BANGLADESH UNIVERSITY OF
ENGINEERING AND TECHNOLOGY

SPEECH EMOTION RECOGNITION

CSE 472 - MACHINE LEARNING SESSIONAL

Group - **A1_8**
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PROBLEM DEFINITION

Machines often lack the ability to interpret emotional cues, limiting their effectiveness in human-centric applications. Speech Emotion Recognition can alleviate this problem.

Speech Emotion Recognition (SER) focuses on **identifying human emotions from speech signals.**

USE CASE OF SER

- Enhanced Human-Computer Interaction
- Healthcare Applications
- Customer Service
- Entertainment

DATASET

We'll use the **IEMOCAP dataset** which is a **12-hour collection of audio-visual recordings** of actors in dialogues, **labeled with emotions** (e.g., happiness, anger) **as the base dataset**. It's widely used for developing and testing speech emotion recognition models.

From this base dateset, we chose the pre-processed variant which has the **audio data**, **spectrogram**, **MFCC (Mel-frequency cepstral coefficient).**

DATASET

IEMOCAP Full-release

https://www.kaggle.com/datasets/dejolilandry/iemocapfullrelease

IEMOCAP Pre-processed Dataset

https://drive.google.com/file/d/1Nnxh3y7hkkmsh3Y5Dg4q1qerRZWcePH8/view

DATASET ANALYSIS

Why IEMOCAP

Database	Speech Emotion Category						
	Surprise	Angry	Happy	Fear	Sad	Neutral	Disgust
EmoDB	—	127	71	69	62	79	81
eNTERFACE	215	215	212	215	215	—	215
AFEW4.0	103	156	171	113	145	167	106
IEMOCAP	—	1103	1636	—	1084	1708	—

DATASET ANALYSIS

IEMOCAP's emotion distribution

Emotion	Number of Examples
Angry	1103
Happy+Excited	1636
Neutral	1708
Sad	1084
Total	**5531**

EXISTING METHOD

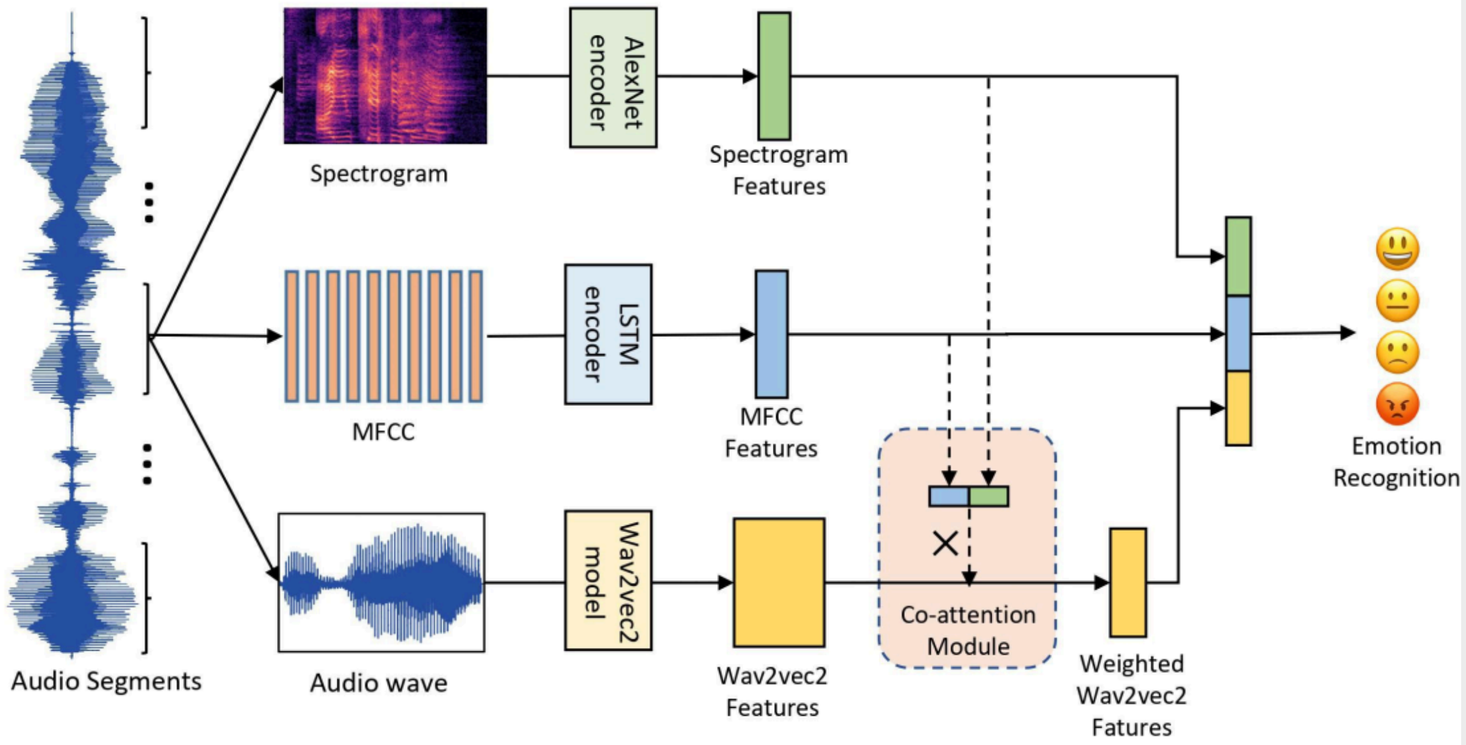


Fig. 1. The overall architecture of our proposed method.

SPEECH EMOTION RECOGNITION WITH CO-ATTENTION BASED MULTI-LEVEL ACOUSTIC INFORMATION

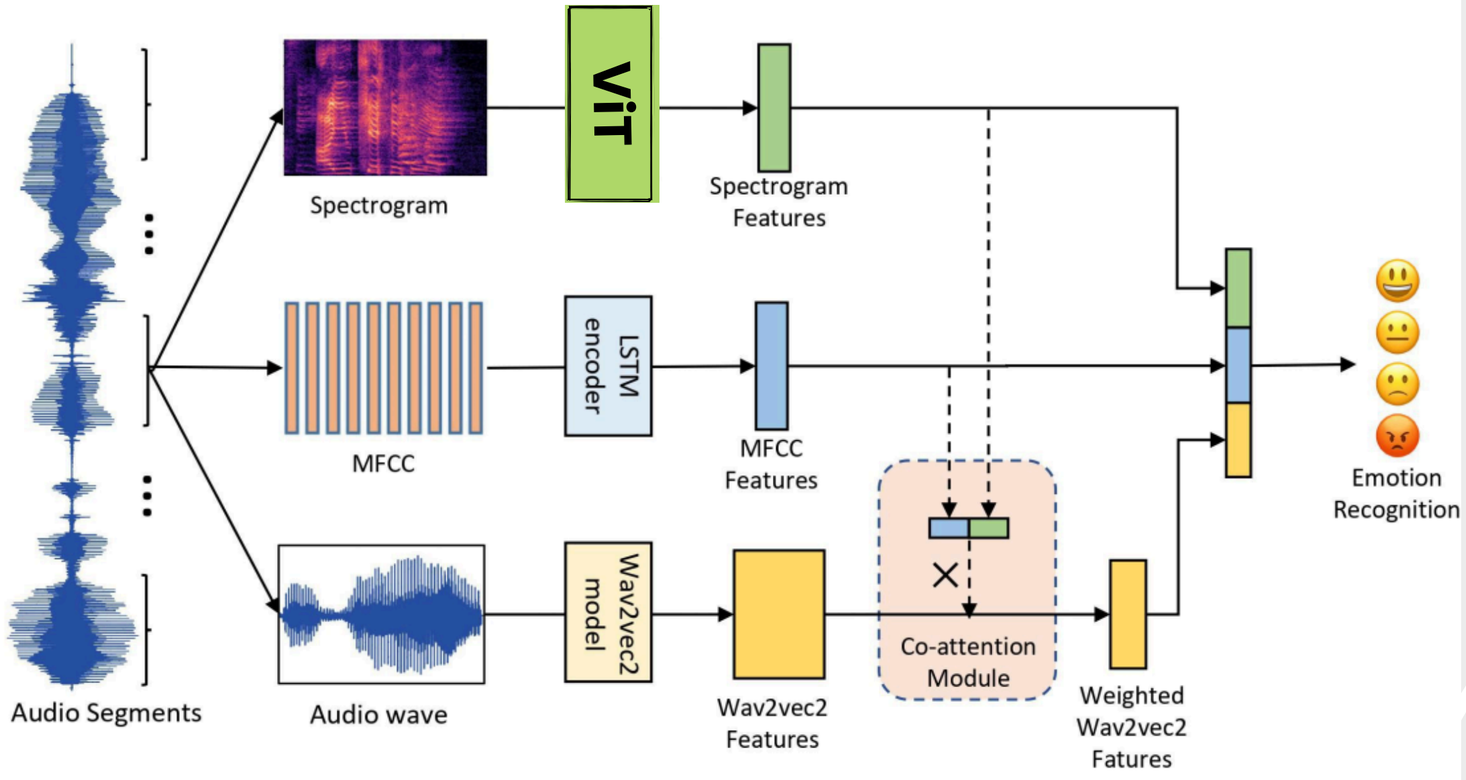
PROPOSED SOLUTION

Our Proposal -

- We have incorporated **Vision Transformer instead of AlexNet Encoder.**
- We have done **ensembling by majority voting** of the output of different models.

PROPOSED SOLUTION

Step -1 (Vision Transformer instead of AlexNet Encoder)



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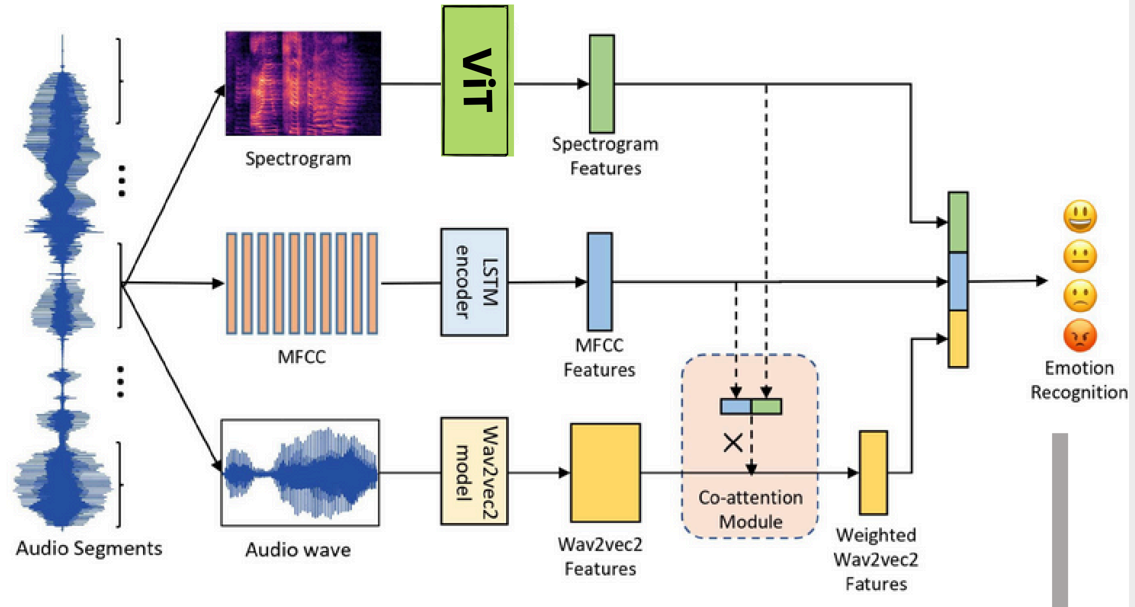
PROPOSED SOLUTION

Step -2 (Ensembling with Majority Voting)



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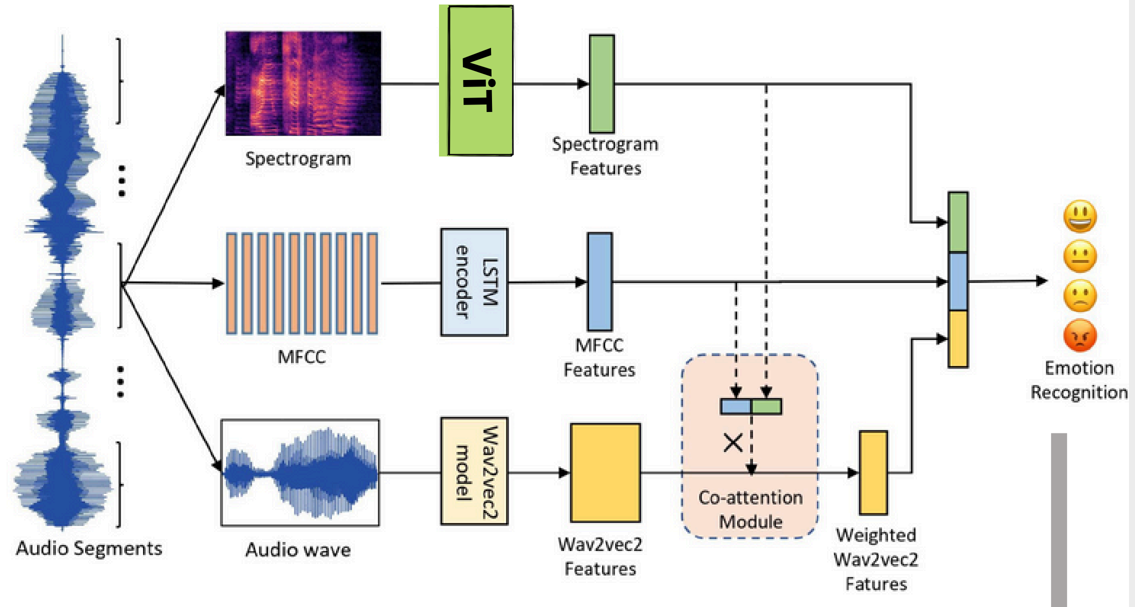

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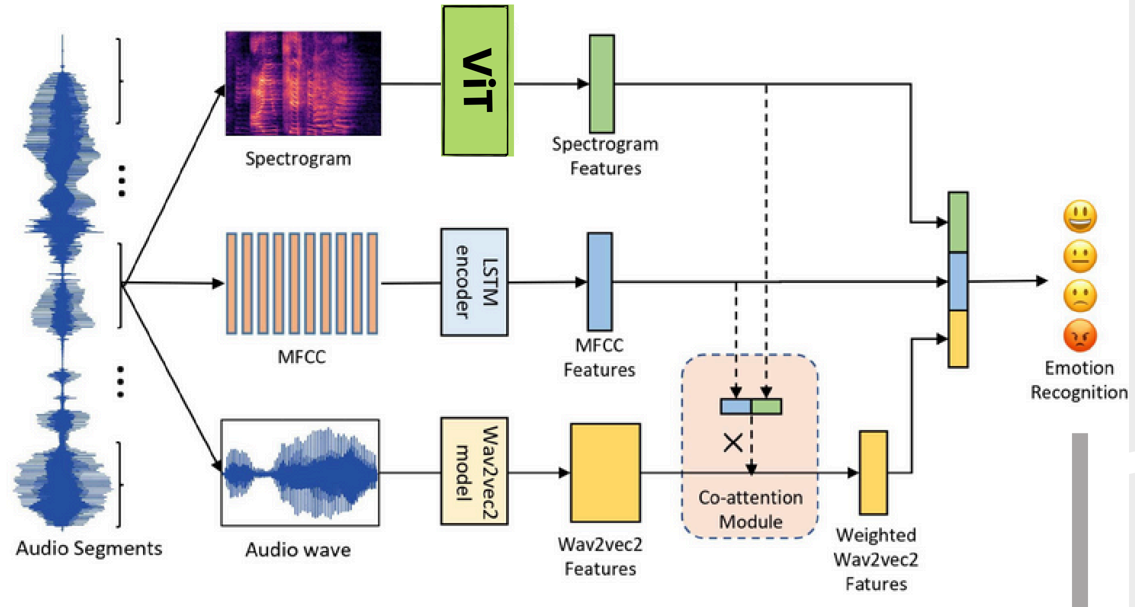

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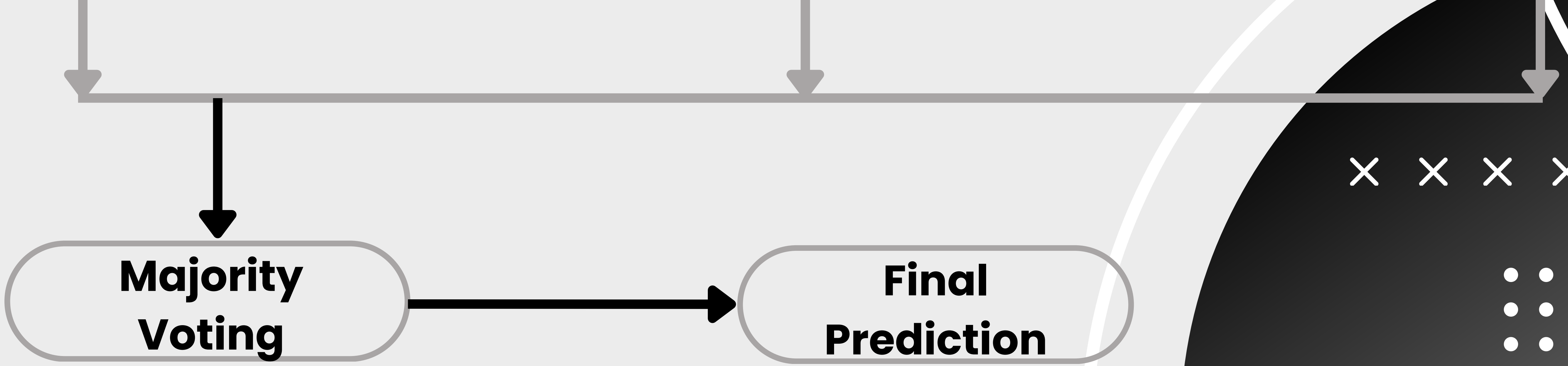


Majority Voting

Final Prediction

LOSS FUNCTION <<<<<

1. **Cross Entropy Loss -**

As it is a multiclass classification, the loss function used here is cross entropy loss

>>>>>

PERFORMANCE METRICS

1 Unweighted Accuracy -

We can measure it by the **total loss divided by total number of samples**

As it is multiclass classification problem we can get the avg loss by UA loss. **It gives same importance to each class.**

PERFORMANCE METRICS

2 Weighted Accuracy -

It gives more importance to the class with fewer samples to **maintain the coherence in emphasizing each class**.

In case of **imbalanced dataset**, we need this loss function to **ensure the importance of each class properly**

PERFORMANCE REPORT

- 7 different models have been trained by selecting 5 actors from the first 9 actors of the dataset randomly.
- 4 of the actors are taken as training set and the reamining is taken as validation set.
- The last(10th) actor is considered as the test data.
- We ran the models on the test data and did majority voting.

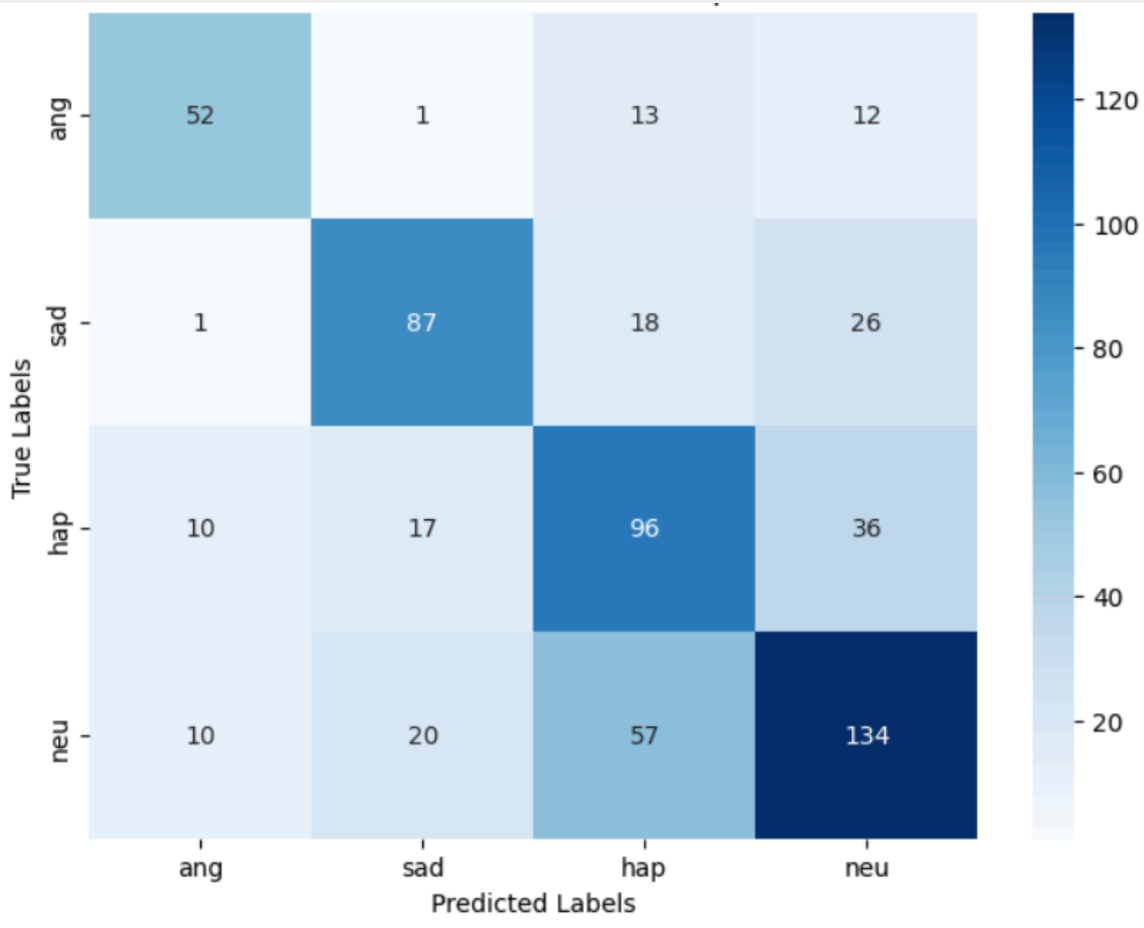
PERFORMANCE REPORT

RESULTS ON TEST SET AFTER ENSEMBLING FOR VIT:

```
WA: 62.54
```

```
UA: 63.40
```

PERFORMANCE REPORT



COMPARISON

RESULTS ON TEST SET AFTER ENSEMBLING FOR VIT:

WA: 62.54

UA: 63.40

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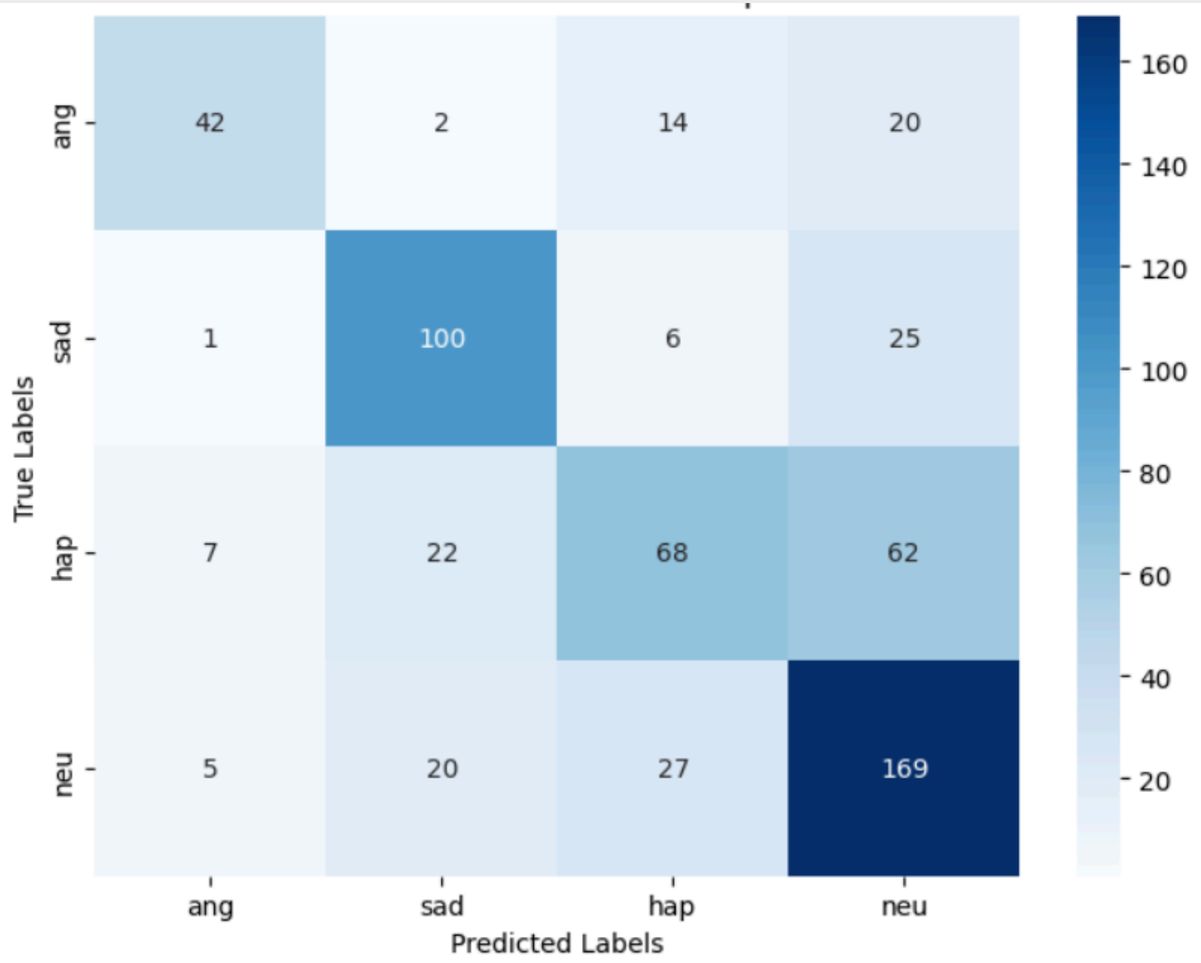
RESULTS ON TEST SET AFTER ENSEMBLING FOR CNN:

WA: 64.24

UA: 62.21

COMPARISON

AFTER ENSEMBLING FOR CNN



COMPARISON

RESULTS ON TEST SET AFTER ENSEMBLING FOR VIT:

WA: 62.54

UA: 63.40

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RESULTS ON TEST SET (WITHOUT ENSEMBLING) FOR CNN:

WA: 64.24

UA: 62.21

DISCUSSION

RESULTS ON TEST SET (WITHOUT ENSEMBLING) FOR CNN:

MODEL-1

WA: 64.07 UA: 65.75

MODEL-2

WA: 64.75 UA: 62.05

MODEL-3

WA: 64.24 UA: 61.48

MODEL-4

WA: 64.24 UA: 62.16

MODEL-5

WA: 63.39 UA: 60.95

MODEL-6

WA: 61.53 UA: 60.34

MODEL-7

WA: 63.05 UA: 66.97

DISCUSSION

The spectogram is of **384*256 shape**. But due to time and resource constraint we **interpolate it to a 224*224 shape**. And then we ran our proposed model on it.

Due to **reshaping the image some information has been lost**. Still our model performs nearly similar to the state-of-the-art model.

DISCUSSION

In the paper, they have **splitted the dataset into 8:1:1** as **the train, validation and test dataset**

But due to resource constraint, **we split the dataset into 4:1:1 as the train, validation and test set**

DISCUSSION

The difference in result in different training cases shows that there is **a personal bias** while creating a dataset for Speech Emotion Detection.

So, without ensembling, **taking the direct result** from 1-2 or the best performing model might result **in huge success in similar cases and huge degradation of performance in opposing cases.** So, **there will be inconsistency without ensembling.**

THANK YOU