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Speech Based Emotion Recognition

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Abstract: Speech Emotion Recognition is the final year project that we are showcasing in this essay. Speech and emotion recognition is a current research hot topic with the aim of enhancing human-machine interaction. In order to categorise emotions into different groups, discriminator extraction is now used in the bulk of this field of study. The majority of the current study concentrates on the words used in lexical analysis that is language-dependent for detecting emotions when they are spoken. This study uses the Convolutional Neural Network machine learning method five categories to classify emotions groups: anger, calm, anxiety, pleasure, and sorrow.

I. INTRODUCTION

Speech emotion identification is a method for identifying emotions by gathering their traits from computerized audio signals, contrasting them, and then examining the model parameters and associated emotional changes. Extracted features and classifier training are required in order to recognize and understand emotions from audio sources. The classifier modelis trained to correctly identify specific moods using the featureset, which is made up of elements of the audio signal describe the distinctive qualities of the speaker (such as pitch, pitch, and energy). There is a huge amount of opinionated content on social media and online, including on internet forums, Fb, blogs, and user forums. People's decision-making processes are influenced by the ideas posted on the internet by a diverse group of thought leaders and regular people. One way for consumers to express their thoughts and opinions about products or social issues is through text-based reviews. Audio and video are two more methods that are frequently used to communicate ideas. On YouTube, you may find millions of videos covering a wide range of topics, including products and film reviews, products unpacking, political and social issue analyses, and opinionson these topics. On the Internet, there are multiple audio plat- forms where people may express themselves. Audio frequentlyappeals to people more than text because that provides more insight into the speaker's viewpoints. Obtaining public attitude and opinion on certain issues as well as the general public's perception of social or political issues would be extremely helpful for data analysis. This enormous resource is typically underutilised. Audio sentiment analysis is still a relatively new field. The field of speech-basedemotion extraction is still relatively new and difficult. In this work, reliable techniques are presented for extracting emotion or opinion from real-world audio sources.

II. RELATED WORK

Earlier studies assigned audio data to one of a select few emotion categories based on the audio recordings with the strongest cross correlation. In order to ascertain the emotions of each audio recording provided as an input, extra work has been done in MATLAB. Just a small number of emotion types are classified by classification learners, who use a variety of classifiers from MATLAB's toolbox. There are several uses for CNN-based models, including categorization of audio and the surroundings [1, 2]. Just afew 1-D convolution models have been developed for using with raw audio waveforms, including EnvNet [4] and Sample- CNN[1]. Yet, the most of the SOTA discoveries were produced using CNNs using Spectrograms. Most of these models increase the difficulty of the design by using a number of models with varied inputs, whose combined outputs yield the predictions. As an example, [5] processed the raw sound, the spectra show, and even the delta STFT parameters using three networks; [6] utilised two networks only with input ofa mel-spectrograms and even the MFCCs. We show, however,that conventional mel-spectrograms may be used to achieve cutting-edge performance.

III. SYSTEM ARCHITECTURE

The System Architecture is an explanation and illustration of a system, set up in a way that facilitates discussion of the elements of the system's structure and behaviour. Thearchitecture, behaviour, and other characteristics of a system are shown. A formal description of an architectural design expression and illustration of an established system such a way that it is easier to consider the structures and behaviours of thesystem. System parts and subsystems come together to forman architecture of the system and function as one cohesive unit. This system has been taught to distinguish a person's vocal behaviour, which includes a variety of emotions.

The steps in this architectural flow for speech-based emotionrecognition are as follows:

1) Extraction of Features
2) Creating separate training and test sets
3) Testing
4) Preserving the model
5) Adding a model to an interface
6) Recognition of Emotions

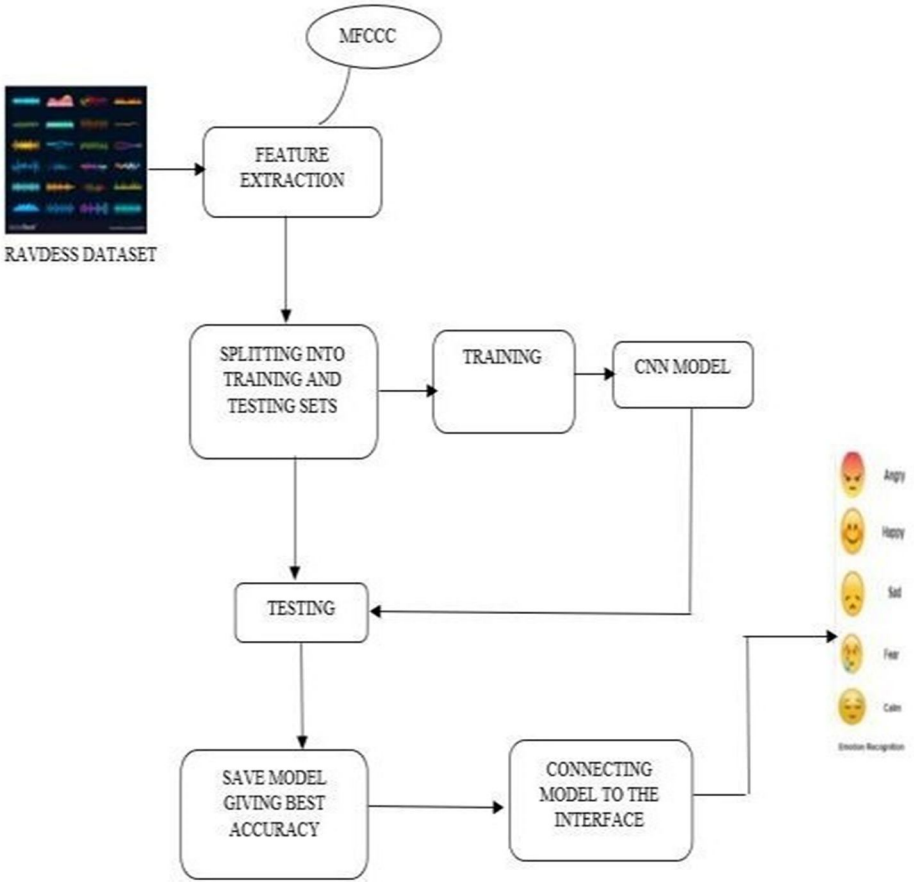

Fig. 1. Architecture of the system

IV. CNN MODEL

Convolutional Neural Network (CNN) models are learning systems that can take an input speech and recognise numerous features and objects while also giving priorities (learning weights and biases) to them. A CNN requires a substantially higher amount of data comparing to other classification tech- niques. smaller amount of preprocessing. With the proper training, CNN may learn these filters and properties, but for essential approaches, filters must be manually constructed.

Convolution operation is used to remove high-level input characteristics, such as edges. One Convolutional Layer is not sufficient for CNN. Low-Level data, such as edge, coloring, gradients direction, and so on, are typically collected by the first ConvLayer. The design responds to the highest-level attributes as well as the addition of layer, providing us anetwork that is just as familiar with the dataset's photos as we are. Notwithstanding their shortcomings, convolutional neural networks have without a doubt marked the beginning of anera in artificial intelligence. The usage of CNNs in computer vision applications such as augmented reality, face recognition,picture search, and editing, is widespread nowadays.

Our results are amazing and important for convolutional neural networks development. Networks show this, but we have a long way to go before we can replicate the fundamentalsof human intelligence.

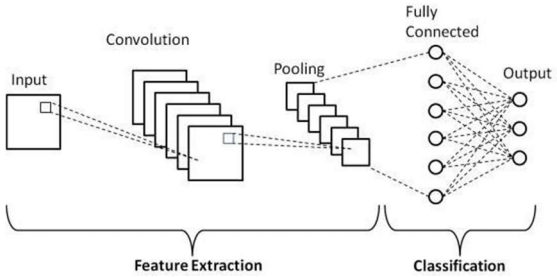

Fig. 2. CNN's Model layers

The layer of artificial neurons that make up the con- volutional neural network are many. Artificial neurons are mathematical operations that calculate the weighted total of several inputs, then output an activation value, just like their biological counterparts.

The activation functions produced by aCNN's layers are sent to the following layer in a huge quantity.

1) The input consists of a sample audio file
2) The MFCC (Mel Frequency Cepstral Coefficient) is ex- tracted using the LIBROSA Python library
3) Employing a Cnn architecture and its layers to train the dataset, reusing the data, splitting it into testing and training groups, and assessing the results
4) Use training data to predict the emotion of human speechIn the classification challenge, the CNN model fared better than the competition. The most accurate validation is achieved by this trained model. There are 18 stages altogether. In the classification challenge, the CNN model fared better than thecompetition. The most accurate validation is achieved by this trained model. There are 18 stages altogether.

The CNN model is separated into four layers:

a) Convolutional layer: recognises utterances of various durations, finds important sections at regular intervals, and shows the feature map sequence.
b) Activation layer: As is typical for convolutional layer outputs, It uses a non-linear activating layer function. It makesuse of the ReLu activation layer.
c) Max Pooling Layer: For the Dense layers, this layer has the most potential. This approach makes it easier to maintain variable-length inputs inside a feature array with a fixed size.
d) Flatten and Dense: A single column from the pooling layer map is then moved to the completely connected layer. Dense provides a fully linked layer to the neural network.

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv1d_7 (Conv1D)            (None, 216, 128)          768
_________________________________________________________________
activation_8 (Activation)    (None, 216, 128)          0
_________________________________________________________________
conv1d_8 (Conv1D)            (None, 216, 128)          82048
_________________________________________________________________
activation_9 (Activation)    (None, 216, 128)          0
_________________________________________________________________
dropout_3 (Dropout)          (None, 216, 128)          0
_________________________________________________________________
max_pooling1d_2 (MaxPooling1 (None, 27, 128)           0
_________________________________________________________________
conv1d_9 (Conv1D)            (None, 27, 128)           82048
_________________________________________________________________
activation_10 (Activation)   (None, 27, 128)           0
_________________________________________________________________
conv1d_10 (Conv1D)           (None, 27, 128)           82048
_________________________________________________________________
activation_11 (Activation)   (None, 27, 128)           0
_________________________________________________________________
conv1d_11 (Conv1D)           (None, 27, 128)           82048
_________________________________________________________________
activation_12 (Activation)   (None, 27, 128)           0
_________________________________________________________________
dropout_4 (Dropout)          (None, 27, 128)           0
_________________________________________________________________
conv1d_12 (Conv1D)           (None, 27, 128)           82048
_________________________________________________________________
activation_13 (Activation)   (None, 27, 128)           0
_________________________________________________________________
flatten_2 (Flatten)          (None, 3456)              0
_________________________________________________________________
dense_2 (Dense)              (None, 10)                34570
_________________________________________________________________
activation_14 (Activation)   (None, 10)                0
=================================================================
Total params: 445,578
Trainable params: 445,578
Non-trainable params: 0
_________________________________________________________________
None
The F1 Score is: 91.04
```

Fig. 3. CNN Model four layers

V. CONFUSION MATRIX

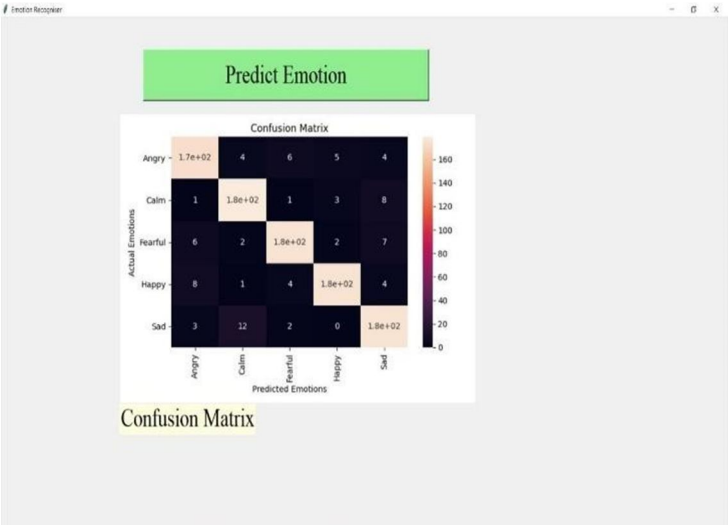

Fig. 4. Prediction Page

This table is used to determine where model mistakes oc- curred in classification issues. The rows show the real classes for which the results should have been. The forecasts we've made are shown in the columns. It is simple to identify which forecasts are incorrect with this table. Using the confusion matrix function on our actual and expected values once metricsimport is complete.
Confusion matrix = metrics.confusion matrix (actual, pre- dicted).
We must change the table into a confusion matrix presenta- tion in order to produce a more understandable visual display. cm display = metrics.ConfusionMatrixDisplay (confu- sion matrix = confusion matrix, display labels = [False, True])

Fig. 5. Recording and analysis of inputs

VI. RESULTS

Fig.6. Happy Emotion

Fig. 7. Sad Emotion

VII. CONCLUSION

By putting the audio into the model, this speech-based emotion identification might be utilised to decipher the opin- ions and ideas. Using their feelings towards a certain brand or political stance as an example. To provide consumers Providing listeners with music suggestions based on their feelings, this tactic utilised in conjunction with a variety of music applications. Moreover, this might be applied to improvethe product recommendations sent to clients of online retailerslike Amazon.

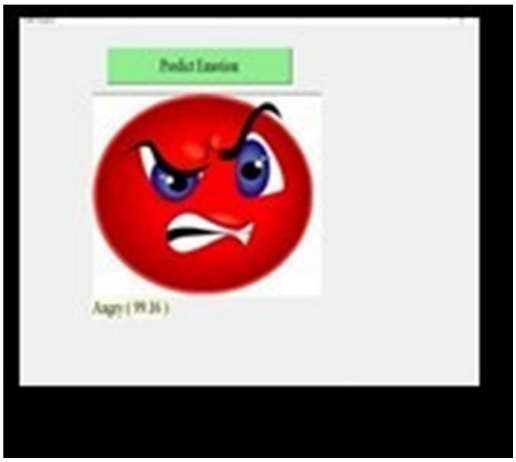

Fig. 8. Angry Emotion

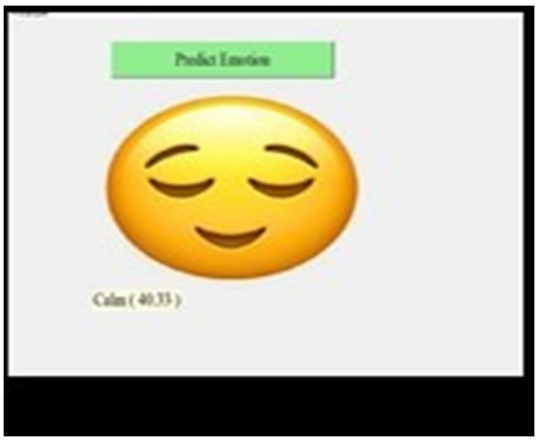

Fig. 9. Calm Emotion

speech-using-machine learning-and-deep-learning/learning-anddeep-learning/

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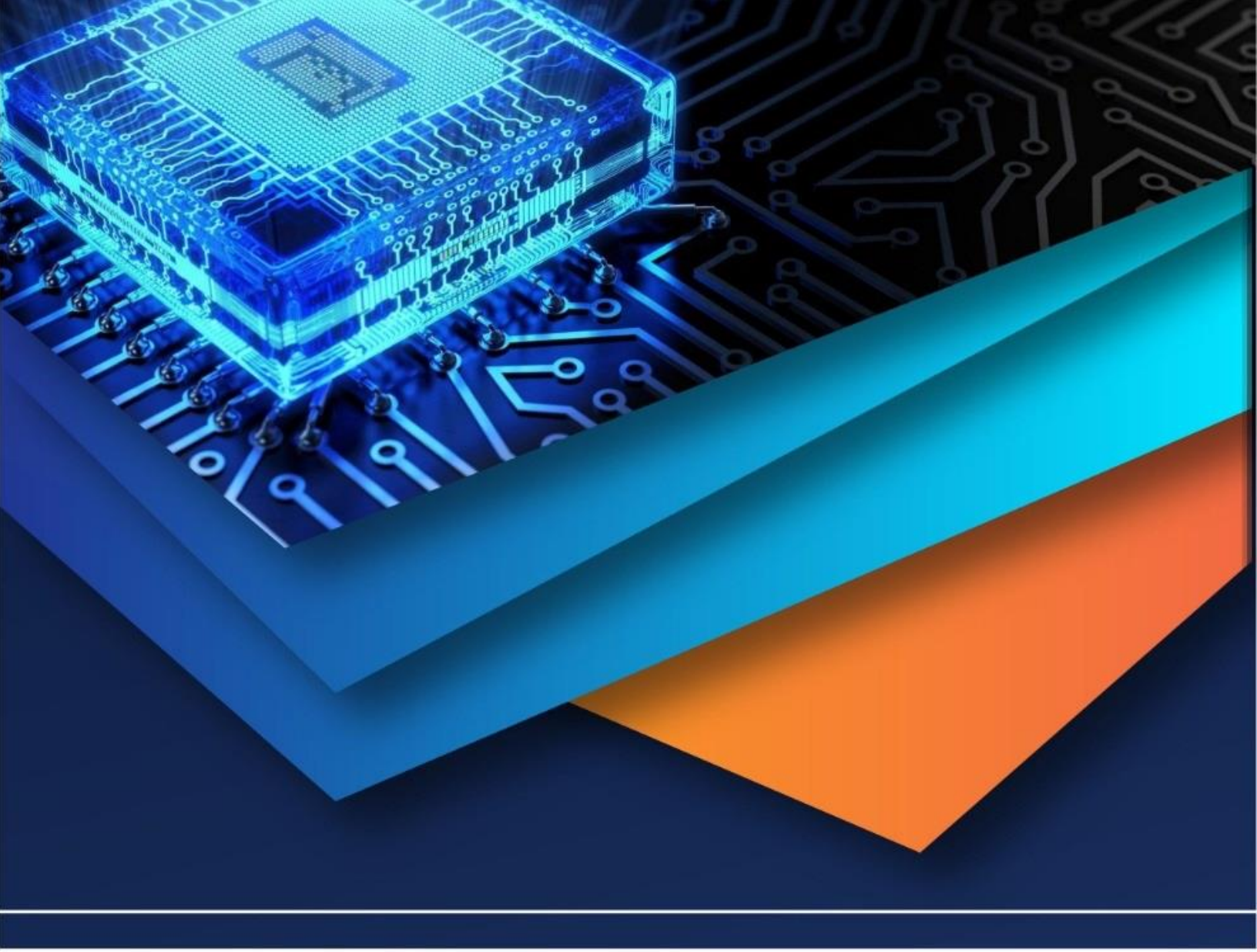

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