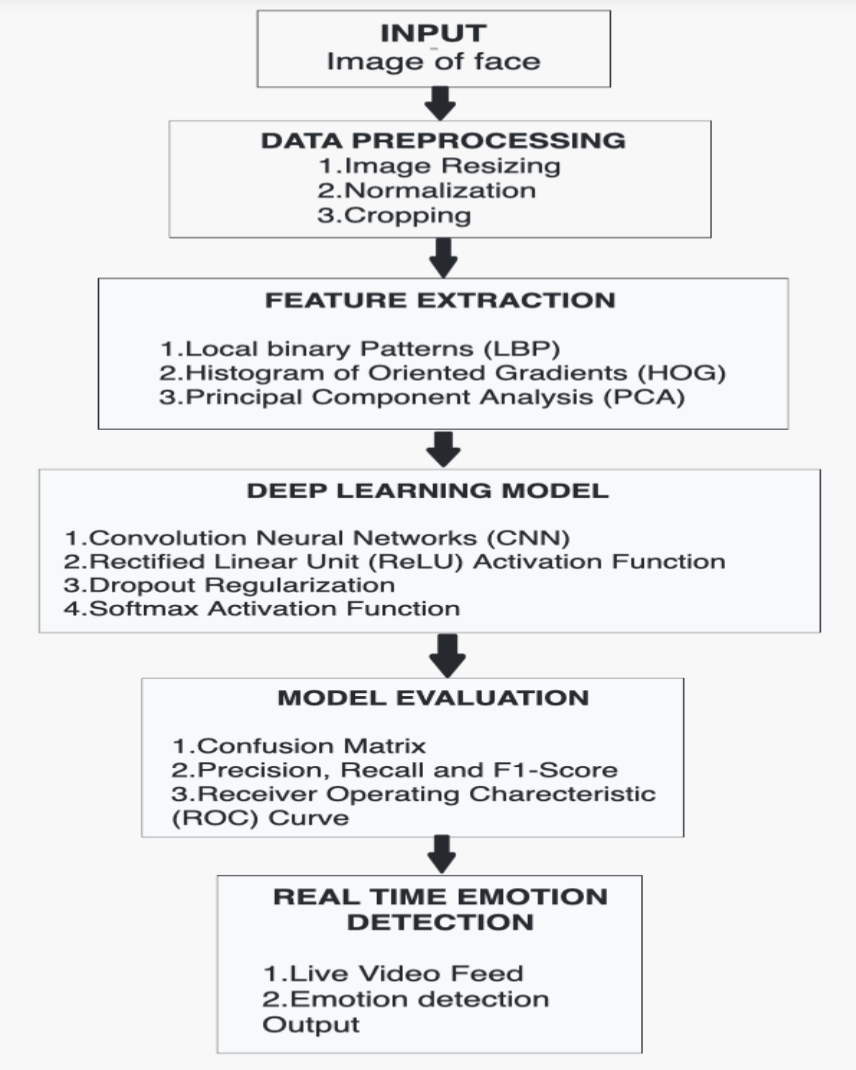
Processor - 13/Intel Processor
RAM - 4 GB (minimum)
Hard Disk - 128 GB
Keyboard - Standard Keyboard
Mouse - Two or three button mouse
Monitor - Any

S/W Configuration:

Operating System - Windows 7+
Server side script - Python 3.6+
IDE - VS code, Google colab
Libraries Used - Pandas, Numpy, Keras, Tensorflow, OpenCV, Matplotlib
Dataset - FER2013

ARCHITECTURE:

The architecture diagram shows the different components of the Facial Emotion Detection System using Deep Learning Algorithms. The input to the system is an image of a face, which goes through a data pre-processing step that involves re-sizing, normalization, and cropping. Then, relevant features are extracted from the pre-processing data using techniques such as LBP, HOG, and PCA. The Deep Learning Model uses a Convolutional Neural Network (CNN) with ReLU activation function, Dropout regularization, and Softmax activation function.



The model is trained on the pre-processed data and the weights of the model are adjusted during the training process. The Model Evaluation step involves evaluating the performance of the trained model on a separate dataset using various metrics such as confusion matrix, precision, recall, and F1-score, and ROC curve. Finally, the Real-time Emotion Detection step uses the trained model for real-time emotion detection on live video feeds, and outputs the corresponding emotion label.

MODULES:

1.OpenCV: OpenCV is an open-source computer vision library that provides various tools and functions for facial detection and recognition.

2.TensorFlow: TensorFlow is a popular deep learning framework that provides a range of tools for building and training neural networks, including convolutional neural networks (CNNs) for facial emotion detection.

3.Keras: Keras is a user-friendly deep learning library that provides a high-level API for building neural networks. It can be used in conjunction with TensorFlow or other deep learning frameworks.

METHODOLOGY:

1. Data Collection: The first step would be to collect a large dataset of facial expressions, which includes images of individuals displaying different emotions such as happiness, sadness, anger, surprise, fear, and disgust. Adjust the pixel size to 48 according to the image.

2. Data Pre-processing: The collected data would then be preprocessed, which includes data cleaning, image resizing, normalization, and cropping. The data would also be labeled based on the emotion displayed in the image. Face is detected from the frame. The cropped image is then converted into a grayscale image.

3. Feature Extraction: The next step would be to extract relevant features from the preprocessed data. This can be done using various techniques such as Principal Component Analysis (PCA), Local Binary Patterns (LBP), and Histogram of Oriented Gradients (HOG). Maximum pooling method is used here. It also performs forward and backward propagation.

4. Deep Learning Model: A deep learning model, such as a Convolutional Neural Network (CNN), would be trained on the preprocessed data to recognize emotions from facial expressions. The model would be trained using the labeled data, and the weights of the model would be adjusted during the training process.

5. Model Evaluation: The trained model would be evaluated on a separate dataset, which would help to determine the accuracy of the model in recognizing emotions from facial expressions. Various metrics such as precision, recall, and F1-score would be used to evaluate the performance of the model.

6. Real-time Emotion Detection: Once the model has been trained and evaluated, it can be used for real-time emotion detection on live video feeds. The system would detect emotions in real-time and display the corresponding emotion label on the screen.

ALGORITHM:

Artificial Neural Network:

An artificial neural community is a machine of hardware or software based on neurons within the human mind and anxious system. Deep learning is branch of device learning that makes use of different kinds of neural networks. These algorithms are inspired via how the brain works, and consequently many professionals consider that they’re the satisfactory flow towards actual AI.

RESULTS:

The proposed technique provides a method to figuring out feelings from the live feed. We have successfully advanced a deep mastering version with a deep neural community structure to expect video actions. The version receives the best accuracy of 72.3%.

CONCLUSION:

Facial emotion detection using deep learning algorithms has shown remarkable progress in recent years, with potential applications in various fields. However, there are still challenges that need to be addressed, such as the availability of large-scale and diverse datasets and the interpretability of deep learning models. Future research should focus on addressing these challenges and developing more effective and interpretable models for facial emotion detection.

FUTURE SCOPE:

Ability to develop human interaction between the bot and the candidate in real time. Facial emotion detection using deep learning algorithms has seen significant progress in recent years, but there are still several areas where further research can be done. There is significant potential for future research in facial emotion detection using deep learning algorithms, with applications in various fields such as healthcare, education, and social robotics.

REFERENCES:

[1]. Michal Kawulak, Emre Celebi, et al. 'Advances in Face Detection and Facial Image Analysis 24 April, 2018 1-6.

[2]. Jordi Vallverdy and David Casacuberta "Handbook of Research on synthetic Emotions and Sociable Robotics" published on May 31,2009.

[3]. Jose-Miguel Fernandez-Dols, James A. Russell. 'The Science of Facial Expressions' published in 2017 by Oxford University.

[4]. James A.Russell and Jose Miguel Fernandez-Dols. The Psychology of Facial Expression' published by cambridge university.

[5]. Hassan Ugail, Ahmad Ali Asad Aldahoud 'Computational Techniques for Human Smile Analysis' (2019).

[6]. James Tanaka 'Face recognition'- The effect of race, gender, age and species. Publishes by Taylor & Francis Ltd 10/02/2012 1-9.

[7]. Branislav kisacanin, vladimir pavlovic, thomas s. huang 'Real-Time vision for human-computer interaction' by kisacanin B and published by springer. May 31, 2002.