Mini Project Presentation

Machine Learning In **Face Expression Detection**

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Under the supervision of
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INTRODUCTION

- ➔ Expressions reveal what takes place in the human mind at a time.
- ➔ Using the representational power of Machine Learning and Deep Learning techniques such as Convolutional Neural Networks(CNN), to distinguish between several emotions from pictures of facial expressions.
- ➔ Detecting parts of the face, e.g. the mouth, eyes, eyebrows, nose whereas other parts, such as ears and hair, play little part in the output.
- ➔ Automatic recognition of micro-expressions using machine learning techniques thus promises a more effective result and saves time and resources.

OUR MAIN GOAL

is to develop an automated multi-cultural facial expression classification system that can classify the seven universal expressions namely sadness, happiness, anger, fear, neutral, disgust and surprise.

Our Progress

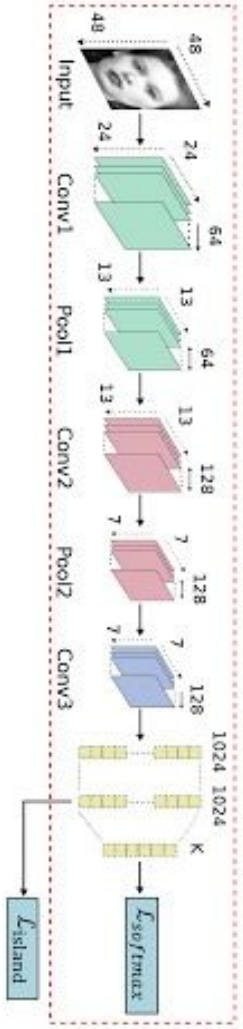
- ➔ Implementation Of a Basic Model(Real-Time)
- ➔ Basic Neural Network Model
- ➔ Collection of 4 Datasets(Comparative Study)
- ➔ Literature Survey
- ➔ Understanding Feature Extraction
- ➔ Future Scope
  (Multicultural Facial Expressions, Microexpressions)
- ➔ Applications

System/Model Architecture

Face detection and crop=> Grayscale conversion=> Image normalization => Image augmentation

Data preprocessing(normalisation)

Data Augmentation



1st Convolution Layer	First Convolution Layer	64 filters of kernel size 3x3, Activation - ReLU, Input size 48x48
	First Max Pooling Layer	Pooling Size 2x2
	Dropout Layer(0.5)	Excludes 50% neurons randomly
2nd Convolution Layer	Second Convolution Layer	64 filters of size 3x3, Activation-ReLU
	Second Max Pooling	Layer Pooling size 2x2
	Dropout Layer(0.5)	Excludes 50% neurons randomly
3rd Convolution Layer	Third Convolution Layer	128 filters of size 3x3, Activation-ReLU
	Third Max Pooling Layer	Pooling size 2x2
Fully Connected Neural Networks	First Fully Connected Layer	Activation: ReLU
	Dropout Layer(0.2)	Excludes 20% neurons randomly
	Second Fully Connected Layer	Activation Function: ReLU
	Dropout Layer (0.2)	Excludes 20% neurons randomly
Output Layer	Output Layer	7 nodes for 7 classes,Activation: SoftMax
	Optimization Function	Adam
	Loss function	Categorical Cross Entropy

Phases of Implementation

PHASES OF IMPLEMENTATION

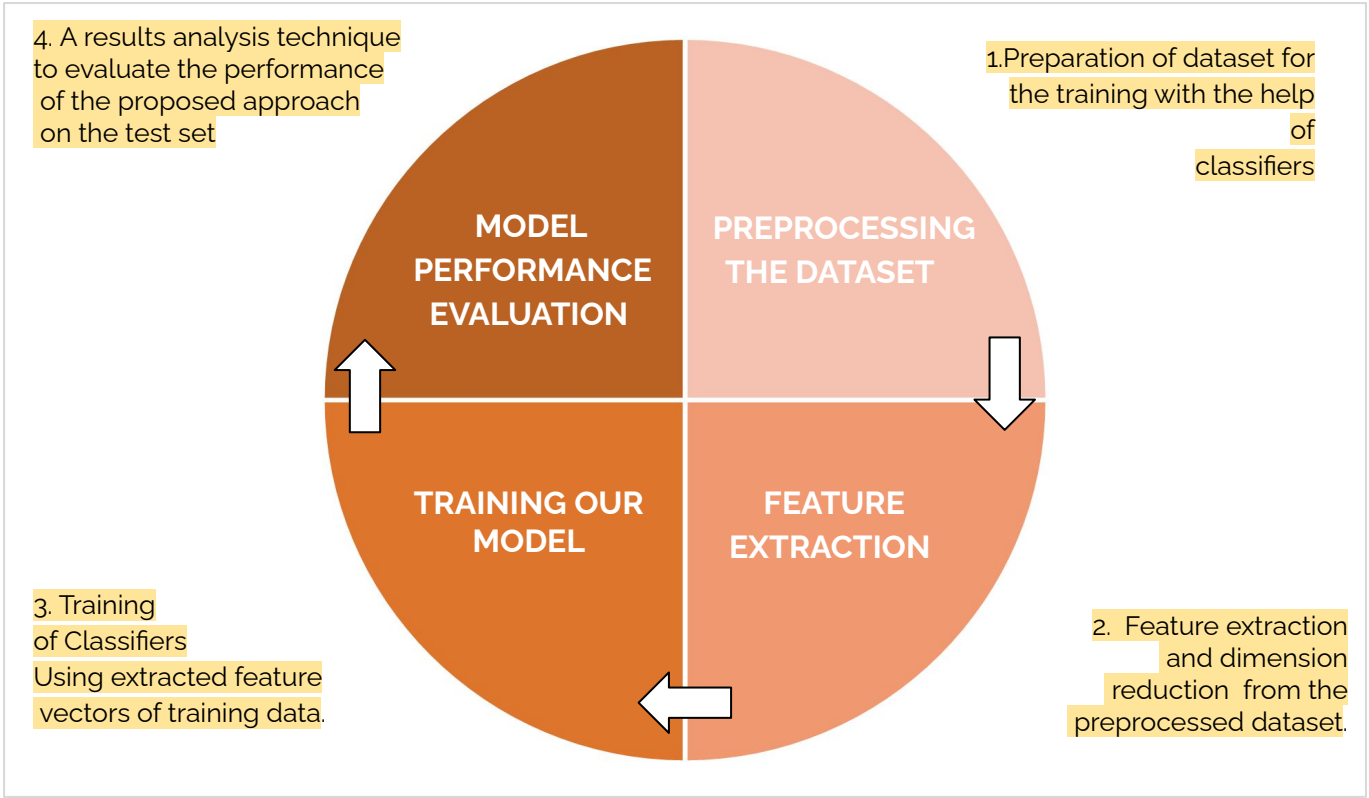
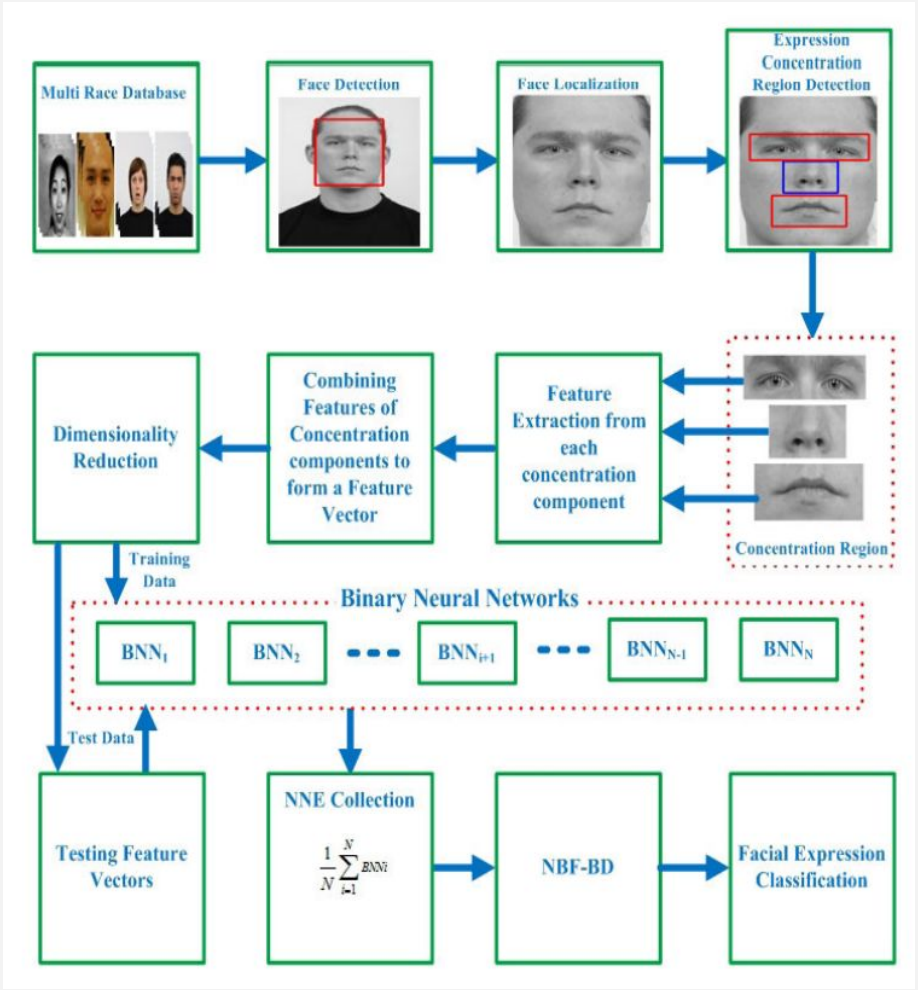


Image Processing

Training Our Model

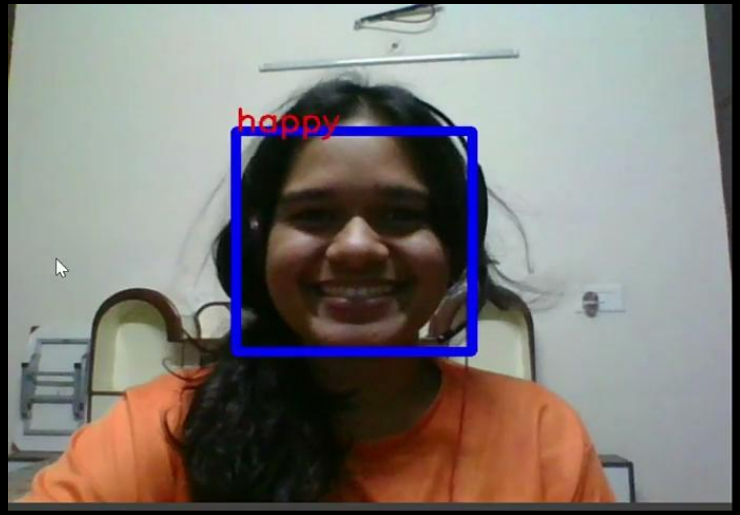


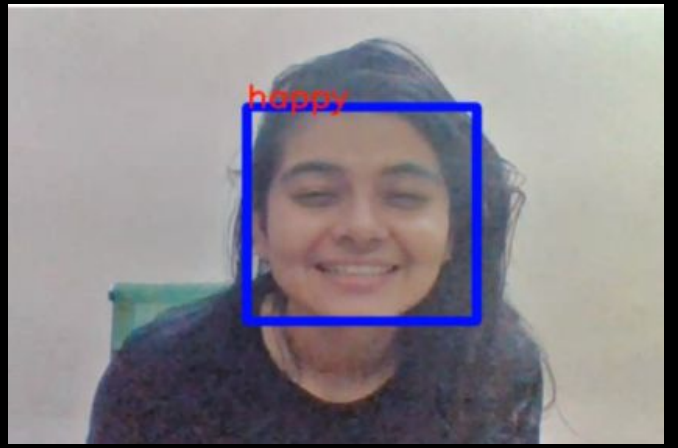
Feature Extraction

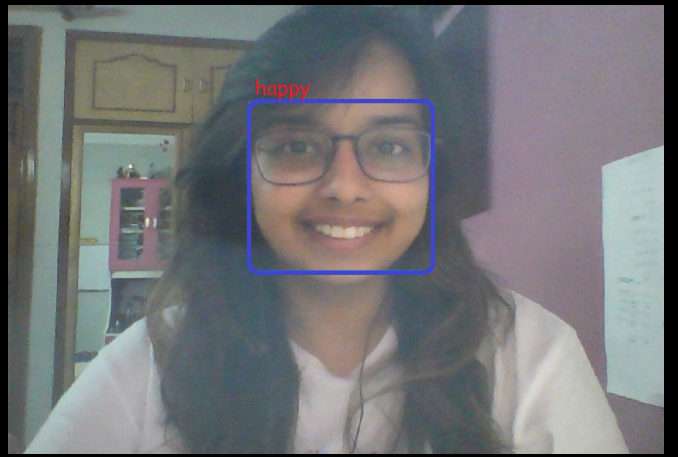
Result Analysis

Our Implementation (Results)

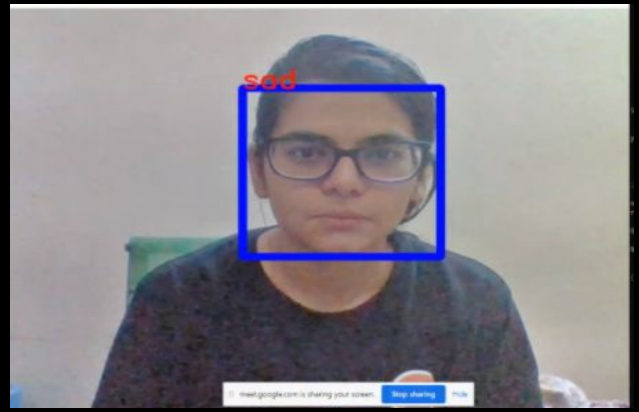
Happy

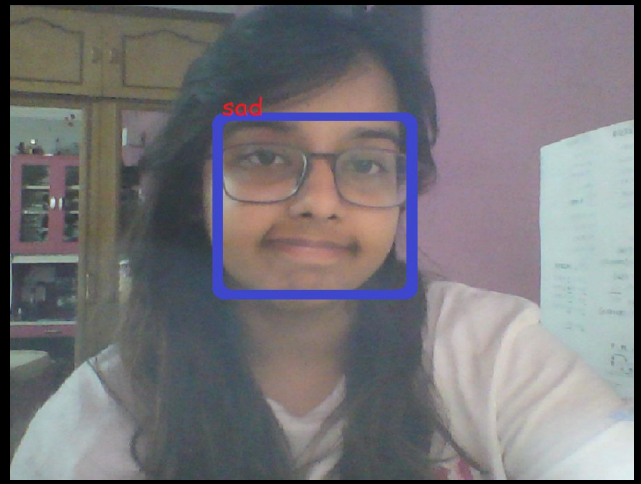




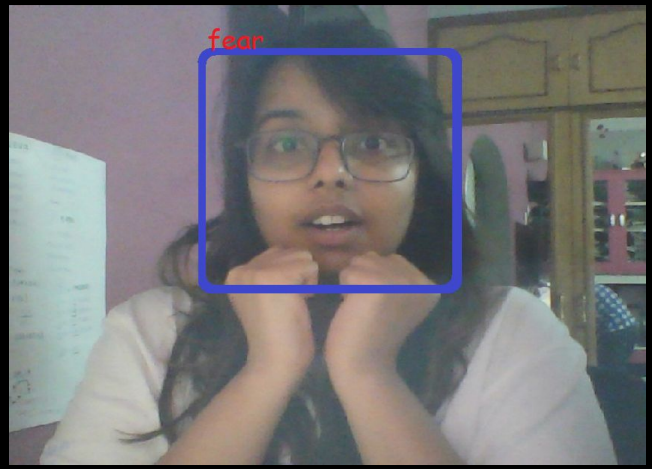


Sad

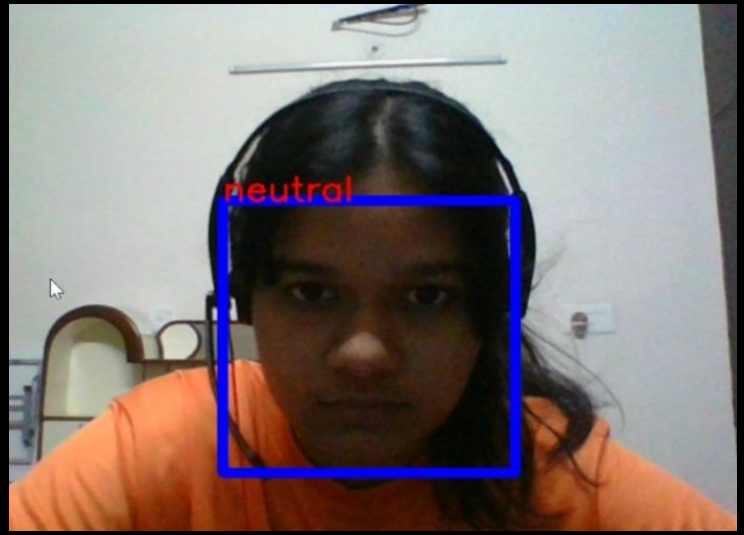


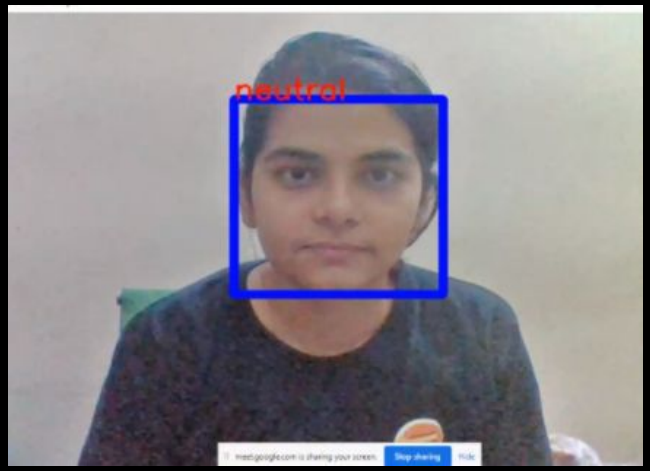


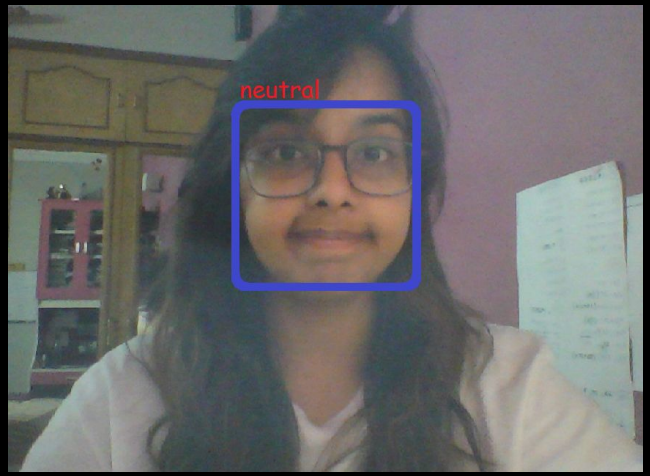
Fear



Neutral







Training Set Accuracy = 89.97%
VAL Set Accuracy= 58.07%

Epoch Cycles Taken = 200

Dataset

(4 categories)

FER DATASET

Source:
Kaggle.com

Authors:

Pierre-Luc Carrier and Aaron Courville

The data consists of 48x48 pixel 28,709 grayscale images of faces.

➔ The dataset categorizes into seven categories

0=Angry; 1=Disgust; 2=Fear; 3=Happy; 4=Sad; 5=Surprise; 6=Neutral

➔ The train.csv contains two columns, "emotion" and "pixels".

FER DataSet

Disgust

Fear

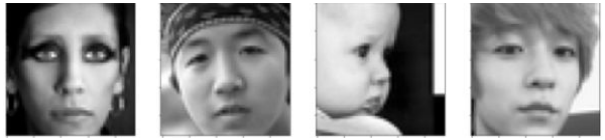
Surprise

Angry

Happy

Sad

Neutral



Multicultural Facial Expression DATASET

(JAFFE)

Source:
Researchgate

Authors:
Michael Lyons, Miyuki Kamachi, and Jiro Gyoba

- ➔ **213 images**
- ➔ **256x256 pixels resolution**
- ➔ **8-bit grayscale**
- ➔ **7 Posed Facial Expressions**
- ➔ **10 Japanese female expressers**

(TFEID)

Source:
/bml.ym.edu

Authors:
Chen, L.F. and Yen, Y.S.

- ➔ **268 images**
- ➔ **7 basic expressions**
- ➔ **40 subjects(20 Male and 20 Female Taiwanese models)**

(RaFD)

Source:
Socsci

Authors:
Radboud University Nijmegen

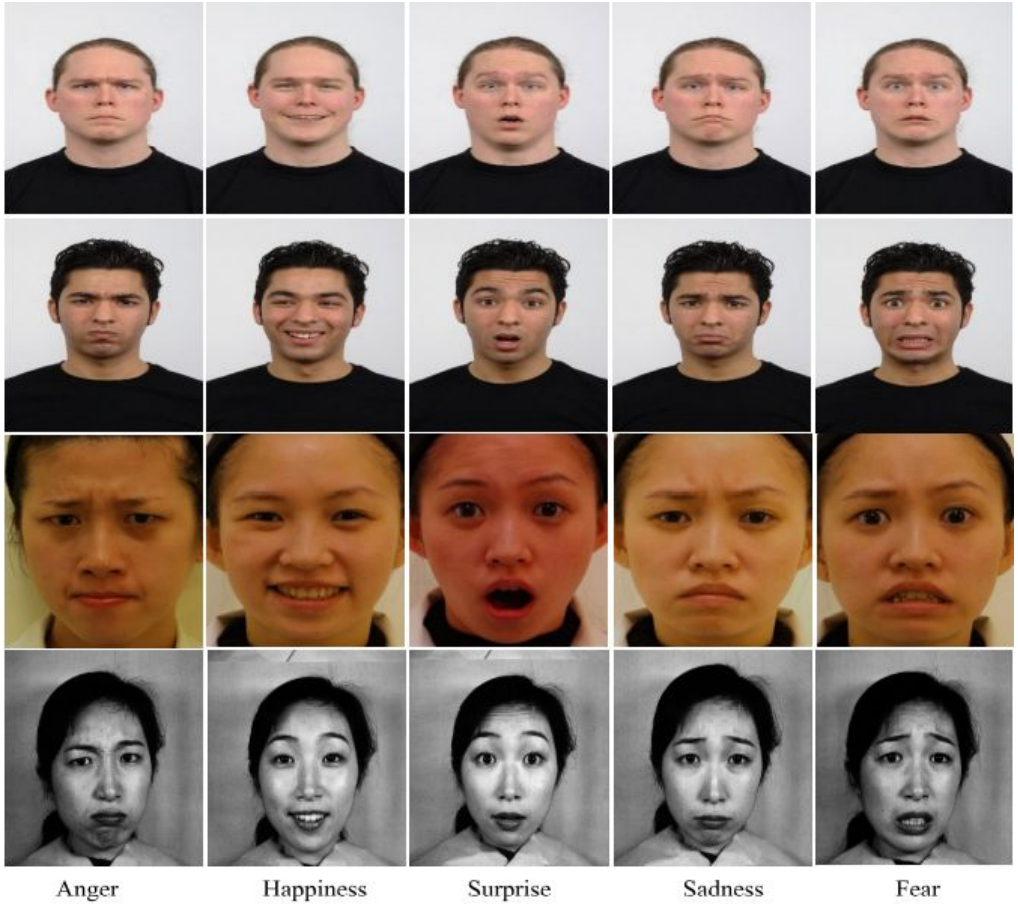
- ➔ **7 emotional expressions**
- ➔ **67 models:** Caucasian males and females, Caucasian children, boys and girls, and Moroccan Dutch males

SAMPLE IMAGES

(RaFD)

(TFEID)

(JAFFE)



Moroccan

Caucasian

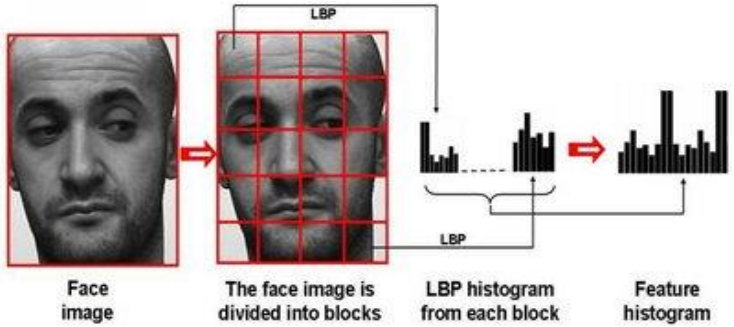
Taiwanese

Japanese

FEATURE EXTRACTION

Extracts the significant features which contribute most to the expression representation because the irrelevant features may affect the accuracy of the classifier.

LOCAL BINARY PATTERN



PRINCIPAL COMPONENT ANALYSIS (PCA)

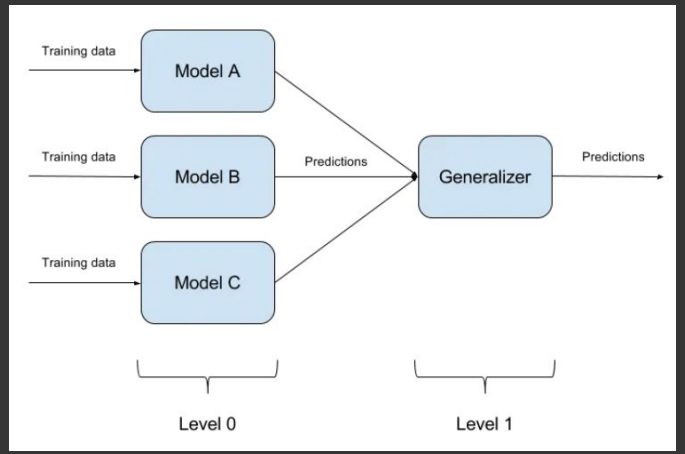
Dimensionality Reduction Technique

- ➔ Removes inconsistencies
- ➔ Redundant data
- ➔ Highly-correlated features

ENSEMBLING

Operates on the idea of combining the decisions from multiple models to improve the overall performance.

Predictions	Max Voting (Mode of the outputs)	Averaging (average of the outputs)	Weighted Average (weighted average of the outputs)
Model 1	7	7	7 (0.23)
Model 2	8.5	8.5	8.5 (0.24)
Model 3	8	8	8 (0.24)
Model 4	9.5	9.5	9.5 (0.18)
Model 5	8	8	8 (0.23)
Final ensembled rating	8	(7+8.5+8+9.5+8)/5 =8.2	(1.61+3.96+1.71+1.84)/1.12 =8.14



LITERATURE SURVEY

Facial Expression Recognition	CNN Softmax loss Batch Normalization.

Accuracy: 60.7%(kaggle)

Artificial Neural Network Based Ensemble Approach for Multicultural Facial Expressions Analysis	Multicultural, ensemble, artificial neural network

Accuracy: 89.47%(JAFFE. TFEID, RaFD)

Deep-Emotion: Facial Expression Recognition Using Attentional Convolutional Network	SVM, Neural network, or Random Forest

Accuracy: 70.02%(FER2013),92.8%(JAFFE),98.0%(CK+)

Facial micro-expression recognition: A machine learning approach	Extreme Learning Machine (ELM),Support Vector Machine (SVM), Local Binary Pattern (LBP)

Accuracy: 62.5 %(CSME 2)

FUTURE SCOPE

Multi-Cultural facial expression

Analyzing Micro-Expressions

To improve the performance and accuracy of model

- ➔ To achieve the promising results using temporal feature extraction technique (LBP-TOP) and a machine learning algorithm with an efficient and very fast learning speed (ELM).
- ➔ Use of optimization algorithms such as genetic algorithm.

TIME FLOW

To study the field of Face Detection in Machine Learning and its problem statements.

Collecting Datasets and processing it

Applying ML Algorithms on Datasets & train the data according to the problem statement

Testing Data & evaluating the accuracy of Algorithm.

Getting required results & getting maximum accuracy.

APPLICATIONS

- Mental Health care
- Tourist Satisfaction
- Criminal interrogation & Lie detection
- For measuring the confidence or attention level of humans during their interviews and online classes
- Driver safety
- Video conferencing

Thankyou!