

FACE EMOTION DETECTION AND RESPONSE SYSTEM USING CNN

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Abstract:

Artificial intelligence's fast development has had a significant impact on the world of technology. Machine learning and deep learning algorithms have had a lot of success in many applications including classification systems, recommendation systems, pattern recognition, and so on, because previous algorithms failed to match human demands in real time. Emotion influences a person's ideas, actions, and feelings. Using the benefits of deep learning, an emotion recognition system can be constructed, and various applications such as feedback analysis, face unlocking, and so on may be executed with high accuracy. This project's main goal is to develop a Deep Convolutional Neural Network (DCNN) model that can classify five different human face expressions. The hand gathered picture dataset is used to train, test, and verify the model.

Introduction:

Computer systems, software, and networks are rapidly developing and being used. These systems play an important role in our daily lives and make life much easier. In today's world, facial expression recognition systems are critical because they can capture human behavior, sentiments, intentions, and so on. Traditional facial expression detection methods are slow and inaccurate, whereas deep learning-based face emotion recognition has proven to be superior. This method intends to create a deep convolutional neural network model that can distinguish five different human facial expressions, which could be useful for customer feedback analysis.

Machine learning is one of the newest computer science technologies that is projected to have a 90% impact in the next four years. An artificial neural network, inspired by the human brain, is used in deep learning, a type of machine learning. Convolutional Neural Networks (CNNs) are a type of deep neural network that uses convolution as a mathematical procedure. Because the collection is made entirely of images, the system uses a 2D CNN to identify them. Not only has the proposed deep convolutional neural network been taught to categorize five different human facial emotions, but it has also been shown to perform effectively.

Literature Survey:

Speech is recognized as the most adaptable and natural means of communication, according to Alif Bin Abdul Qayyum et al. [1], who presented "Convolutional Neural Network (CNN) Based Speech-Emotion Recognition." Speech may reveal a great deal about a person's mental, behavioral, and emotional traits. Additionally, activities related to speech-emotion recognition can aid in cybercrime prevention. Research on speech-emotion recognition utilizing concurrent machine learning algorithms has been at an all-time high for quite some time. Diverse methodologies, including Recurrent Neural Network (RNN), Deep Neural Network (DNN), spectral feature extraction, and others, have been utilized on various datasets. This paper describes a new Convolutional Neural Network-based speech-emotion detection system (CNN).

According to ImaneLasri et al [2], deep learning algorithms have had remarkable success in a variety of disciplines, including computer vision. A CNN model can be trained to evaluate images and recognize facial expressions. In this study, they developed a system that can recognize students' moods based on their facial expressions. The three steps of their technique are face recognition using Haar Cascades, normalization, and emotion recognition using CNN on the FER 2013 database with seven distinct types of expressions. The findings suggest that face emotion detection is possible in education and that it can assist teachers in adapting their presentations based on the moods of their students.

Shuang Liu et al. [3] suggested "Facial Emotion Recognition Based on CNN," stating that Computers will ultimately acquire not just IQ but also EQ as artificial intelligence progresses. Affective computing, or giving computers feelings, has recently sparked a lot of interest. One of them is facial expression recognition, which has become a hotspot in the field of emotional computing research. Face expression recognition is studied using the Valence-Arousal dimensional emotion model in this study. Using a convolution neural network, this study develops a method for predicting the valence dimension of face expressions.

Whitehill et al. presented in [4] a method for detecting involvement in pupils based on their facial expressions. As students interacted with cognitive skills training software, the technique used Gabor characteristics and the SVM algorithm to determine involvement. The authors got their classifications from videos that were annotated by humans.

Ref.No.	Authors	Paper	Summary
[1]	Alif Bin Abdul Qayyum et al	Convolutional Neural Network (CNN) Based Speech-Emotion Recognition	In this paper Speech is regarded as the most versatile and natural mode of communication. Speech may transmit a wealth of information about a person's mental, behavioral, and emotional characteristics. Furthermore, efforts connected to speech-emotion recognition can assist in the prevention of cybercrime.
[2]	Imane Lasri et al	Facial Emotion Recognition of Students using Convolutional Neural Network	In this paper they say that Deep learning approaches have achieved significant success in a variety of domains, including computer vision. Indeed, a convolutional neural networks (CNN) model can be taught to evaluate photos and recognize facial emotion.
[3]	Shuang Liu et al	Facial Emotion Recognition Based on CNN.	In this paper they say that As artificial intelligence advances, computers will eventually acquire not just IQ but also EQ. Affective computing, which gives computers emotions, has gotten a lot of interest recently. Facial expression recognition is one of them, and it has emerged as a research hotspot in the field of emotional computing.
[4]	Whitehill et al	Facial Emotion Recognition of Students using Convolutional Neural Network	In this paper they proposed an approach that recognizes engagement from students' facial expressions. The approach uses Gabor features and SVM algorithm to identify engagement as students interacted with cognitive skills training software.

Modules Identified

This project is classified into two modules

- Python flask server
- Web Application

Python Flask Server: Python flask framework is used as a backend for this project where in the input video stream from the web application is processed on the server and respond with a reaction.

Web Application: The web application built using HTML, CSS and Java Script uses sockets to transfer the video stream from the user to the server.

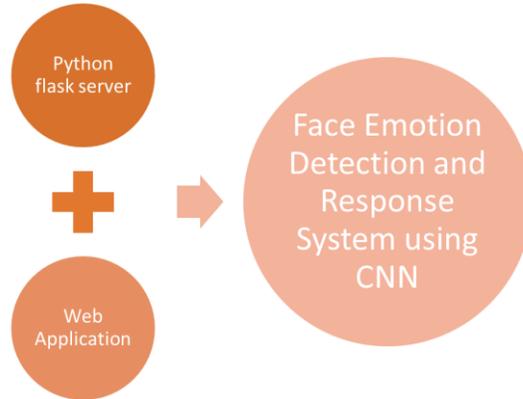


Fig 1 shows the various modules used in the paper

Objectives:

Face Emotion is highly crucial in understanding human psychology. Human emotion detection has several uses, such as identifying the emotion of a student in an online class. Our project focuses on the development of a web application that takes an input stream of video feed from the user's web cam and analyses and attempts to improve their feeling by doing various actions such as playing a good music.

Machine learning techniques have advanced to the point that it is now possible to build a machine learning model that can understand a human's emotions. Because the Python flask APIs established for it may be used for a multitude of other applications, such as classroom proctoring, this project has endless potential.

Results:

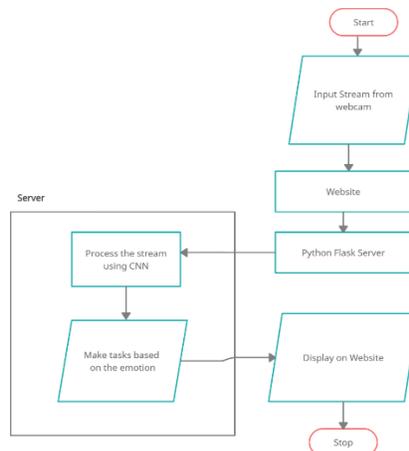


Fig 2. Shows the flow diagram of the model

Using the java script sockets method, the video stream from the web application is transferred from the client to the python flask server. The stream delivered to the server is processed by the Python Flask server using CNN, and a task to be completed is sent to the client in order to provide an appropriate answer. Figure 2 depicts the detailed flow of the procedure. This approach recognizes emotions on all faces in the camera feed. The test accuracy attained 63.2 as shown in the figure 3.

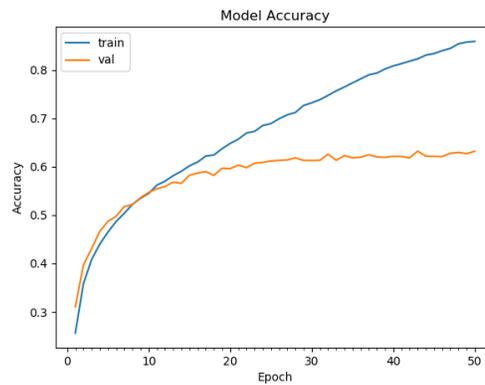


Fig 3. Shows the accuracy of the model.

```

import cv2
import numpy as np
import socket
import time

HOST_IP = '192.168.1.100'
HOST_PORT = 8080
CLIENT_IP = '192.168.1.101'
CLIENT_PORT = 8081

sock = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
sock.bind((HOST_IP, HOST_PORT))
sock.listen(5)

print('Server is listening...')

while True:
    (conn, (client_ip, client_port)) = sock.accept()
    print('Client connected: ', client_ip, client_port)

    # Receive data from client
    data = conn.recv(1024)
    if not data:
        break

    # Decode the received data (assuming it's a video frame)
    frame = cv2.imdecode(np.frombuffer(data, dtype=np.uint8), cv2.IMREAD_ANY)

    # Process the frame (e.g., emotion recognition)
    # ... (omitted processing code) ...

    # Encode the result and send back to client
    result = cv2.imencode('.jpg', frame)
    conn.sendall(result.tobytes())

    conn.close()
    
```

Fig 4. Shows the code for open cv

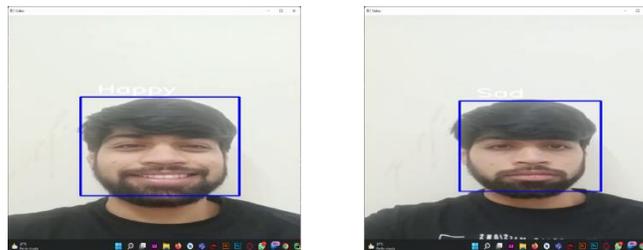


Fig 5. Shows various emotions detected

Conclusion:

We may infer that a human emotion recognition system can be highly valuable, especially during difficult periods like covid, when individuals are not physically connecting with one another.

When working, a user web application with a basic user interface can assist users to relieve tension.

We are excited to work on future advancements to this concept in order to improve the efficacy of the present emotion recognition algorithms.

Refereneeces :

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