Real-Time Facial Emotion Recognition

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ABSTRACT

Facial emotion recognition is pivotal in understanding human emotions and enhancing human-computer interaction. This project aims to develop a real-time facial emotion recognition system that utilizes the Mini-Xception model architecture and LSTM (Long Short-Term Memory) networks. The system captures emotions from live webcam feeds, providing instant feedback on individuals' emotional states.

In this project, we have primarily focused on the Mini-Xception model for facial feature extraction and emotion classification, which is effective for capturing facial features. Additionally, we have trained a separate model using LSTM networks, which are particularly well-suited for capturing temporal dependencies in emotion expressions. We utilized the FER-2013 dataset for experimental analysis, and our results indicate that the combined approach efficiently performs face detection and classification with different emotions, taking advantage of both the Mini-Xception model and LSTM algorithms.

INTRODUCTION

Facial Expression Recognition (FER) stands at the forefront of computer vision, aiming to decipher human emotions by analyzing facial expressions. This technology holds tremendous potential across various industries and research field.In this project, our objective is to develop an advanced Facial Expression Recognition system utilizing the FER2013 dataset. While our initial focus will be on the integration of a specialized Convolutional Neural Network (CNN) architecture, known as the Mini Exception model,which is renowned for its exceptional performance in recognizing subtle and nuanced facial expressions, we will also explore the powerful capabilities of an LSTM (Long Short Term Memory) model. LSTMs, with their ability to understand temporal dependencies in sequential data, offer a promising avenue for enhancing emotion recognition accuracy, especially in scenarios where context and temporal dynamics play a crucial role.

METHODOLOGY

Initially, the face region is extracted from the provided face images using our proposed face detection algorithm. Subsequently, deep features are extracted from the last fully connected layer of the Mini-Xception model. Mini-Xception, a pre-trained convolution model, is known for its state of the art performance in various applications like image classification, object detection etc. , making it a suitable choice for our facial emotion recognition system.

Our experimental results demonstrate that the proposed method is both straightforward and outperforms other techniques. After training the architecture, we tested the model in real time. First, the system detects human faces within the frame. Subsequently, the detected facial images are passed to the Mini-Xception model, which classifies the emotions they express. This entire process operates at a frame rate of 30 frames per second in real-time video feed.

It's worth noting that we also explored the use of LSTM for emotion recognition, but it yielded slightly lower accuracy compared to the Mini-Xception model. Therefore, we decided to employ the Mini-Xception model for the final real-time video emotion recognition, ensuring optimal performance in our system.

DATABASE

The project will utilizes the FER2013 dataset, which contains a variety of grayscale facial images categorized into seven emotion labels. These images are diverse in terms of lighting conditions, facial expressions, and backgrounds.To train our models we used dataset: FER-2013. The FER2013 dataset had been created by acquiring and combining the result of Google image search for every particular emotion . Each and every image in FER dataset is labeled image and it consists of seven emotion images i.e., anger, disgust, fear, happy, sad, surprise, and neutral. This dataset consists of 35,887images in the training set, 3,500 labeled images in the test set, and 3,500 images in the development set. It consists of pair of posed and un-posed identification images, these images are in grayscale and pixel value is 48x48.

ALGORITHMS

Algorithm Used: The main algorithm used in this script is Convolutional Neural Networks (CNNs) for facial emotion recognition. The mini XCEPTION model architecture (a smaller version of the XCEPTION architecture) is utilized for learning and predicting emotions from facial images. Additionally, data augmentation techniques are employed to

enhance the model's ability to generalize to different variations of the input data.

- INPUT: FER2013 Data set
- OUTPUT: Classification of emotions
- Step 1: Load the FER-2013 dataset.
- Step 2: Partition the dataset into training and testing.
- Step 3: Apply the preprocessing techniques.
- Step4: Build the model using Mini-Xception algorithm.
- Step5: Test data is given to Mini-Xception for classification.

The next algorithm we used is the LSTM algorithm which primarily consists of these steps:

- INPUT: FER2013 Data Set
- Step 1: Data Preprocessing
- Step 2: Sequence Generation
- Step 3: Model Architecture
- Step 4: Training and Testing

MODEL

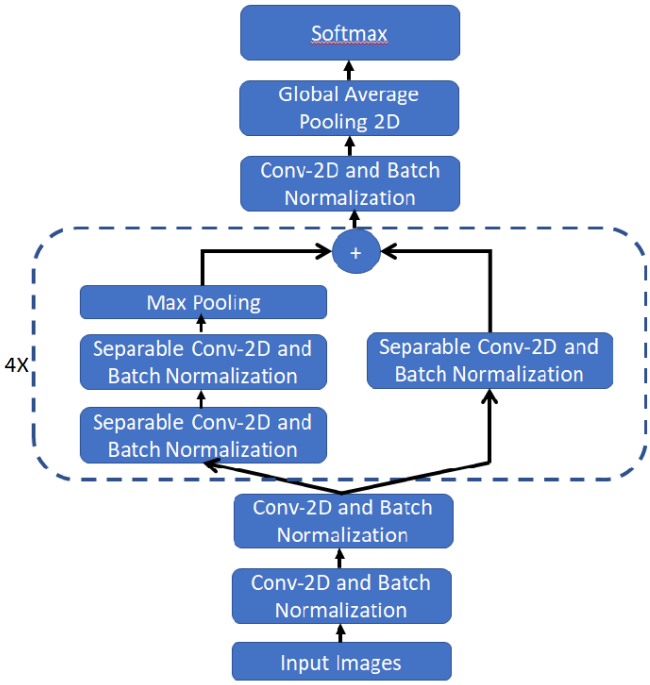

Figure 1: Mini Xception Model

RESULTS

We used and compared two models for the emotion recognition task which are as follows:

- MiniXception : Accuracy = 60.7 percent
- LSTM : Accuracy = 54.57 percent

On using the final selected model , Mini Xception model, two windows appear on the screen , namely "Your Face" which detects the face and recognizes emotions . The second window namely "Probabilities" show the probabilities of different emotions in the form of percentage.

CONCLUSION

In this project, we implemented Mini-Xception which is an enhanced model of Xception architecture using residual networks for Emotion expression and Recognition. We also implemented the LSTM model using the FER-2013 database . We found that MiniXception model gives better performance than the LSTM model. There are different types of emotion expressions such as (e.g., anger, disgust, fear, happy, sad, surprise, and neutral.) we tried to recognize. In modern years, many works have introduced an end-to-end plan for emotion expression recognition, utilizing deep learning models.

REFERENCES

- Real Time Emotion Detection of Humans Using Mini-Xception Algorithm - IOP Science
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- CNN-LSTM Facial Expression Recognition Method Fused with Two-Layer Attention Mechanism