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MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY
WEST BENGAL

Image Processing & Online Recommendation of Products Using Artificial Intelligence Techniques

Under the guidance of: **Mrs. Soma Bandyopadhyay**

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Presentation Planning

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Introduction

- Customer’s may not be influenced and controlled by the brand and firm, while placing an order or a request.
- They are influenced by interactions with search engines, recommendations, online reviews and other information while navigating around the digital environment.
- Facial expression and emotion analysis can help online product and service based companies in capturing their customer's expressions and hence emotions which may aid in their choose the right target consumers.
- Facial muscle generates monetary adaptation in facial appearance which can be recapitulated by incorporating action units.

Dependencies

- KERAS
- PANDAS
- NUMPY
- TENSORFLOW
- KERAS CONV2D
- GOOGLE COLAB
- CV2
- MATPLOTLIB
- SKLEARN

Dataset Description

- The data consists of 48x48 pixel grayscale images of faces.
- The total data used for Training and Testing are 20962 and 6043 respectively.
- The facial emotions that we have worked with are:

Emotion	Angry	Happy	Sad	Surprise	Neutral
Tag	0	3	4	5	6

Dataset Representation

- Sample of Kaggle's tagged dataset

- Representation of dataframes in Pandas

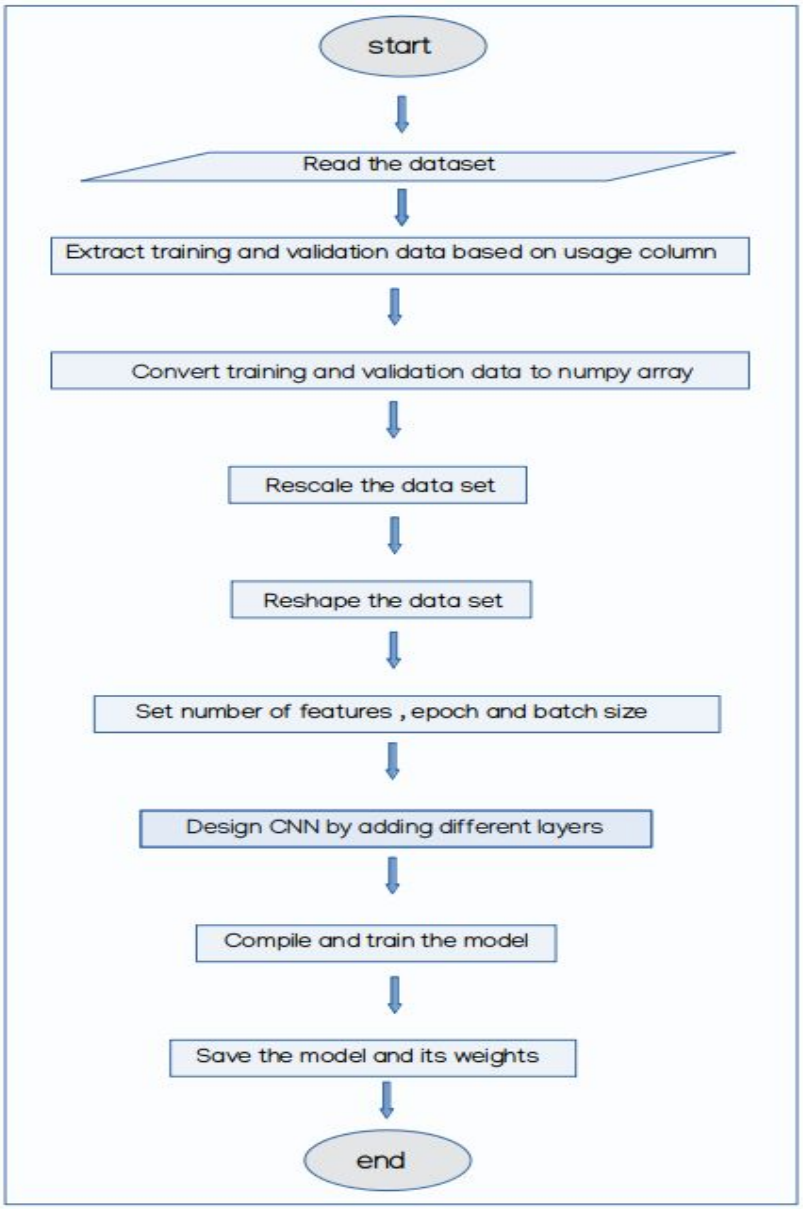
	emotion	pixels	Usage
0	0	70 80 82 72 58 58 60 63 54 58 60 48 89 115 121...	Training
1	0	151 150 147 155 148 133 111 140 170 174 182 15...	Training
2	2	231 212 156 164 174 138 161 173 182 200 106 38...	Training
3	4	24 32 36 30 32 23 19 20 30 41 21 22 32 34 21 1...	Training
4	6	4 0 0 0 0 0 0 0 0 0 0 0 3 15 23 28 48 50 58 84...	Training

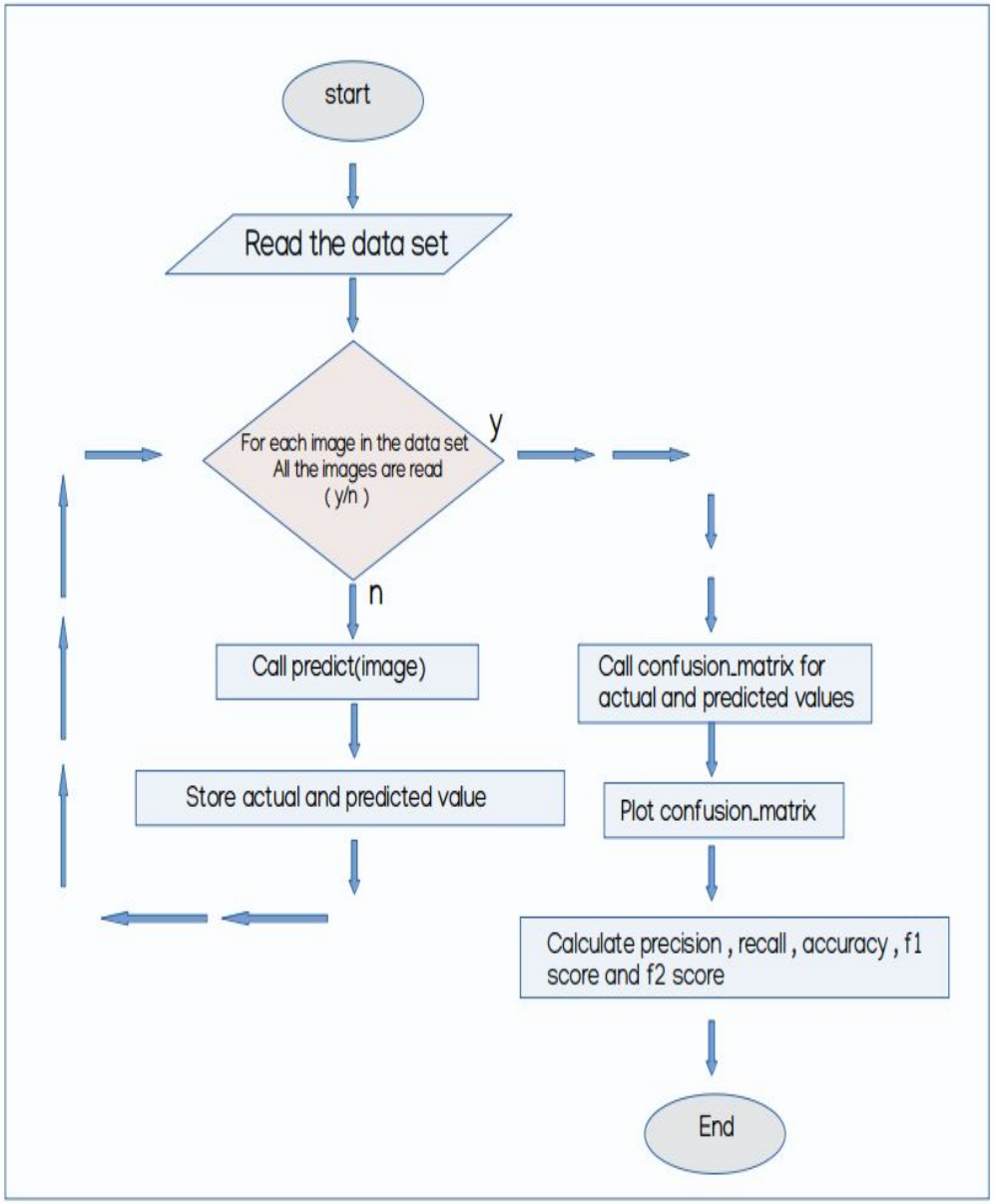
Data Sanitization and Cleaning

- The dataset was already clean that we have used from Kaggle,so no preprocessing was required
- Reduced the count of training data for the tag of Happy to around 4000.
- Finally the training and validation data counts boiled down to:

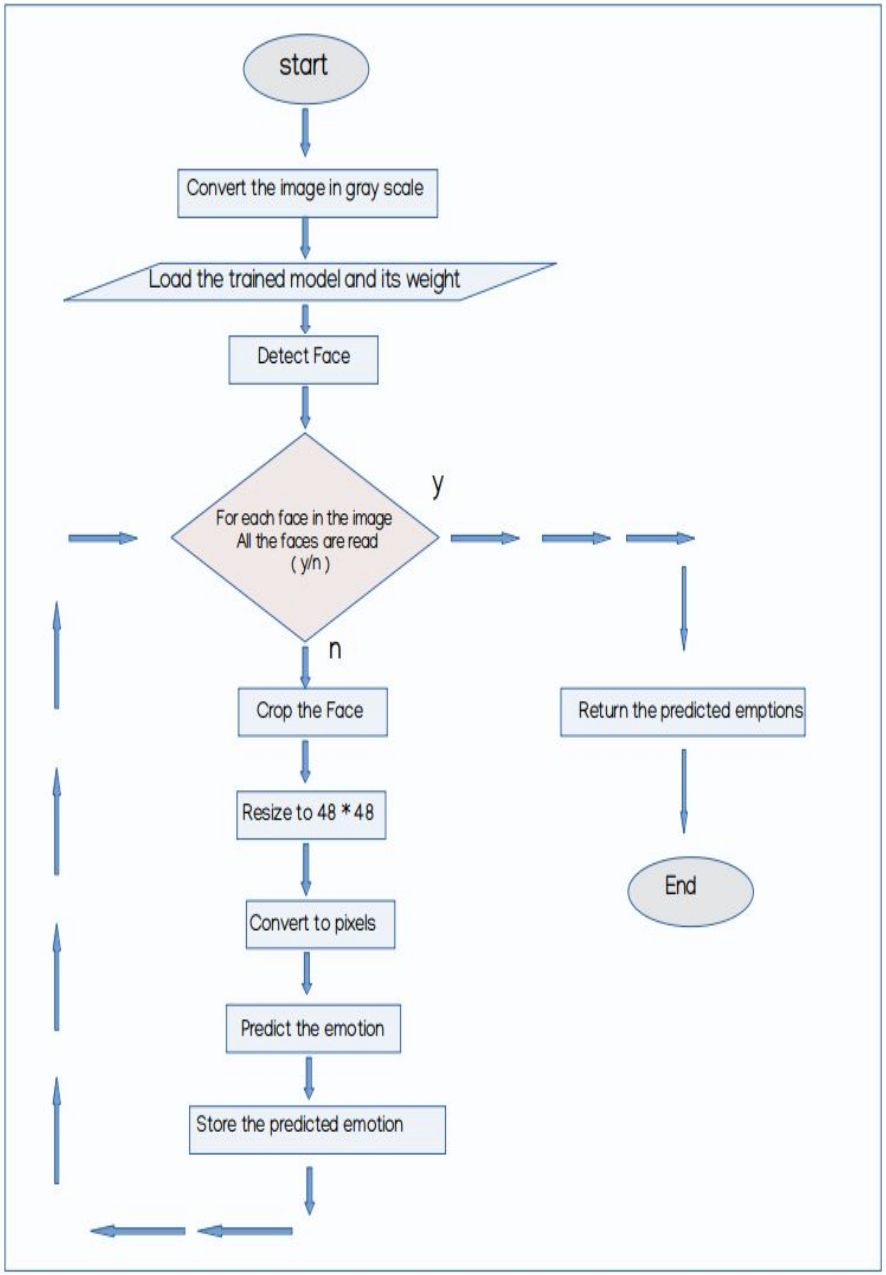
Emotion	Angry	Happy	Sad	Surprise	Neutral
Training Count	3995	4001	4830	3171	4965
Validation Count	958	1774	1247	831	1233

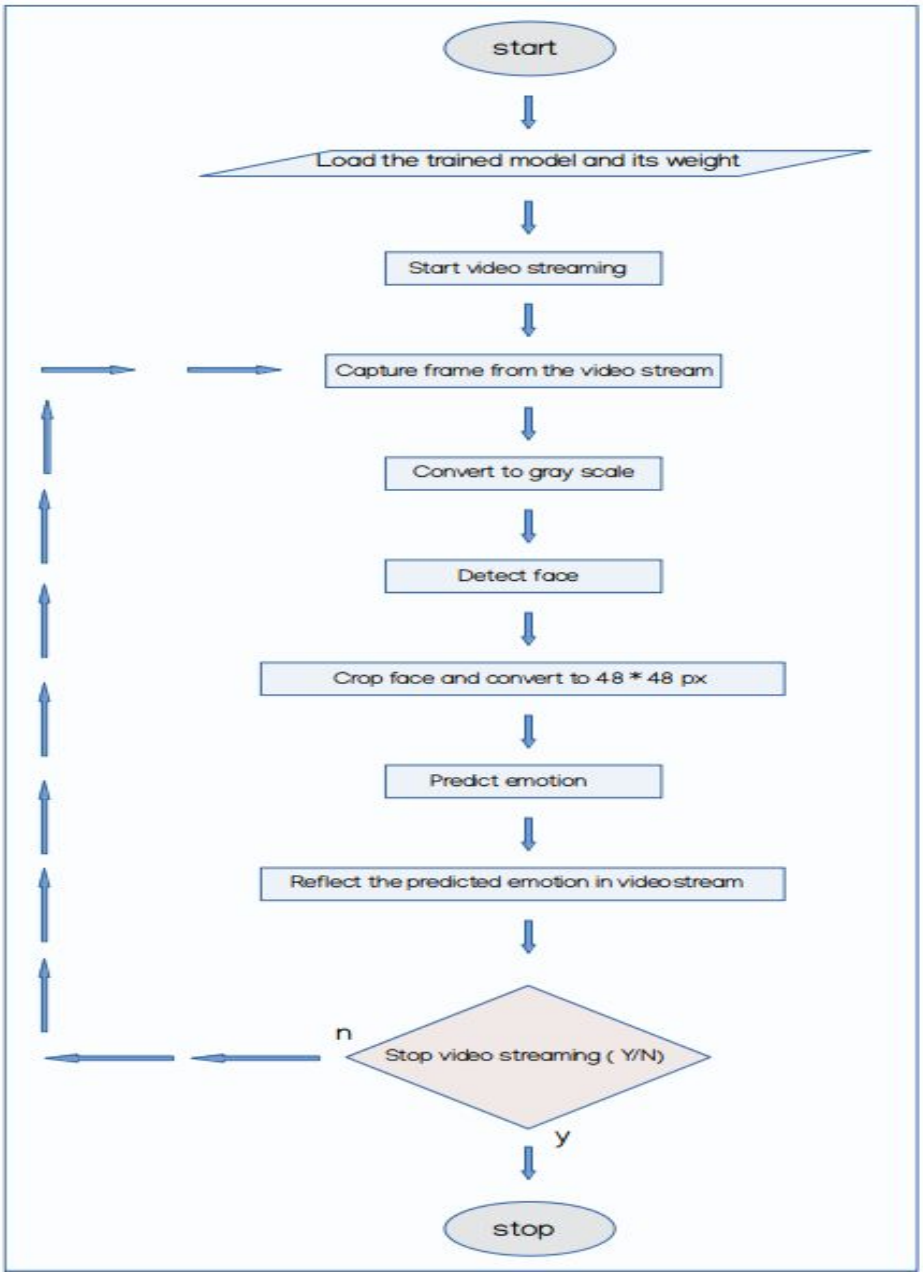
Flow of Control – Training and Performance Analysis



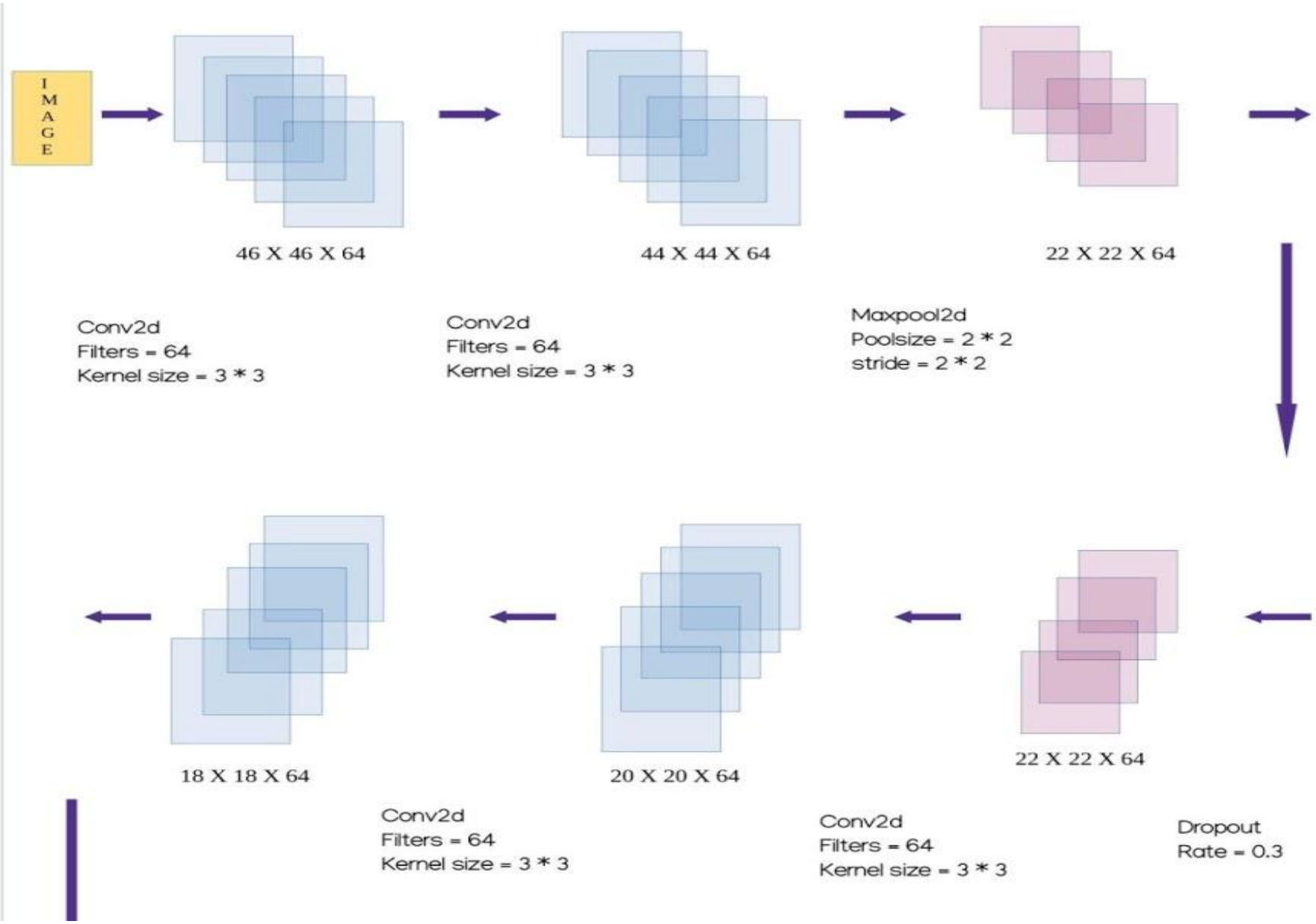


Flow of Control - Prediction on Real Time Data

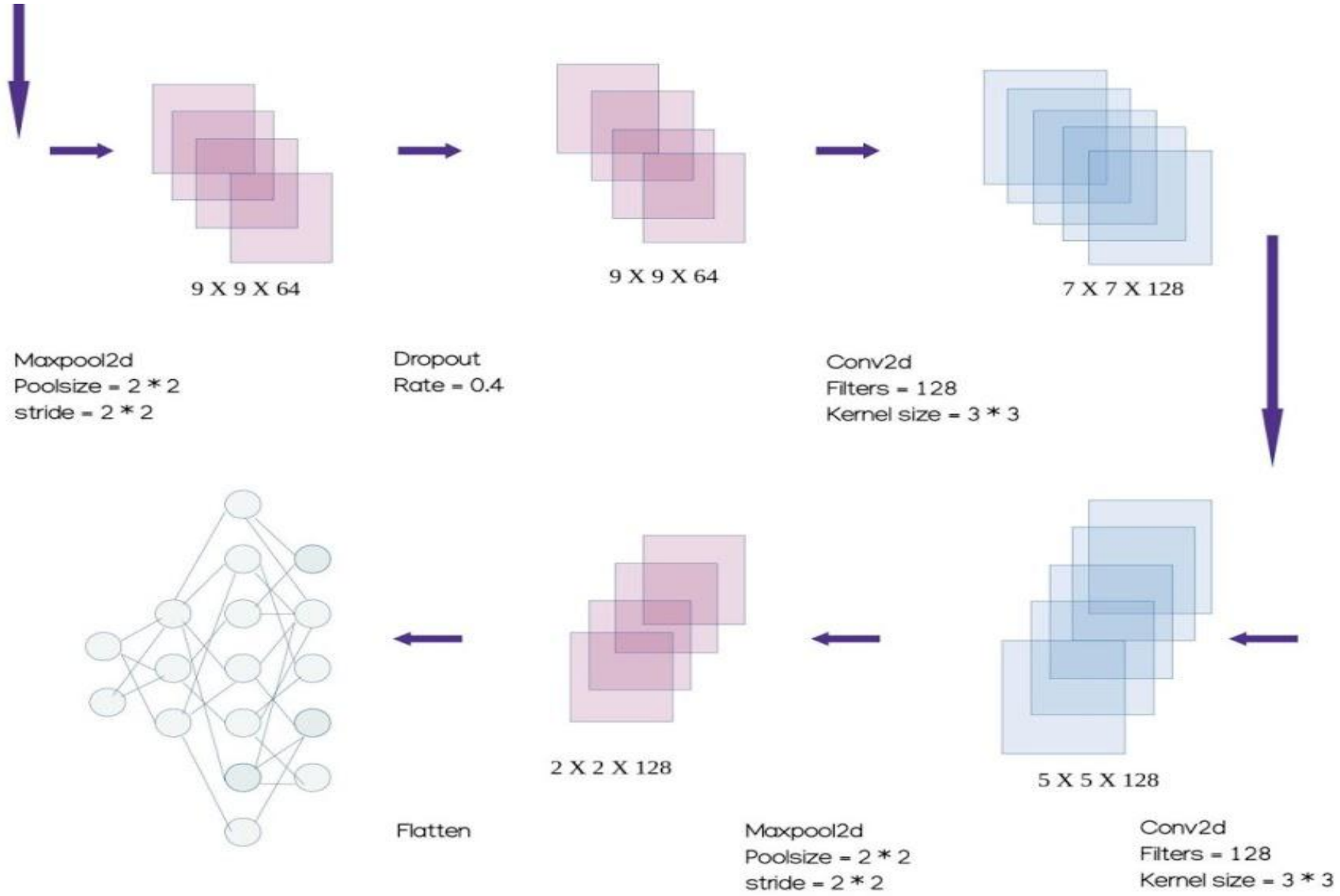




Architecture



Architecture (contd.)



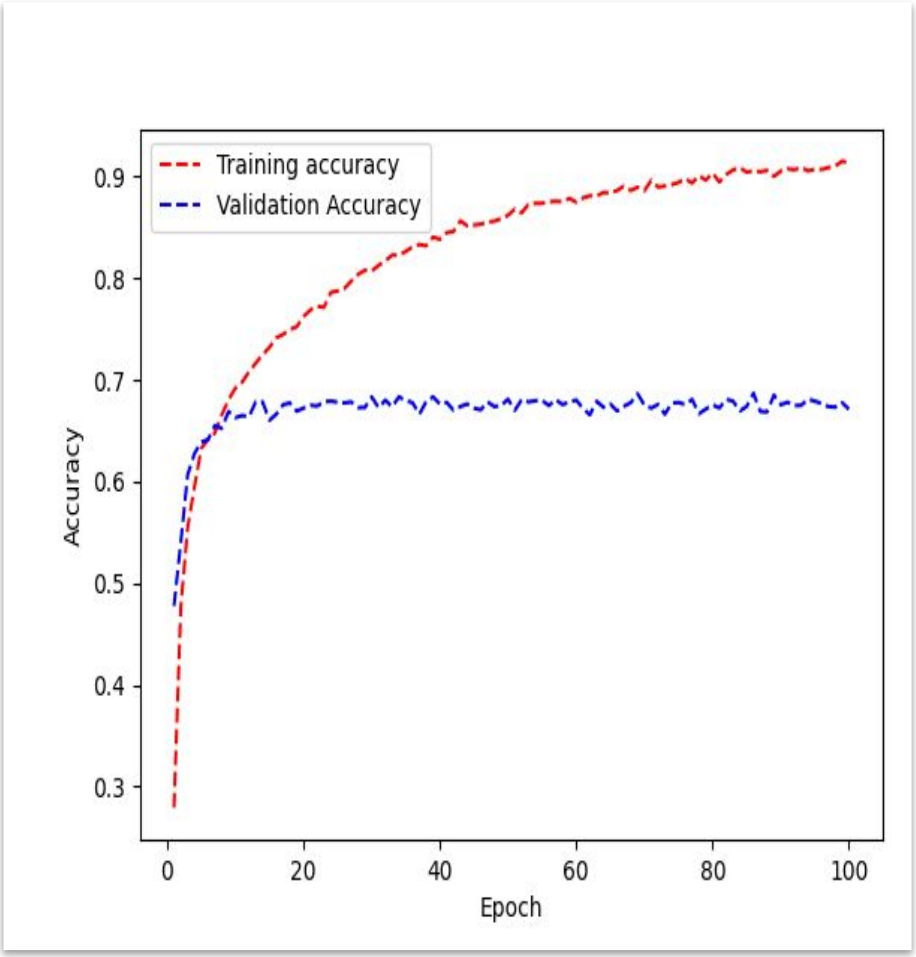
Summary of the Model

Model: "sequential_6"

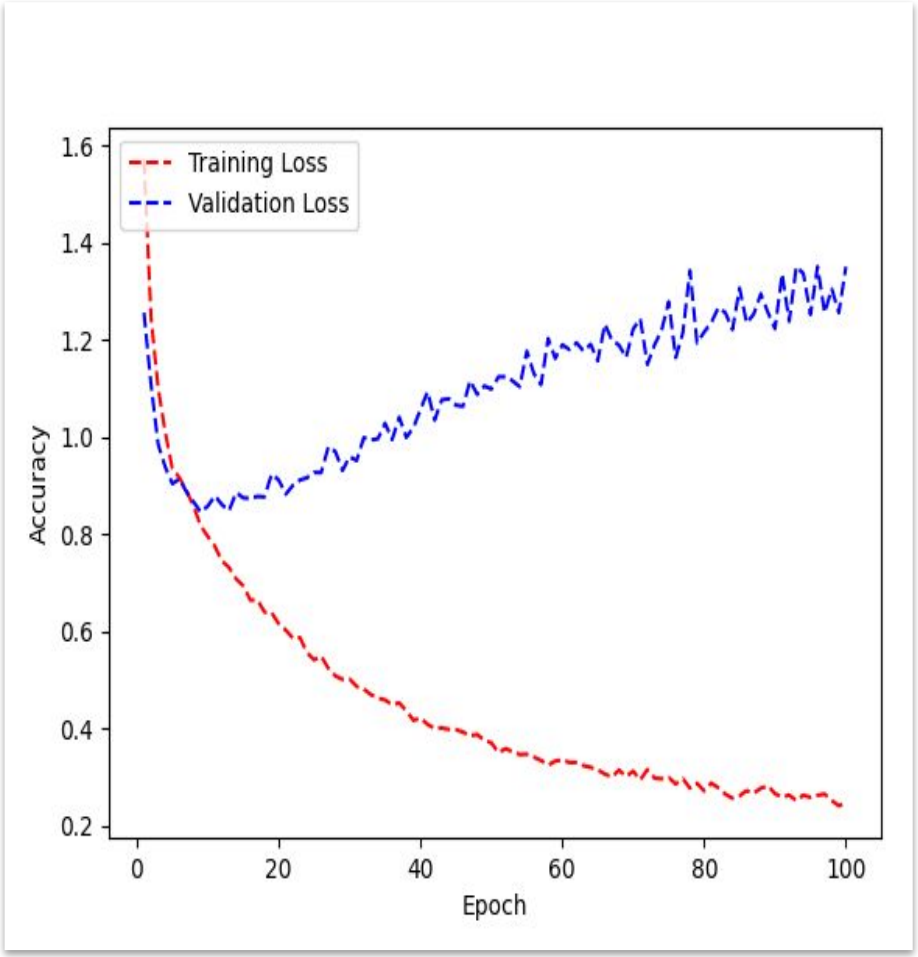
Layer (type)	Output Shape	Param #
conv2d_36 (Conv2D)	(None, 46, 46, 64)	640
conv2d_37 (Conv2D)	(None, 44, 44, 64)	36928
max_pooling2d_18 (MaxPooling	(None, 22, 22, 64)	0
dropout_24 (Dropout)	(None, 22, 22, 64)	0
conv2d_38 (Conv2D)	(None, 20, 20, 64)	36928
conv2d_39 (Conv2D)	(None, 18, 18, 64)	36928
max_pooling2d_19 (MaxPooling	(None, 9, 9, 64)	0
dropout_25 (Dropout)	(None, 9, 9, 64)	0
conv2d_40 (Conv2D)	(None, 7, 7, 128)	73856
conv2d_41 (Conv2D)	(None, 5, 5, 128)	147584
max_pooling2d_20 (MaxPooling	(None, 2, 2, 128)	0
flatten_6 (Flatten)	(None, 512)	0
dense_18 (Dense)	(None, 512)	262656
dropout_26 (Dropout)	(None, 512)	0
dense_19 (Dense)	(None, 512)	262656
dropout_27 (Dropout)	(None, 512)	0
dense_20 (Dense)	(None, 7)	3591

Summary of the architecture

Model Training and Validation

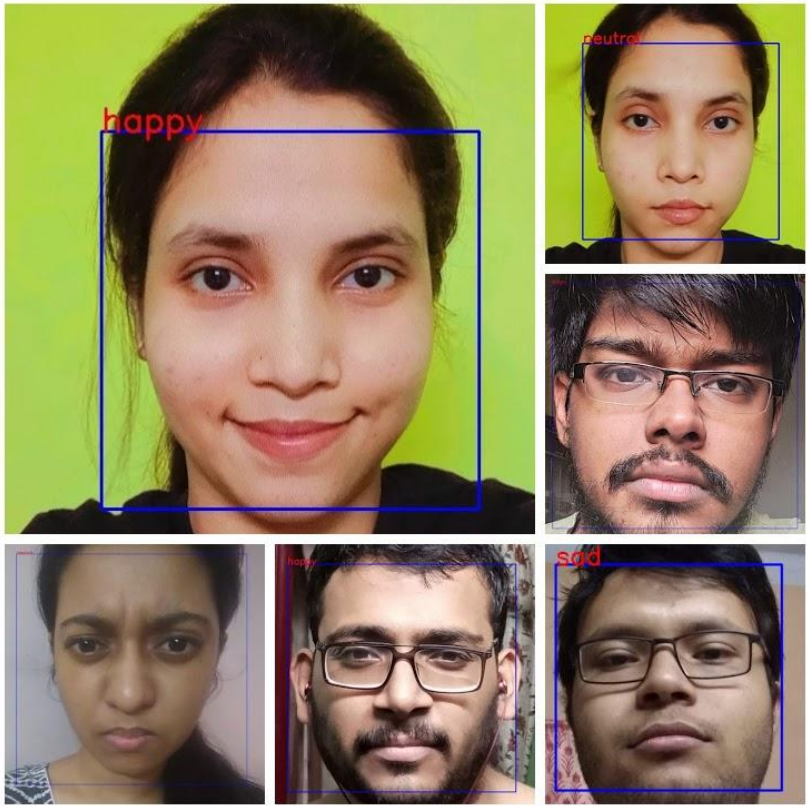


Accuracy plot



Loss plot

Model Testing



Test on Offline Images

Test on Live Video:

Multiple frames are extracted from live video stream and fed to the Model for Predictions

Performance Measurement

		Predicted Class: POSITIVE	Predicted Class: NEGATIVE
Actual Class	POSITIVE	True Positive (TP)	False Negative (FN) Type II Error
	NEGATIVE	False Positive (FP) Type I Error	True Negative (TN)

- General Binary Classification

  Predictions:

  - **True Positive (TP)**
  - **True Negative (TN)**
  - **False Positive (FP) – Type 1 error**
  - **False Negative (FN) – Type 2 error**

Accuracy Checkpoints

- Precision

$$\text{Precision} = \frac{\text{TP}}{\text{TP} + \text{FP}}.$$

- Recall

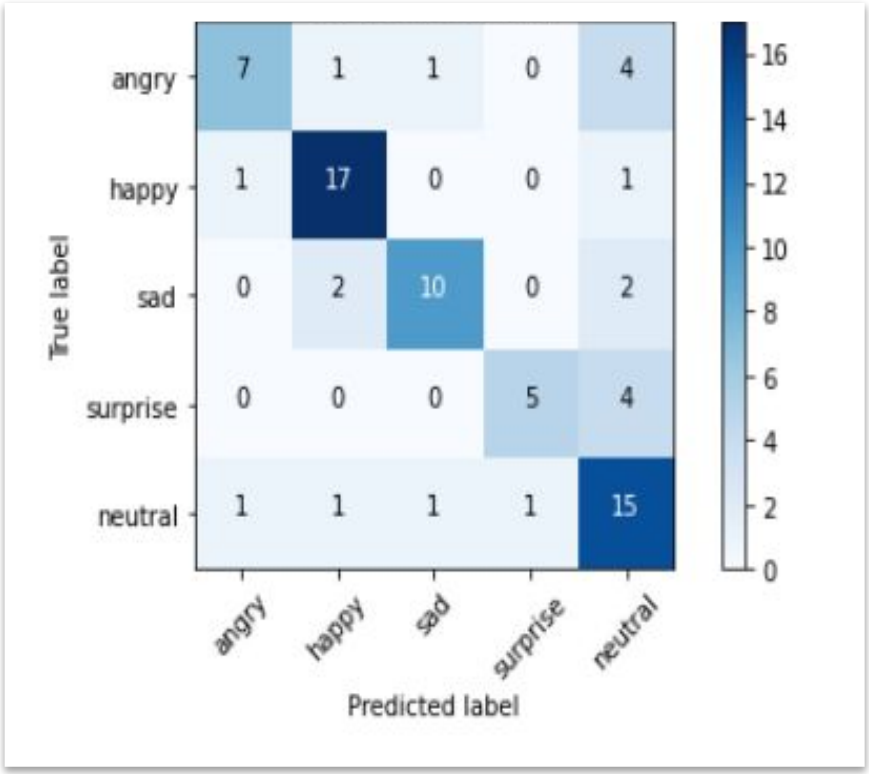
$$\text{Recall} = \frac{\text{TP}}{\text{TP} + \text{FN}}$$

- F1-Measure

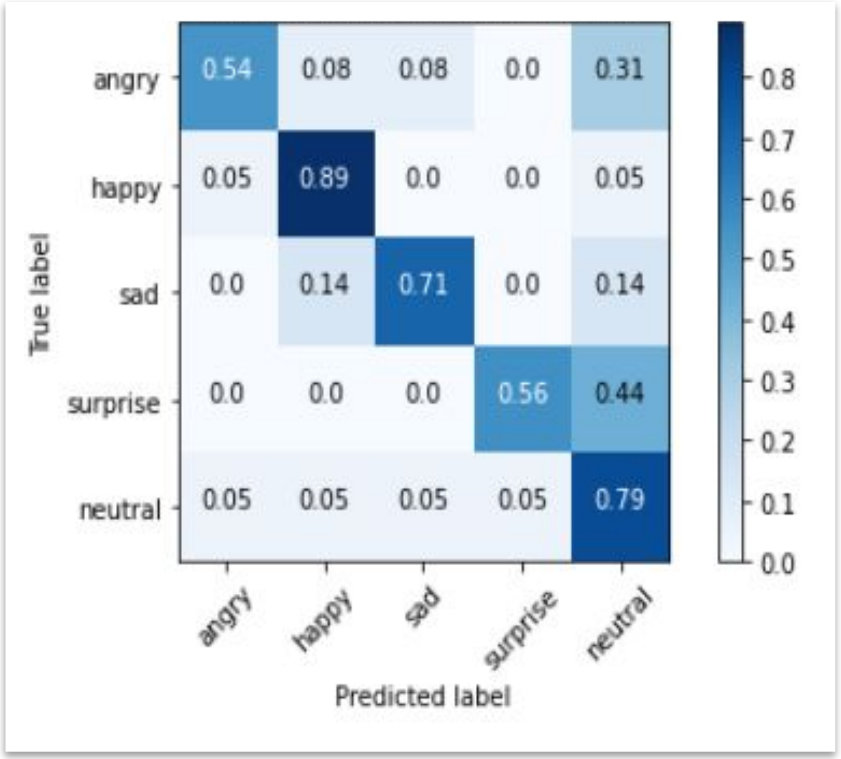
$$\text{F1} - \text{Measure} = \frac{2}{\frac{1}{\text{Recall}} + \frac{1}{Precision}}$$

Observation

Confusion Matrix generated for this Model.



Confusion Matrix



Normalized Confusion Matrix

Result and Discussion

Accuracy : **73%**

	Emotions	Precision	Recall	F1 Score
0	angry	0.78	0.54	0.64
1	happy	0.81	0.89	0.85
2	sad	0.83	0.71	0.77
3	surprise	0.83	0.56	0.67
4	neutral	0.58	0.79	0.67

The correctness of Predictions of each individual emotion is analysed in terms of Precision, Recall and F1-Score.

Future Scope

- Real-Time quality prediction for online shoppers.
- In order to achieve better accuracy, we need to integrate both audio and facial based systems into a single system.
- Unable to show a mixture of two or more basic emotions (like Surprise with Happiness).
- This will push researchers in the future to build larger databases and create powerful deep learning architectures to recognize all basic and secondary emotions.

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Thank You