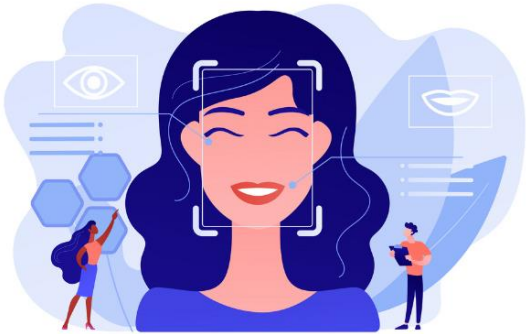
MEDICAL ALERT SYSTEM USING EMOTION DETECTION

GROUP - 8



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We the Team!

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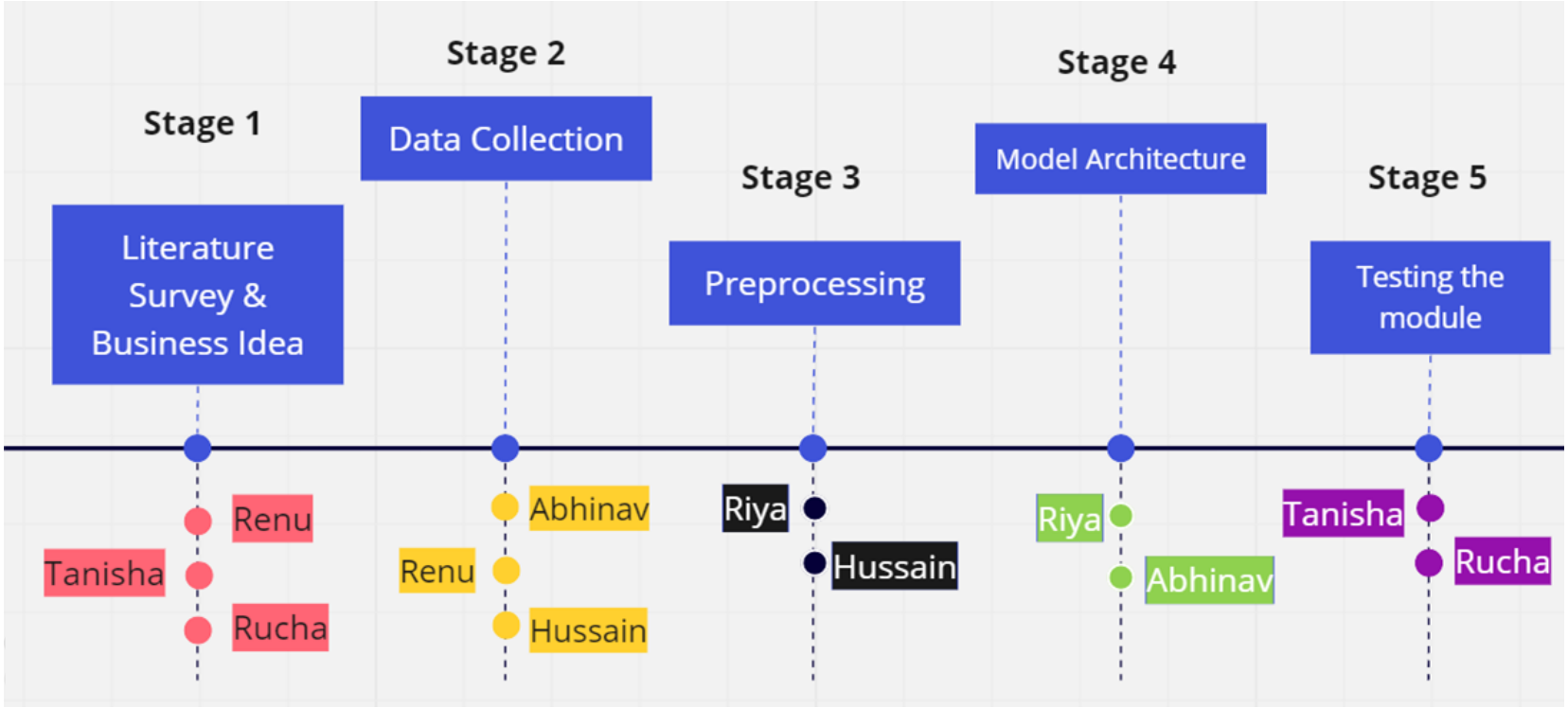
Project Outline



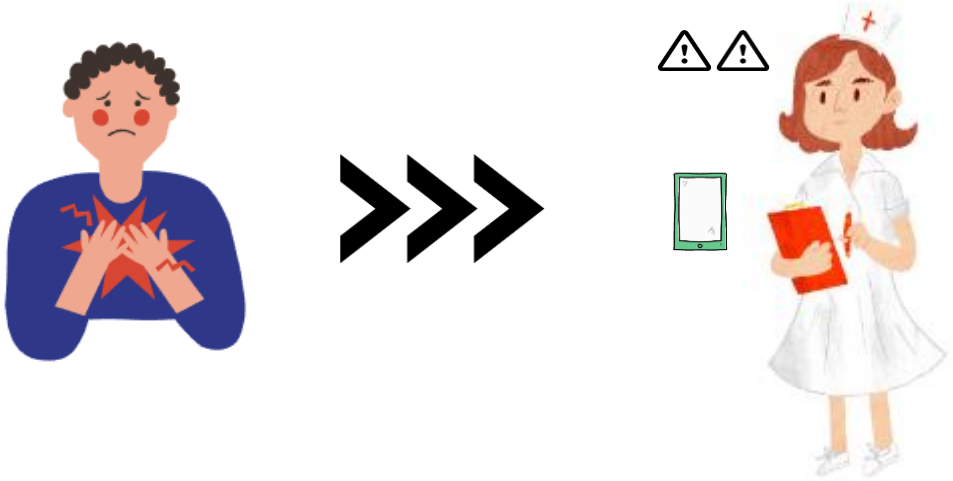
Literature Survey

- ***Dataset*** - FER2013, Custom dataset from medical centers, CMU-MOSI and CMU-MOSEI
- ***Preprocessing*** - Resizing the image, Converting to grayscale
- ***Architecture*** - CNN, CNN+LSTM, Neuro Fuzzy logic, Optimization algorithms
- ***Metrics*** - Precision, F1 Score, Recall
- ***Accuracy*** - Precision: 77.8 to 99.5 by using a DFFN model
- ***Application*** - Face recognition, security for data collected, lie detection, use cases in various scenarios.

Link : Literature Survey

Holistic Objectives

- ❑ Emotion Recognition in Healthcare
- ❑ Medical Alert System
- ❑ Real-time Detection
- ❑ Improved assistance



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Abstract

WHO notes that, with 1.7 nurses per 1,000 people, India falls short of their recommended rate of 3 nurses per 1,000 people and that, in order to comply with WHO standards by 2024, the nation will require 4.3 million more nurses. To tackle this, we suggest a novel system; being an AI-based emergency monitoring system that would enable real-time surveillance and instantly detect changes in comfort by detecting real-time facial expressions, to warn medical personnel and emergency contacts. This would optimize the problem of rigorous training of nurses and aid them to give adequate attention to patients.

As a result, our system will accurately identify faces, evaluate sentiment, and alert the healthcare division to view the patient's situation.

Business Use Case

- An addition to basic amenities.
- Automating 24-hour monitoring service.
- Software capable of detecting distressing emotions.
- Commercially viable
- An aid rather than a replacement.

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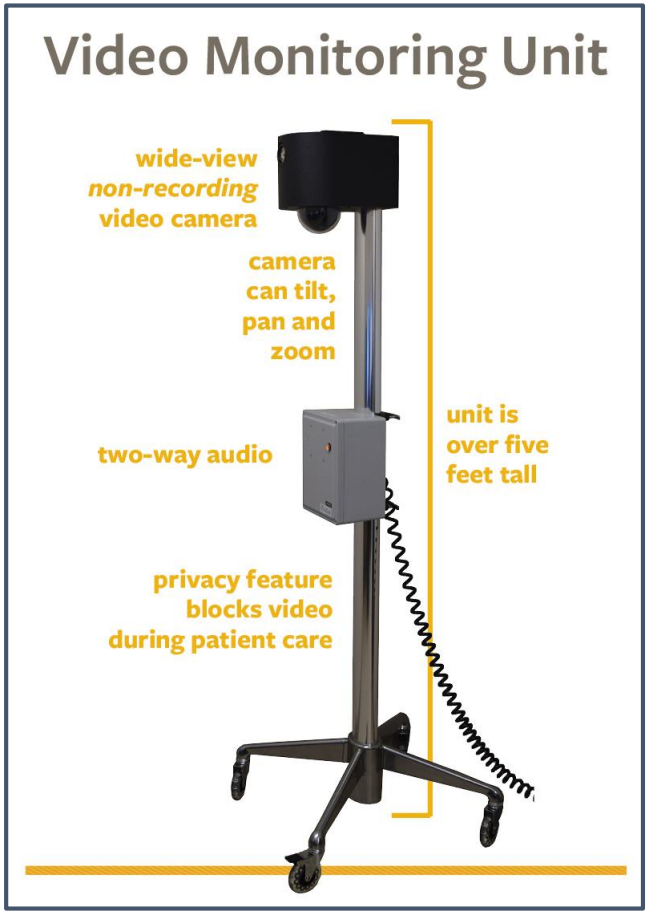
Business Use Case



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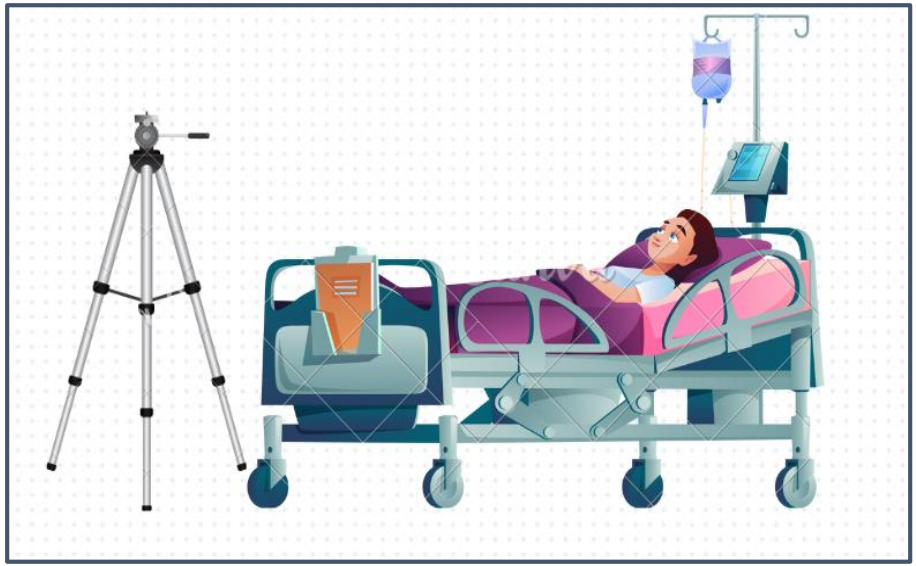
Business Use Case



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Business Use Case

- **Subscription Service** : AI-monitored care could act like a service that patients can choose to avail. It will act as an ‘extra eye’ to keep the patient in check.
- **Psychiatric Patient treatment:** Can be used as a monitoring system especially for mentally-ill patients in rehab centres.
- **Pandemic** : At a time when medical professionals were overwhelmed, our model could have reduced the reaction time of nurses, while avoiding human contact.

Concepts used

Positive Label: Happy

Negative Label: Not Happy

False Positives

Predicted State

Actual State

	Happy	**Not Happy**
Happy	True Positives	False Positive
Not Happy	False Negative	True Negatives

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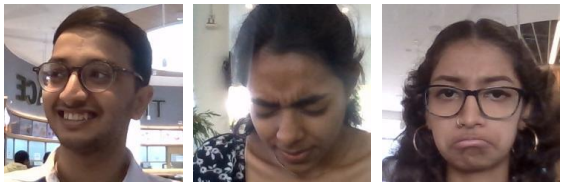
Our Data

➔ 240 x 240, 28k jpg images

- **Custom data** - Pygame



➔ 48 x 48, 36k jpg images, **FER2013**

➔ 240 x 240, 750 png images, **CK+**

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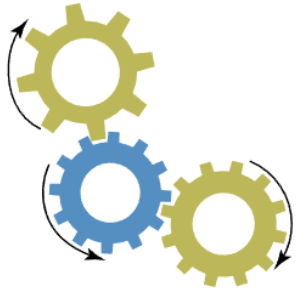
Pre-processing



Data collection and processing were done as follows:

1. The data was self collected using the PyGame library and by slicing live-feed from a local desktop camera.
2. Frames were collected as images according to the set limit.
3. By keystrokes, the data collector and subject were able to navigate through pygame.camera() module and capture required data.
4. The subject was asked to mimic the required emotion and these emotions were recorded and saved to the local drive in realtime.
5. Approximately 50,000 images were collected, which, after cleaning, have resulted in ~28,000 images.

Algorithm Used

For this project we used the following models:

1. Transfer learning using MobileNet
2. CNN
3. Convolutional bidirectional LSTM

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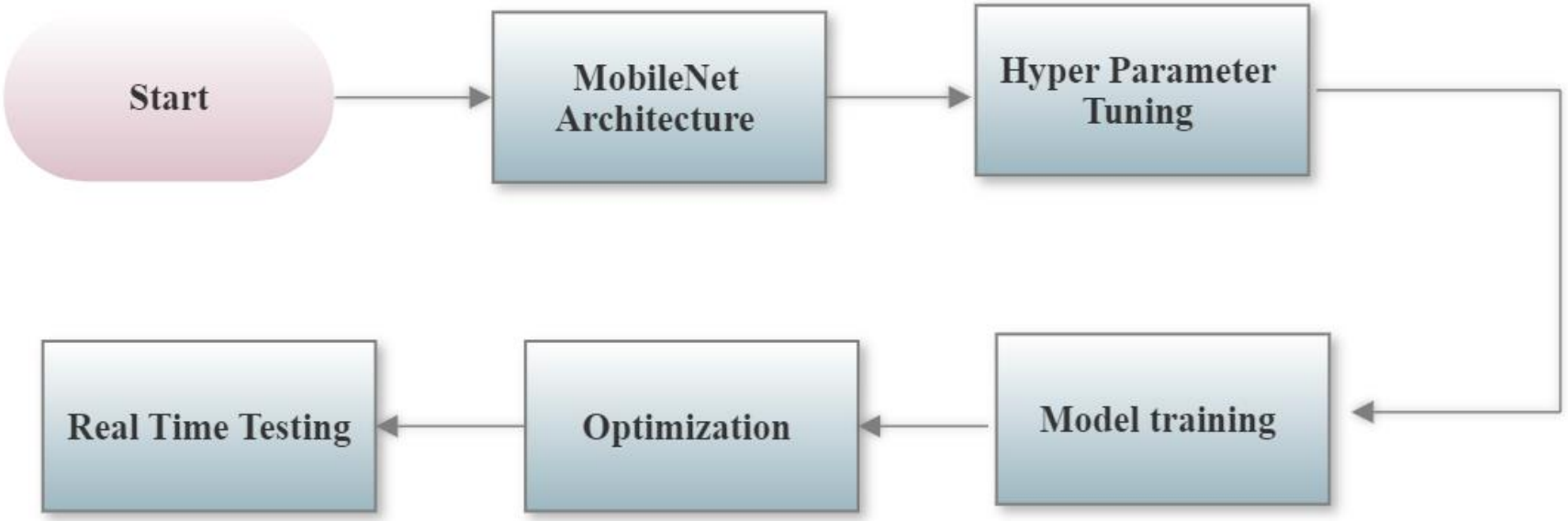
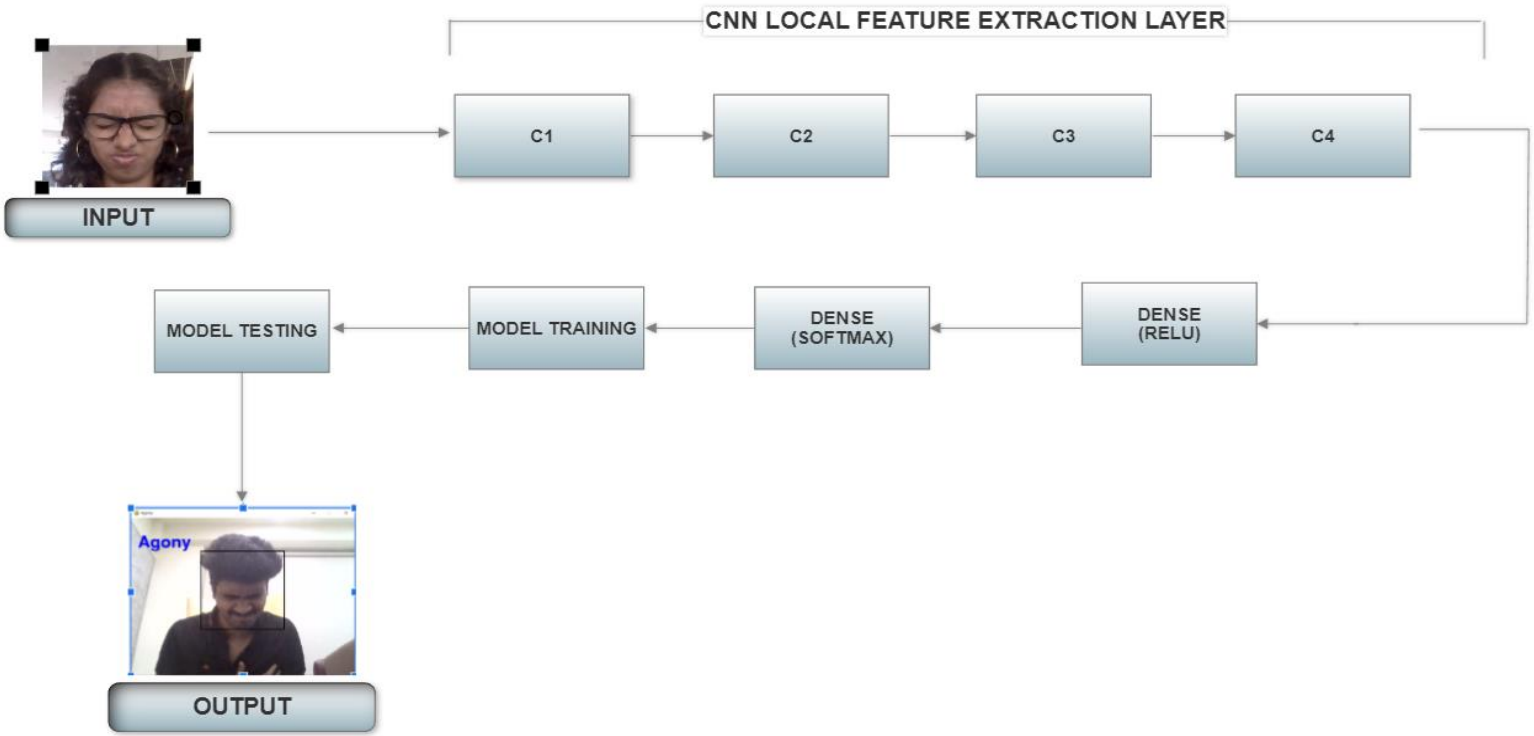
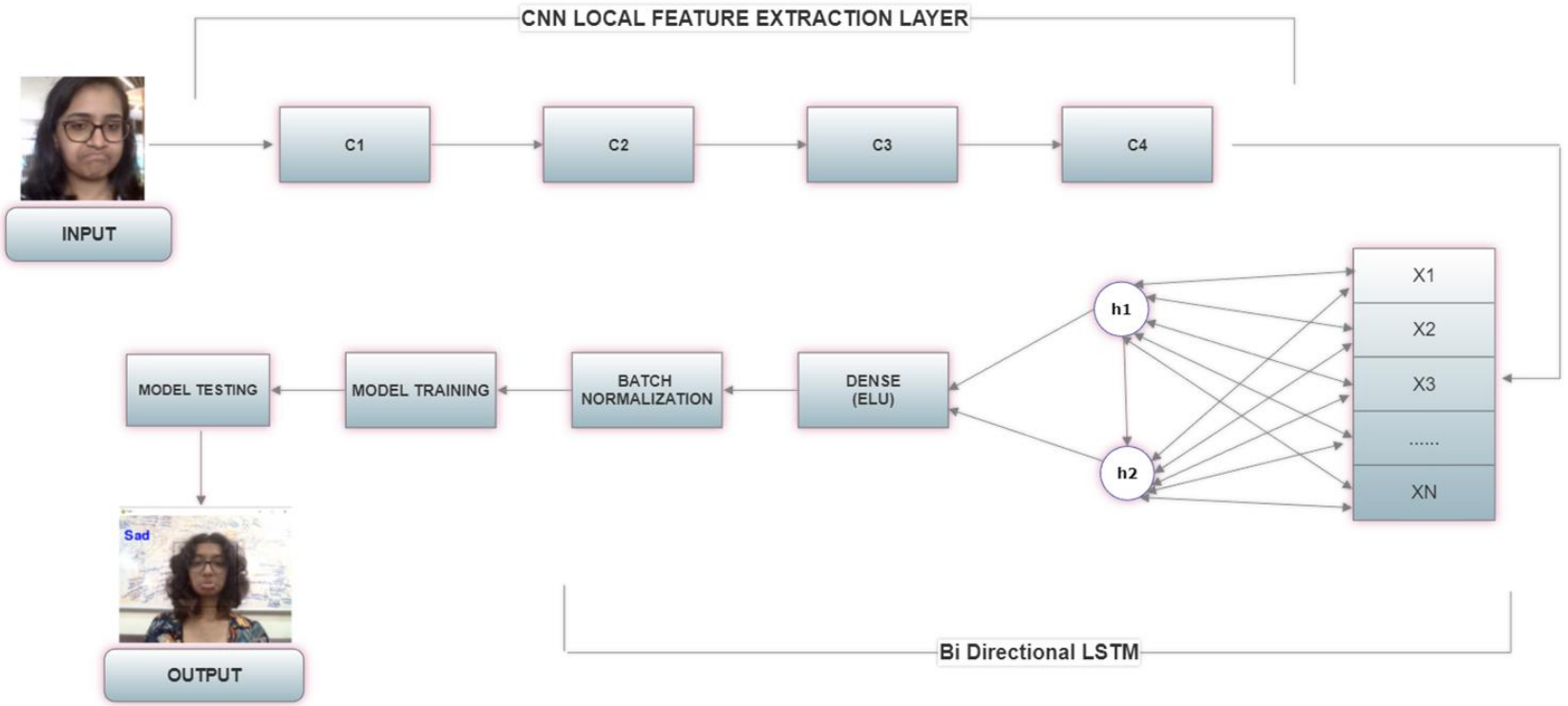
Transfer Learning



CNN


CNN LOCAL FEATURE EXTRACTION LAYER
C1
C2
C3
C4
INPUT
DENSE (RELU)
DENSE (SOFTMAX)
MODEL TRAINING
MODEL TESTING
Agony
OUTPUT

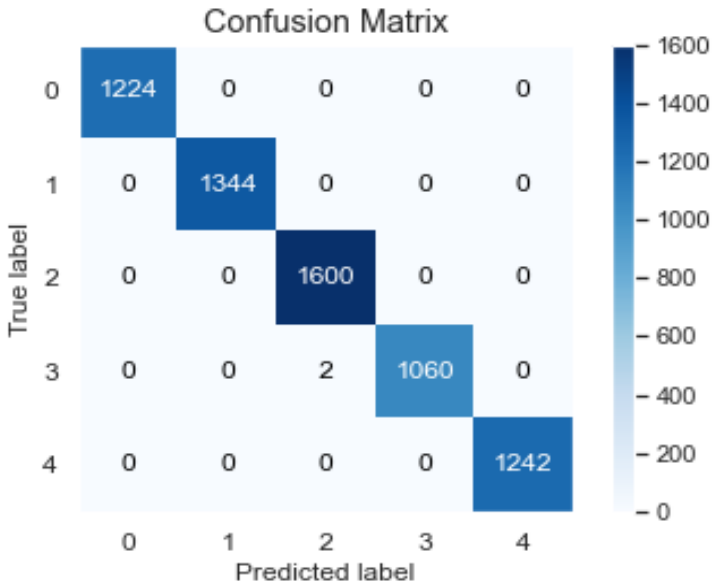
CNN + BIDIRECTIONAL LSTM



Comparison of Models

Model	Layers	Accuracy
CNN	6	92.22
CNN+Bi-directional LSTM	6	81.56
MobileNet	18	99.94

Confusion matrix



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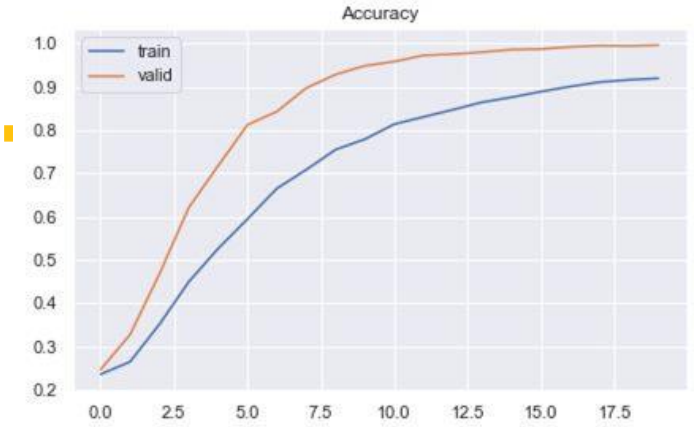
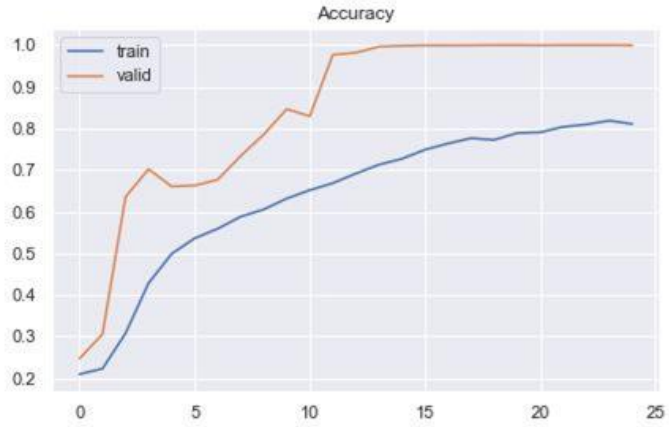
CNN

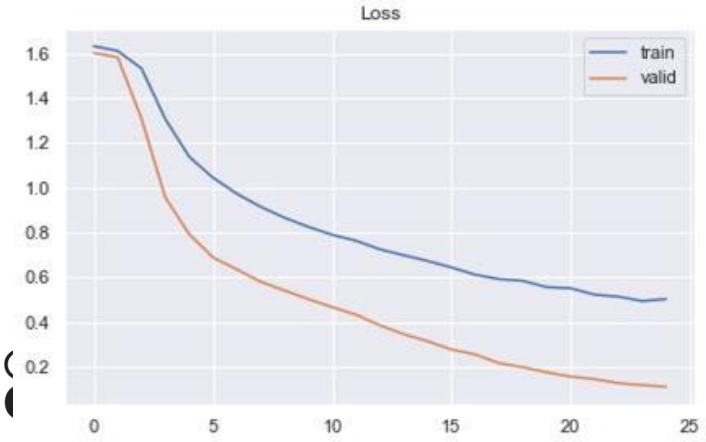
CNN+Bi- Directional LSTM

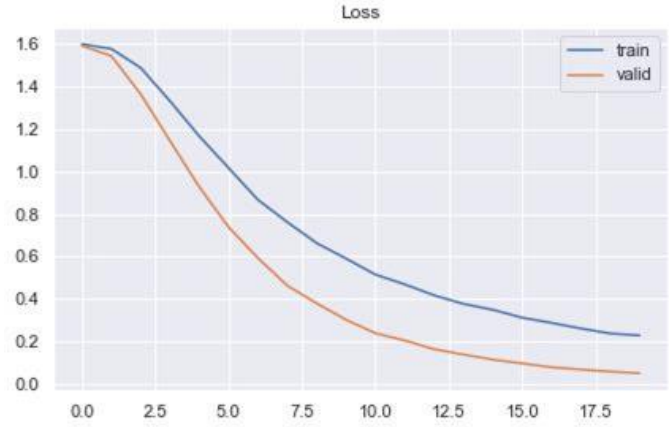
Accuracy Function



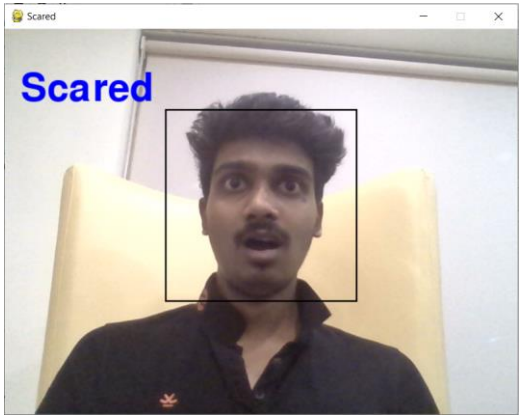


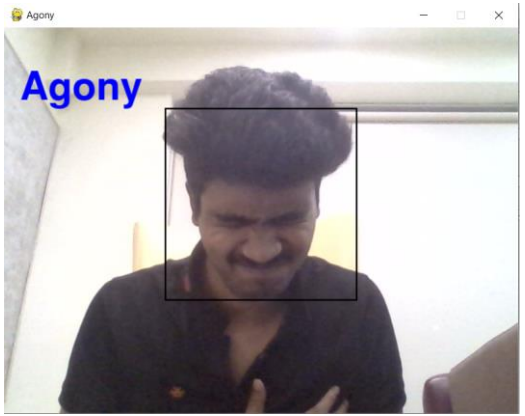
Loss Function

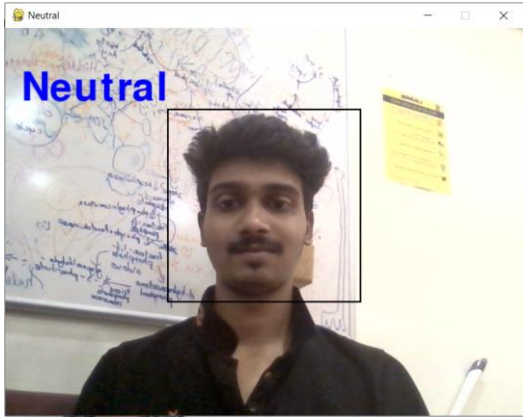




Visualization







Optimal Case

The optimal case in our scenario would be if the patient is facing the camera and there is an appreciable amount of light around the patient. We also wish to implement an alert system so ideally we wish to reduce the number of false positives and spam alerts.

Additionally our model should be as light as possible without compromising the accuracy.

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Final Recommendation

Emotion detection is a problem that is largely dependent on the dataset. Since we work with a big set of images, we need to find the optimal trade-off between complexity and error rate. Based on the data we gathered by experimenting with various architectures (CNNs, Bi-Directional LSTMs, Mobilenet), we have found Mobilenet architecture to be an appreciable estimation of our final goal.

With a little more data, little more time and effort, it is possible to create a emotion detection system that can uphold the industry standards required in a healthcare facility.

Challenges Faced

- Overfitting
- An Alternative to OpenCV
- Trial and Error of Testing and Training different Models
- Diverse Educational Backgrounds

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Our Learning

- Technical
  - Equivalent functions
  - Data collection automation
- Personal
  - Volunteering
  - Accepting responsibility
- Research
  - Medical negligence
  - Unexplored applications
- Business
  - Identifying a gap in the market
  - Identifying the product/service that best fills this gap
  - Analyzing cost-cutting mechanisms
- Social
  - Combining diverse skill sets
  - Teamwork, Leadership, Communication

Future Enhancements

- Data diversity - Race & Age
- Model accuracy of patients with wearables (masks, spectacles)
- Multiple Face Emotion Recognition
- Night Vision
- Face Detection before Face recognition

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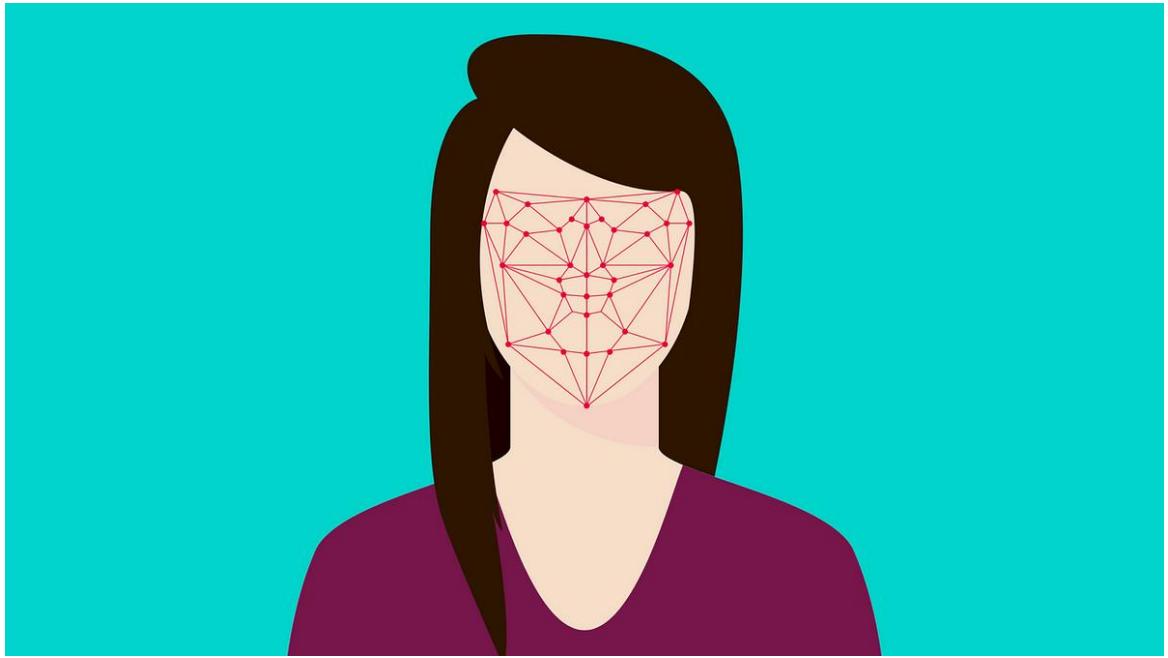
Demo

Live feed demo



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Thank You