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CNN Based Face Emotion Recognition System for Healthcare Application

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Abstract

INTRODUCTION: Because it has various benefits in areas such psychology, human-computer interaction, and marketing, the recognition of facial expressions has gained a lot of attention lately.
OBJECTIVES: Convolutional neural networks (CNNs) have shown enormous potential for enhancing the accuracy of facial emotion identification systems. In this study, a CNN-based approach for recognizing facial expressions is provided.
METHODS: To boost the model's generalizability, transfer learning and data augmentation procedures are applied. The recommended strategy defeated the existing state- of-the-art models when examined on multiple benchmark datasets, including the FER-2013, CK+, and JAFFE databases.
RESULTS: The results suggest that the CNN-based approach is fairly excellent at properly recognizing face emotions and has a lot of potential for usage in detecting facial emotions in practical scenarios.
CONCLUSION: Several diverse forms of information, including oral, textual, and visual, maybe applied to comprehend emotions. In order to increase prediction accuracy and decrease loss, this research recommended a deep CNN model for emotion prediction from facial expression.

Keywords: CNN, BCI, Emotions, ML

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1. Introduction

We suggest a face emotion recognition system that makes use of the CNN algorithm to recognize a person's feelings when they are photographed. A deep learning CNN model trained to classify frames into non-crash or non-crash groups is used by the system to analyse each video frame [1] For image classification applications, CNN has shown no revealed as an accuracy rate greater than 95%, ex They require no more preparation than procedures [2].

These algorithms are commonly used for computer vision tasks such as object recognition and image classification and are trained on labelled facial data to identify visual features such as eye, nose, and mouth positions [3]. If a new face is touched system, CNN searches for facial features specific to that person to insert the face [4].

This embedding can then be compared to others in the system's database for consistency. CNN-based facial recognition systems have applications in various industries such as social networking, advertising, security, and surveillance [5 However, facial recognition technology has become an issue of ethical privacy, especially due to potential bias and manipulation of technology [6,7].

Facial expression using CNN has been a hot research topic because the ability to accurately read facial expressions has

important implications for potential applications in psychology, human-computer interaction, marketing, security, and in research, such as improving human-robot interaction, driver fatigue in vehicle insights, advertising and retail and improving the customer experience [8].

Additionally, CNN-based facial emotion identification has shown promising results in overcoming challenges faced by traditional emotion recognition systems, such as changes in facial expression and lighting conditions [9].

By employing CNN algorithms to recognize emotions from facial expressions, researchers hope to achieve high accuracy rates. This will pave the way for the creation of practical and effective real-world applications across a range of fields [10].

2. Literature Survey

Faces display a wide variety of emotions that are shared by all people. Many apps that need extra security or private data have used facial recognition technologies [11]. To determine a person's emotional state, facial emotion detection may be used to examine facial expressions of sadness, pleasure, surprise, rage, and fright. Accurate facial emotion identification and detection are crucial for marketing goals [12].

Most companies depend on the reactions that clients have to all of their products and services. Intelligent systems make it possible to determine whether a customer is interested in a product or service based on their emotional response to a captured image or video [13] people have elaborated emotional profiles on their face, these words are universal.

Facial recognition technology has been incorporated into a variety of applications, particularly those related to data privacy or other security [14]. Facial expression recognition is a technique that involves analysing a person’s expressions of happiness, surprise, anger, and fear to determine the person’s current state of emotional well-being [15] Accurate facial recognition and recognition is necessary for consumption effectively meet marketing objectives [16]. Most industries are based on products and services generated by consumers as a whole [17].

It is possible to determine if a customer is satisfied with a product or service based on the emotional reaction they have to a photograph or video that was taken by an artificially intelligent system [18]. This can be done by observing the customer's reaction. In the past, a range of machine learning techniques, such as Random Forest and Support Vector Machine (SVM), were used in order to predict sentiment from photographs that had been modified [19].

For example, recent advancements in computer vision have seen considerable improvements as a result of the use of deep learning. The use of a convolutional neural network (CNN) model can be helpful when attempting to identify facial expressions. The training and testing aim may both be met with this dataset. To estimate sentiment from edited photos, a variety of machine learning methods have been utilized in the past, such as Random Forest and SVM [20].

For instance, current developments in computer vision have significantly improved thanks to deep learning. To recognize face expressions, a convolutional neural network (CNN) model might be utilized. This dataset meets both training and testing purposes.

3. Proposed System

The system we suggested uses CNN algorithm to detect facial expression. The aim is to develop a system capable of detecting an individual's emotions through the use of a camera. The proposed methodology involves the utilization of a convolutional neural network model that has undergone deep learning to accurately classify video frames into two categories, namely accident-related and non- accident-related. This model will be employed to conduct a comprehensive analysis of each frame of a given video.

The classification of photographs using convolutional neural networks has shown to be a speedy and accurate process. For comparatively smaller datasets, CNN- based image classifiers have outperformed earlier picture classification techniques, achieving accuracy levels of above 95%. Additionally, they need less preparation. CNNs, a kind of deep learning algorithm, are extensively used in computer vision applications including object detection and picture classification. In order to teach CNNs the specific characteristics of diverse faces, such as the positioning of the eyes, nose, and mouth, they are trained on a big dataset of tagged faces for facial recognition.

CNN analyses the facial characteristics of a new face as it is added to the system and produces a unique representation of the face known as a face embedding. This embedding may then be compared to the embeddings of other faces in the system's database to determine if there is a match. The usage of CNN face recognition systems has increased recently in a number of industries, including social networking, advertising, security, and surveillance. The privacy and ethical implications of face recognition technology are also a concern, particularly in light of possible biases and the risk of misuse.

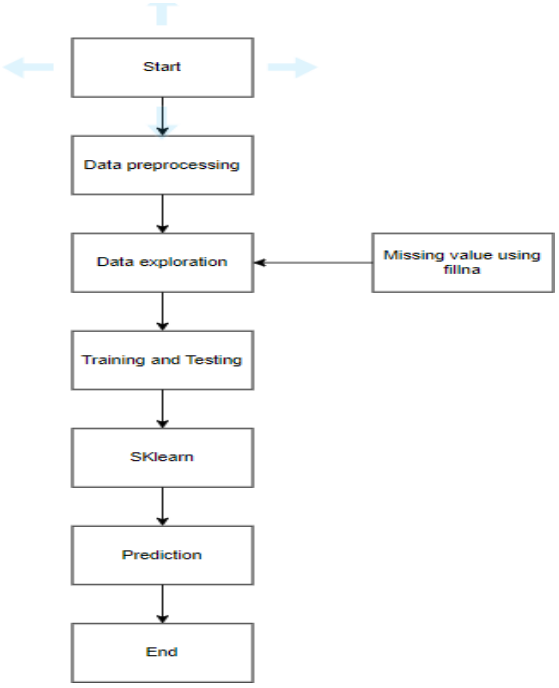

Figure 1. Proposed block diagram

3.1 Dataset

We utilized 28,709 photos with 7 distinct face emotion recognition models, including angry, happy, neutral, sad, disgusted, terrified, and startled.

Pierre-Luc Carrier and Aaron Courville produced the dataset, which was first made public in 2013 as a result of a Kaggle contest. The photographs were gathered from a variety of websites, TV programme, and movies, among other places. The FER2013 dataset, which has grown to be a standard in the area, has been used to train and test a variety of facial expression recognition methods, including deep neural networks.

The collection does have some restrictions, however, such the relatively poor quality of the photographs and the fact that the emotions were annotated through crowdsourcing, which might result in mistakes and inconsistencies.

3.2 Image Pre Processing

People connect with one another via speech, gestures, and emotions. As a result, a wide range of industries have a significant need for technology that can recognize the same. In terms of artificial intelligence, it will be considerably simpler for a machine to interact with humans naturally if it can understand human emotion.

It could be useful in psychotherapy and other healthcare settings. The presentation style of an E-Learning system might vary depending on the learner. However, static emotion recognition is generally not very useful. It is vital to understand the user's emotions over time in a genuine setting.

The project's goal is to address this problem and enhance human-machine communication by developing a system that can recognize facial expression. The system will be developed such that it may be used in a variety of fields, including marketing, security, healthcare, and education.

3.3 CNN model

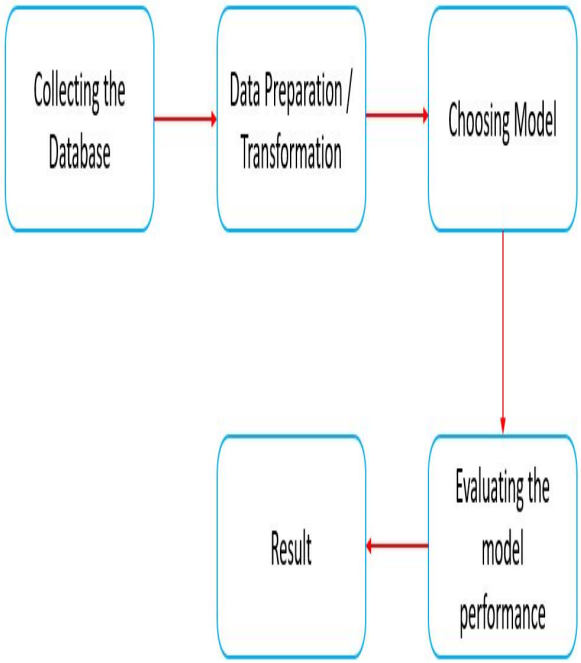

Figure 2. Proposed deep CNN model

The term "bubble chart" is often used interchangeably with "Data Flow Diagram (DFD)."

The graphical formalism is a simple tool that can be utilized to represent a system by illustrating the input data, the various operations carried out on it, and the resulting output data. One of the most critical modelling tools is information technology.

The creation of the system's component models is facilitated through its utilization. The constituents encompassing the system's functionality, its utilized data, an external entity that engages with it, and the modality of

information transmission within it are inclusive of these components.

Furthermore, it illustrates the process of data transformation within the system's information flow. The graphical representation of information flow and data modifications as it moves from input to output is a method commonly employed. It may also be divided into levels that depict increasing information flow and functional complexity and utilized to illustrate a system at any degree of abstraction.

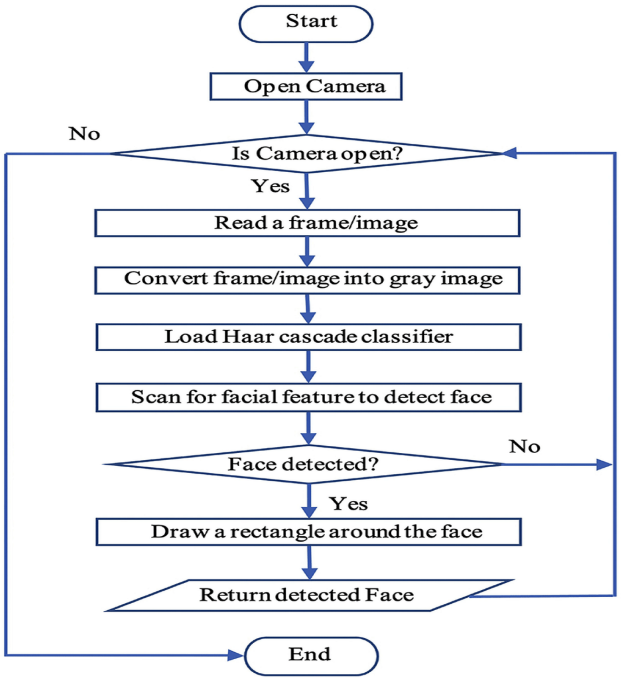

Figure 3. Proposed data flow diagram

4. Results

Figure 4 shows example test photos for predicting emotions from supplied facial expressions, which cover all possible emotions including sadness, anger, contempt, surprise, and fear. It can be seen from both graphs that the suggested deep CNN performed better at predicting emotions from videos than from facial expressions.

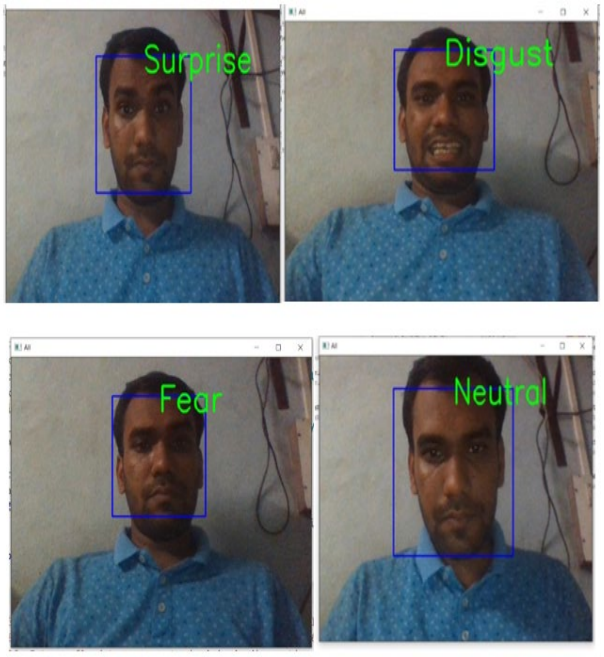

Figure 4. Sample Prediction Images

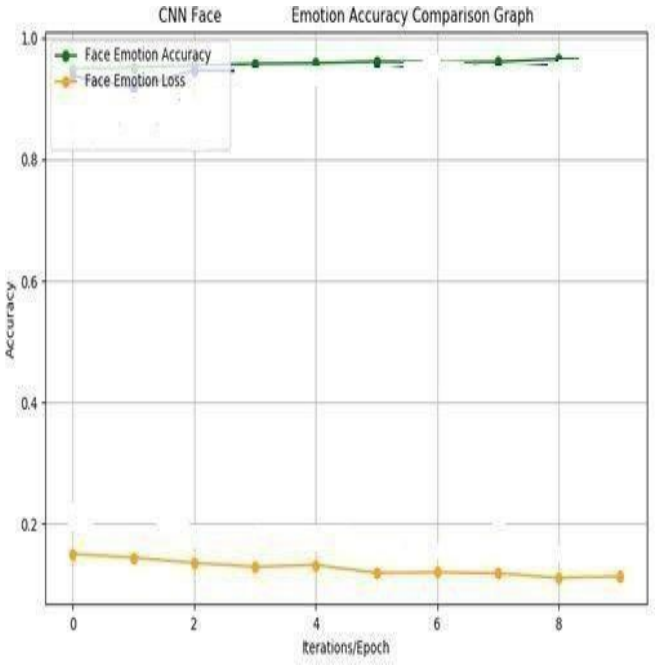

Figure 5. Emotion Accuracy Graphical Plot

5. Conclusion

The study of emotions has become an important topic of research that may assist with a number of aims by delivering some insightful facts. Whether consciously or unintentionally, individuals utilize their facial expressions to communicate their feelings. Emotional research has lately developed as an important academic topic that has the ability to contribute to a broad variety of efforts through

the supply of relevant data. People transmit their ideas and emotions by their facial expressions, whether they are doing so purposely or unwittingly. To have a better understanding of people's sentiments, one may refer to a variety of various forms of information, including spoken, written, and visual material. According to the conclusions of this study, a deep CNN model should be employed for assessing emotions based on facial expressions in order to boost prediction accuracy and minimize loss. Several diverse forms of information, including oral, textual, and visual, may be applied to comprehend emotions. In order to increase prediction accuracy and decrease loss.

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