CAPSTONE PROJECT

FACIAL EMOTION DETECTION – DEEP LEARNING

BACKGROUND

- Facial expressions plays a significant role
  - 55% of emotional exchanges occur through facial expressions
  - Communicate and understand emotions
- Facial emotion detect helps create more emotionally intelligent machines
  - Improve human-machine interactions in a variety of settings
- Create a deep learning model that can classify multiple classes of facial expressions
  - Happy, Sad, Neutral, Surprise

BACKGROUND

- Application are mostly used in
  - Healthcare
  - Education
  - Marketing
  - Entertainment

INTRODUCTION

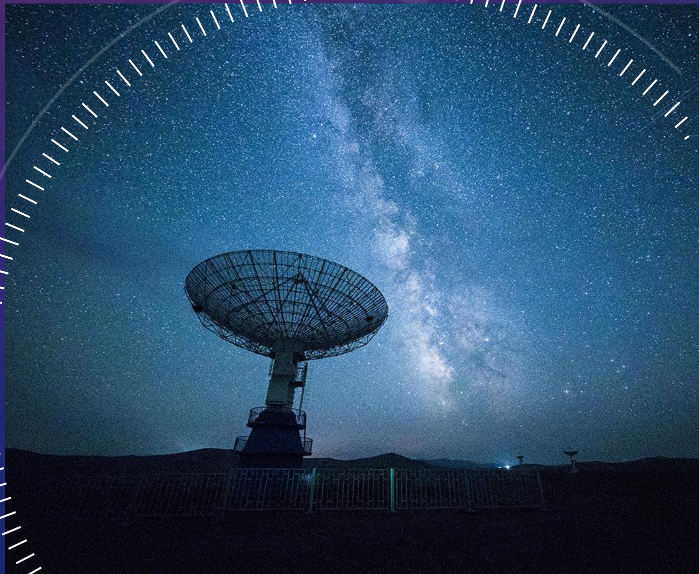
- The most effective algorithms and techniques for recognizing and classifying emotions
- Address bias and fairness in facial emotion detection
- Improve the accuracy and performance of facial emotion detection system

SOLUTION APPROACH

Data Exploration

Build Model And Evaluate

Final Model Solution



DATA EXPLORATION

- Key patterns of the facial expressions
    - Mouthing, Eyebrows, Cheek
- Data distribution
    - Affect the performance of the model
- EDA
    - Image statistics

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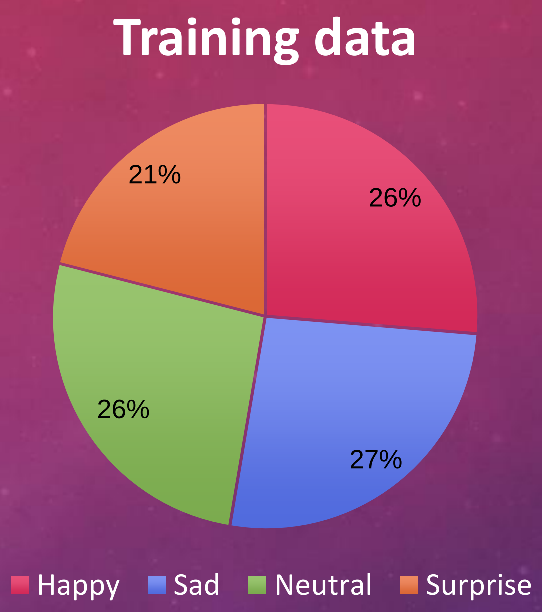

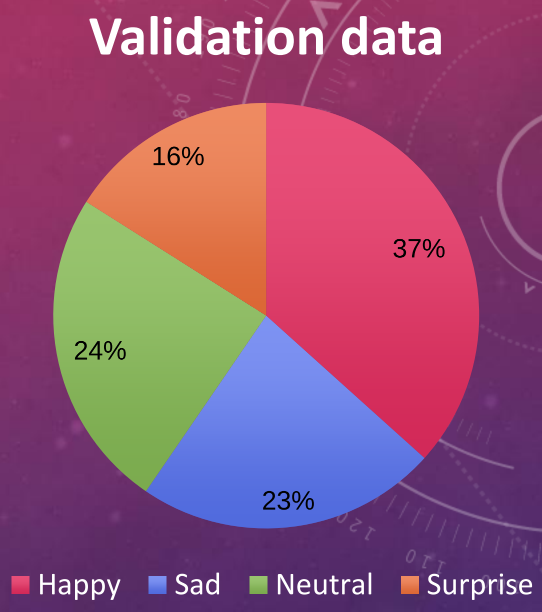

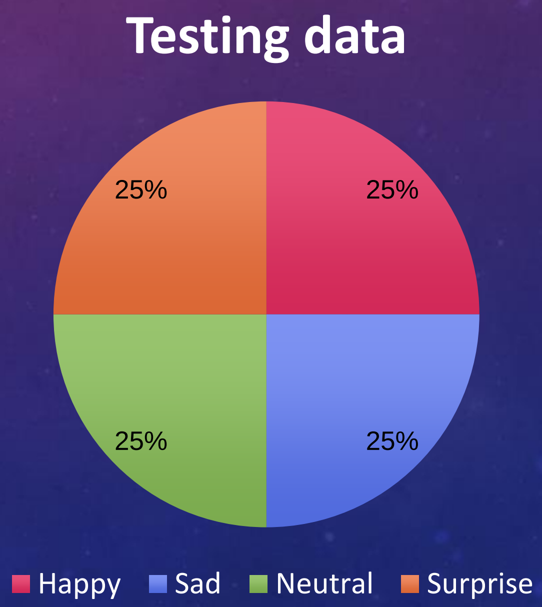

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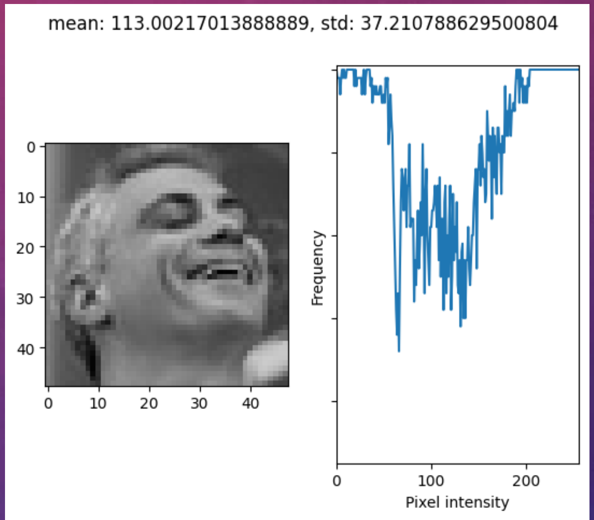
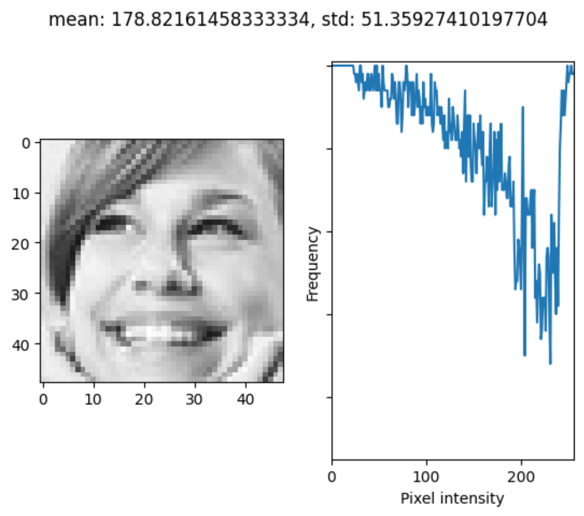
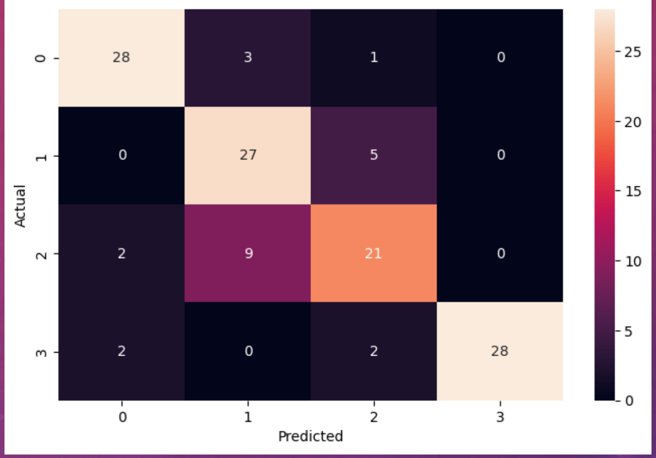


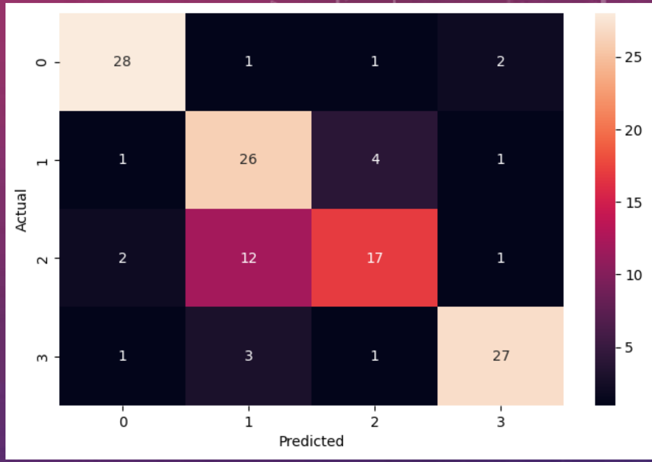


BUILD MODEL - TRANSFER LEARNING

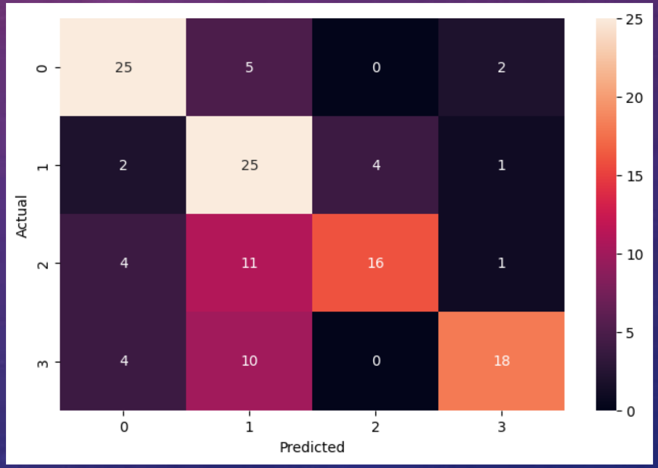
- VGG16, ResNet v2, Efficient Net
- VGG16 Accuracy
    - Training: 78.75%
    - Validation: 77.6%
    - Testing: 81%
    - F1-score: 0.88, 0.76, 0.69, 0.93
- ResNet v2 Accuracy
    - Training: 77.17%
    - Validation: 76.01%
    - Testing: 77%
    - F1-score: 0.88, 0.70, 0.62, 0.86
- Efficient Net
    - Training: 74.71%
    - Validation: 69.24%
    - Testing: 66%
    - F1- score: 0.75, 0.60, 0.62, 0.67



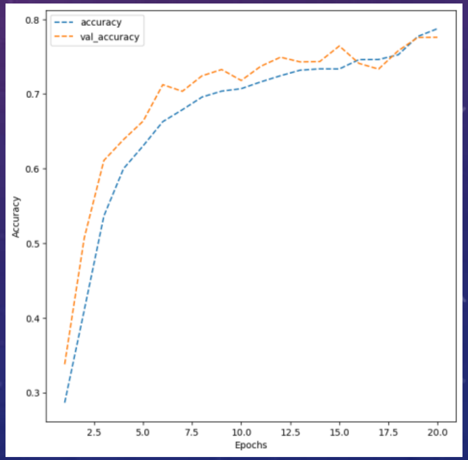
VGG16



ResNet v2



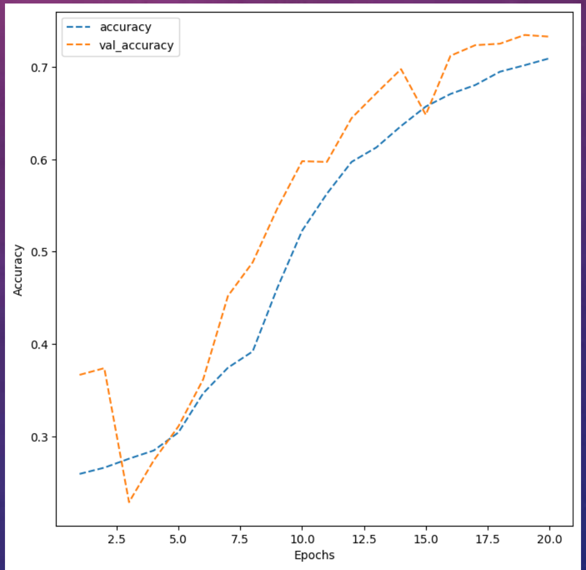
Efficient Net

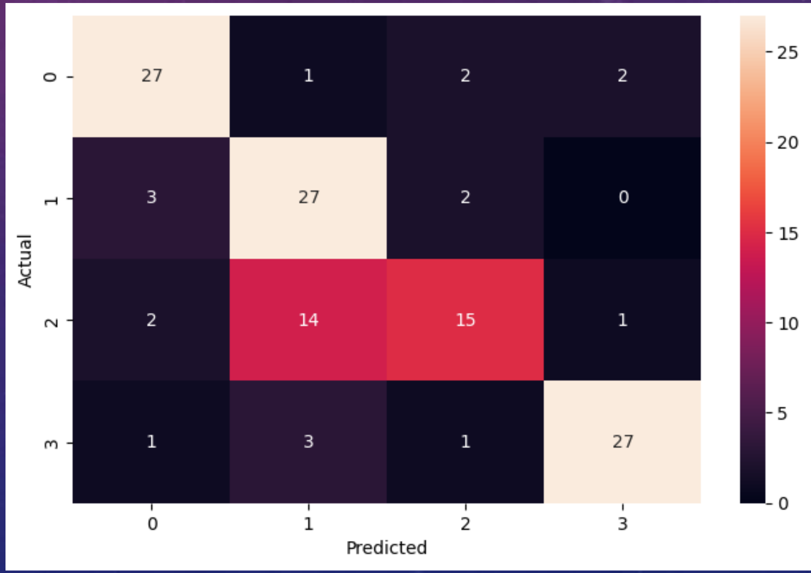


VGG16 accuracy

BUILD MODEL - CUSTOM BUILT MODEL

- 5-block CNN Model
- Accuracy
  - Training: 70.93%
  - Validation: 73.28%
  - Testing: 75%
  - F1-score: 0.83, 0.70, 0.58, 0.87





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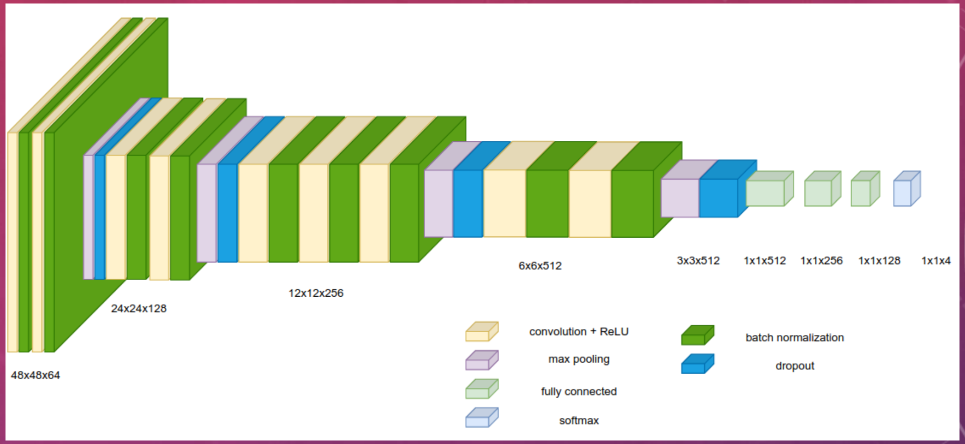
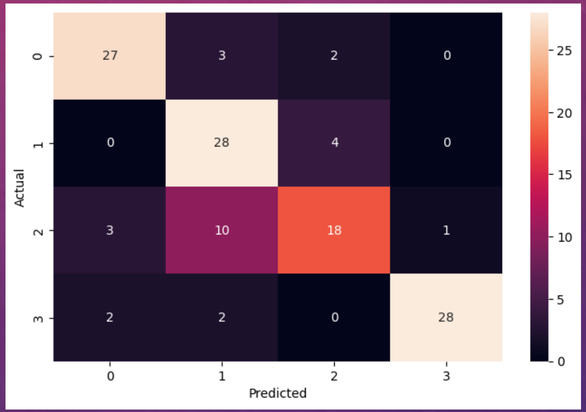
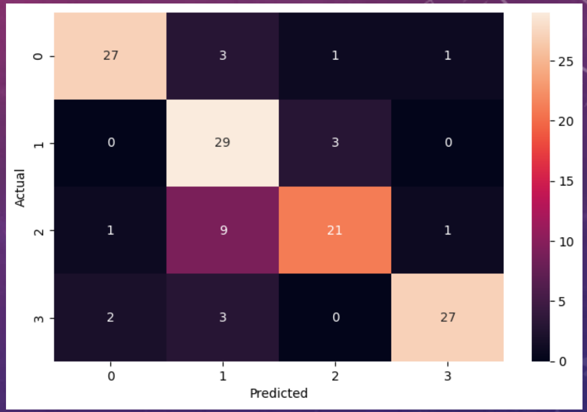


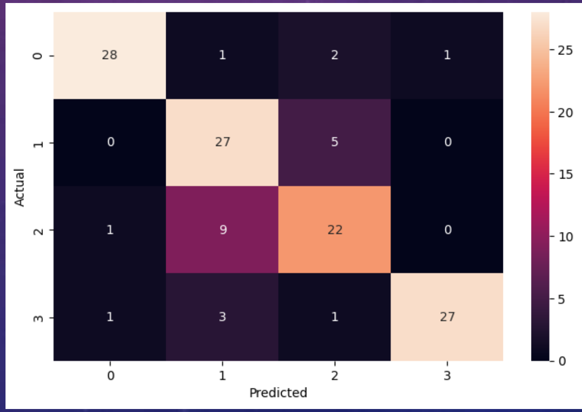
- 4-block CNN Model with batch normailzation and dropout
- Accuracy
  - Without class weight: 79%
    - F1-score: 0.84, 0.75, 0.64, 0.92
  - Class 'sad' and 'neutral' weight 3 : 81%
    - F1-score: 0.87, 0.76, 0.74, 0.89
  - Class 'sad' and 'neutral' weight 3.5: 81%
    - F1-score: 0.90, 0.75, 0.71, 0.90
  - Class 'sad' and 'neutral' weight 4: 80%
    - F1-score: 0.89, 0.74, 0.74, 0.84



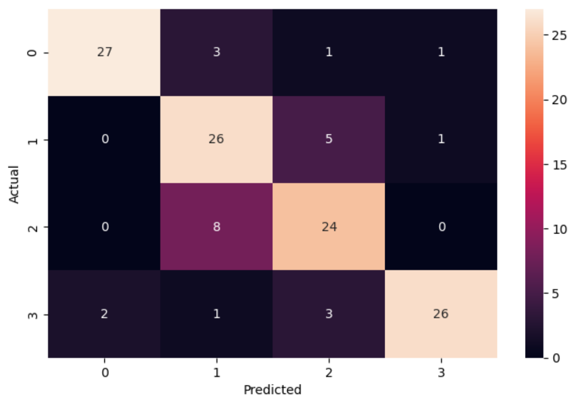
Without class weight



'sad' and 'neutral' weight: 3



'sad' and 'neutral' weight: 3.5



'sad' and 'neutral' weight: 4

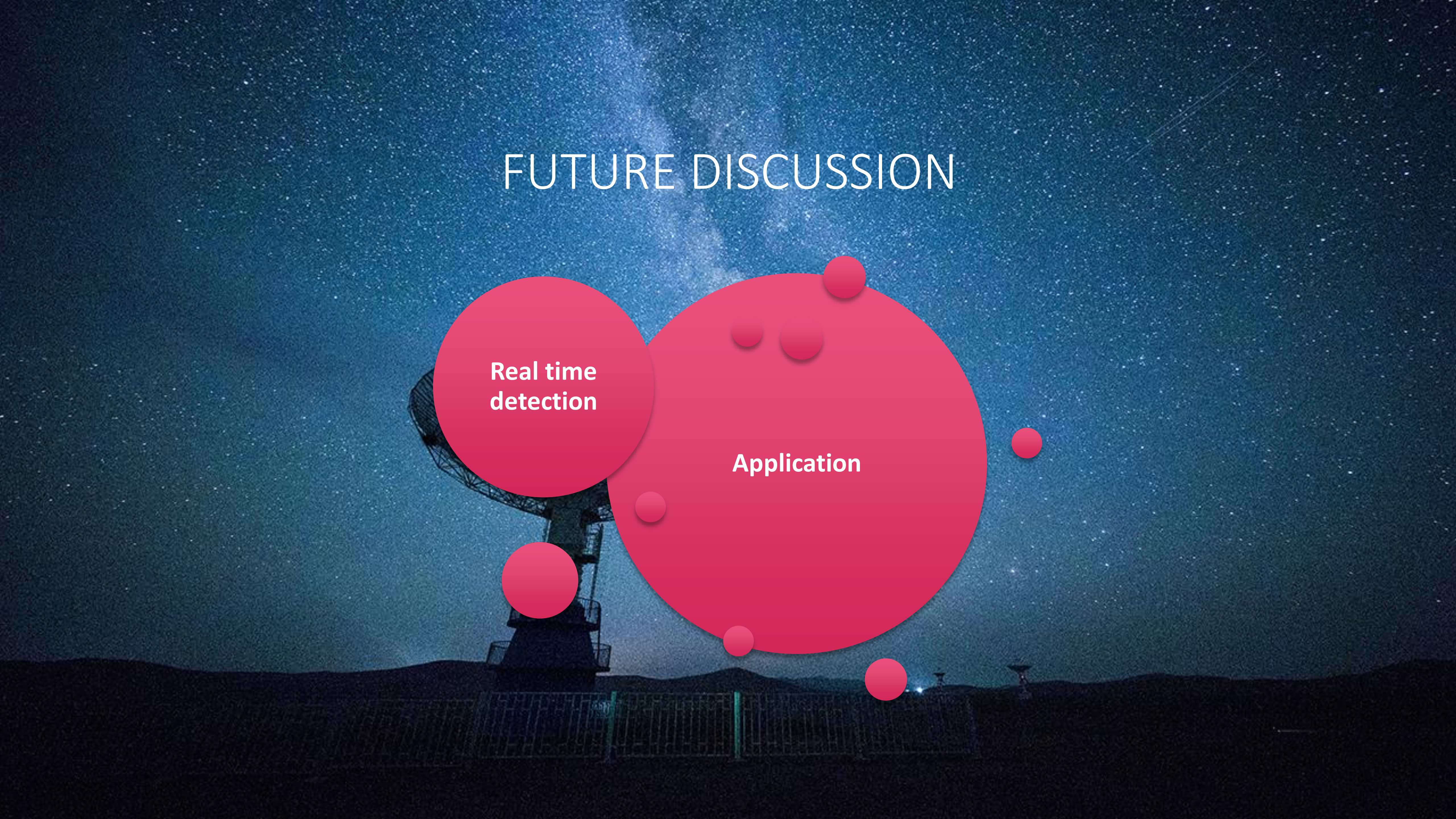
SUMMARY

- On small dataset and domin-specific tasks, pretrained models may perform worse then custom built model
- Dropout and batchnormalization can help adjust model overfitting or underfitting
- Increasing epochs in custom model can improve accuracy
- Training with class weights helps to classify specific classes

PROPOSED SOLUTION

- Apply data cleaning
- Increase dataset
- Ensemble learning

FUTURE DISCUSSION



Real time detection

Application

THANK YOU!

REFERENCE

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[2] https://www.kaspersky.com/resource-center/definitions/biometrics

[3] https://www.thalesgroup.com/en/markets/digital-identity-and-security/government/biometrics/facial-recognition

[4] John Chris T. Kwong, Felan Carlo C. Garcia, P. Abu, R. Reyes

Emotion Recognition via Facial Expression: Utilization of Numerous Feature Descriptors in Different Machine Learning Algorithms, 2018