



Indian Institute of Technology Bhilai
CS559: Computer Systems Design
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FACE EMOTION RECOGNITION ON EDGE DEVICES

Link to the source code: [Face Emotion Recognition Github](#)

In this project, we have used several ML models like VGG-16, DenseNet, ResNet Model and other sequential models for face recognition. We have obtained an accuracy of 70% in this after ensembling the models.

As, mentioned in the proposal, we have implemented the things that we need to do in the first phase. So, I will now explain each step that we did in this phase.

Data Preprocessing:

- In this data preprocessing stage, we processed facial emotion images sourced from the **FER-2013 dataset**
- Utilizing TensorFlow and scikit-learn, we loaded grayscale images of facial expressions categorized into 7 emotion classes. Images were resized to a uniform dimension of 48x48 pixels, and we normalized them in the range between 0 and 1.
- Employing LabelEncoder from scikit-learn, we encoded emotion class labels as integers to prepare them for model training.
- After that we split the training data into 20% validation data.

Testing of Model:

At last, we got the accuracy of **68%** after ensembling the complete models. We have tested the model on 2 images, and I got the results as follows:

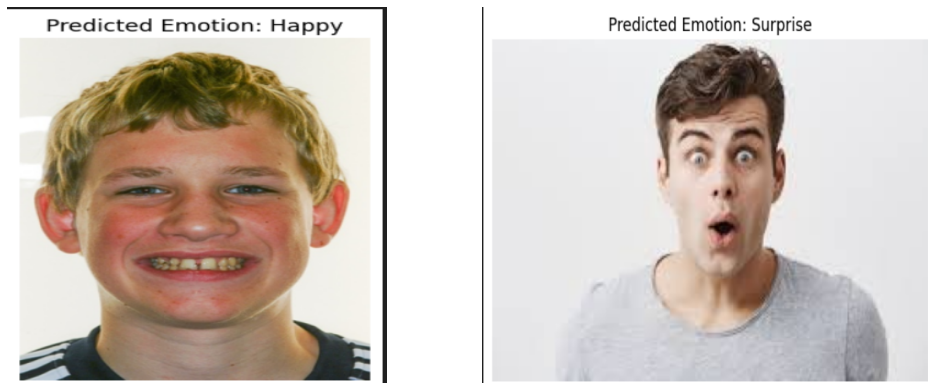


Figure 1: Face emotion recognition

Models:

We have used several pre-trained models like VGG16, DenseNet, ResNet, MobileNet, and while running the model, we did **data augmentation** so to get better accuracies. And we got test accuracies from each model as follows:

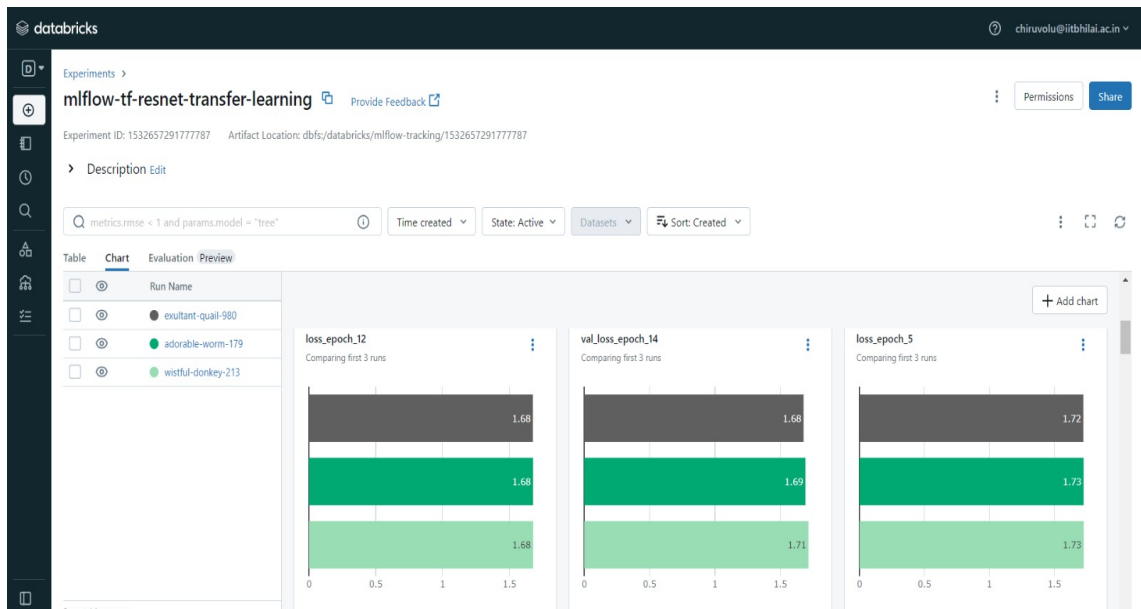
Model	Validation Accuracy (%)
Seq-1	56.77%
Seq-2	54.26%
VGG16	67.00%
DenseNet	62.83%
MobileNet	42.00%
ResNet	59.39%

Table 1: Validation accuracies of different models on FER2013 dataset

ML-flow:

We utilized MLflow in our project to enhance visualization and gain insights into the model's performance. MLflow facilitated tracking and comparison of various experiments, providing detailed metrics on training and validation processes. This enabled us to make informed decisions and optimize our models effectively.

These are some of the observations in Databricks(ML-flow):



mlflow-tf-keras-resnet [Provide Feedback](#)

Experiment ID: 1532657291777786 Artifact Location: dbfs:/databricks/mlflow-tracking/1532657291777786

> Description Edit

Search: Time created State: Active Datasets Sort: Created Columns

Table Chart Evaluation Preview

	Run Name	Created	Dataset	Duration	Source	Models
<input type="checkbox"/>	abrasive-bass-346	1 hour ago	-	39.5s	ipykernel...	-
<input type="checkbox"/>	peaceful-penguin-814	1 hour ago	-	56.1s	ipykernel...	-
<input type="checkbox"/>	bemused-goat-716	1 hour ago	-	55.9s	ipykernel...	-
<input type="checkbox"/>	grandiose-toad-656	2 hours ago	-	39.4s	ipykernel...	-
<input type="checkbox"/>	defiant-newt-569	2 hours ago	-	55.8s	ipykernel...	-
<input type="checkbox"/>	zealous-penguin-556	2 hours ago	-	55.3s	ipykernel...	-
<input type="checkbox"/>	rare-sow-461	2 hours ago	-	40.4s	ipykernel...	-
<input type="checkbox"/>	respected-whale-101	2 hours ago	-	1.9min	ipykernel...	-
<input type="checkbox"/>	vaunted-pug-107	2 hours ago	-	3.0min	ipykernel...	-
<input type="checkbox"/>	luminous-milla-387	2 hours ago	dataset-17256555-1 Train	5.1c...	ipykernel...	-

10 matching runs

Show more columns (49 total)

legendary-vole-571 [Provide feedback](#)

Reproduce Run

Run ID: 6f789de37f8447f2920e710f1df05c01 Date: 2024-04-01 19:39:53 Source: `ipykernel_launcher.py`

User: chiruvolu@iitbhlai.ac.in Duration: 1.9min Status: FAILED

Lifecycle Stage: active

> Description [Edit](#)

> Datasets (1)

> Parameters (26)

Name	Value
batch_size	None
class_weight	None
epochs	5
initial_epoch	0
opt_amsgrad	False

validation_loss [1.8149502277374268](#)

> Tags

> Artifacts

checkpoints

model_summary.txt

Full Path: `dbfs:/databricks/mlflow-tracking/3085524897468568/6f789de37f8447f2920e710f1df05c01/artifacts/model_summary.txt`

Size: 2.81KB

Model: "sequential_2"

Layer (type)	Output Shape	Param #
vgg16 (Functional)	?	14,714,688
flatten_2 (Flatten)	?	0 (unbuilt)
dense_6 (Dense)	?	0 (unbuilt)
dropout_4 (Dropout)	?	0
dense_7 (Dense)	?	0 (unbuilt)
dropout_5 (Dropout)	?	0
dense_8 (Dense)	?	0 (unbuilt)

Total params: 14,714,688 (56.13 MB)
Trainable params: 14,714,688 (56.13 MB)
Non-trainable params: 0 (0.00 B)

Planning for the next phase:

We will proceed to deploy this model on edge devices in the next phase, and during testing, we will ensure its functionality.

Individual Contributions: As we were only 2 members, both of us worked on all parts simultaneously.