BOSCH'S TRAFFIC SIGN RECOGNITION

The German Traffic Sign Recognition Benchmark Dataset

It is a multi-class, single-image classification dataset.

	Train / Test Set	No of Samples
43 Unique Classes	Training Set	39,209
	Test Set	12,630

Challenging aspects of the original dataset –

- Variations in viewpoint
- Variation in brightness of lighting condition
- Motion blur
- Damages to signs

5 New Classes Sourced from Internet

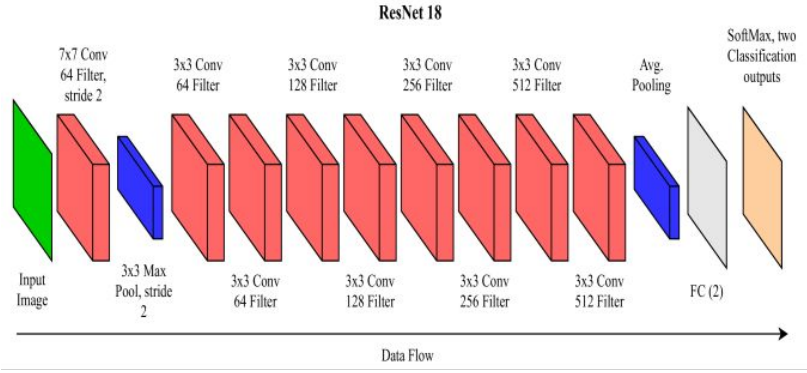
Class Name	No Left Turn	No Horn	Car	Pedestrian Crossing	No Stopping
Sample Image					
No of Samples	246	192	514	202	500
Class Index	43	44	45	46	47

Updated Dataset

48 Unique Classes	Train / Test Set	No of Samples
	Training Set	40,532
	Test Set	12,961

Baseline Network

- Model: Resnet18
- Preprocessing:
  - ➔ Resized images to size (64,64)
  - ➔ Normalized images
- Training parameters:
  - ➔ *Epochs* : 30
  - ➔ *Loss Function* : CrossEntropyLoss
  - ➔ *Optimizer* : Adam



Resnet18 Architecture

Baseline Networks Evaluation Results

- Baseline model was trained on 43 classes
- It was fine-tuned using updated dataset and evaluated on updated test set.

Number of Classes	Added Dataset Creation UI Augmented Images ?	F1 Macro	Accuracy
43	No	0.9816	0.9872
43	Yes	0.9610	0.9690
48	No	0.9762	0.9857
48	Yes	0.9523	0.9687

Improved Baseline Network Evaluation Results

From Post Evaluation UI -

- Got intuition for further experiment regarding the performance of the model.
- Made necessary changes in the network training parameters and dataset and trained further.

Experiments done to improve metric :

- ❖ Added unseen train time augmentations
- ❖ Handled class imbalance by penalizing loss.
- ❖ Applied Early stopping
- ❖ Regularization using Coarse Dropout
- ❖ Tried different networks

Number of Classes	Added Dataset Creation UI Augmented Images ?	F1 Macro	Accuracy
48	Yes	0.9719	0.9813

DATASET CREATION UI

Features :

- Apply Augmentations:
  - More than 70 Albumbentation Augmentations and 2 Custom augmentation
  - Multiple images can be augmented by multiple augmentations at a time.
  - Easily remove an augmentation or revert set of augmentations.
  - Real-Time Preview of Augmented image with varying augmentation parameters.
  - Each augmentation has an attached variable probability of being applied.
  - Number of transformed images to be generated for each image can be varied.
  - Users can download an augmented image or can directly add it to the dataset.

DATASET CREATION UI

Features :

- Balance dataset:
  - ➔ Oversamples the minority class by applying a selected set of augmentations.
  - ➔ User can decide the minimum number of samples for each class that need to be present.

- Split Dataset:
  - ➔ A stratified split is created maintaining the class-wise ratio in both train and test set
  - ➔ User can decide the split ratio.
  - ➔ Organized train and validation data in ‘csv’ get downloaded.

DATASET CREATION UI

Let's take a tour of the UI

DEMO VIDEO

POST EVALUATION UI

Lets you test your trained model on the test dataset and analyze various features.

- Each feature has a description which explains about it and gives insights on how the feature could be analyzed to decide what the next experiments can be.
- In some features, changes in dataset or network are suggested based on the given output.

POST EVALUATION UI

Features :

- Metrics
  - Evaluation Metrics
  - Class-wise accuracy
- Predictions
  - Top 5 Classes Predictions
  - Incorrectly Classified Images
- Confusion Matrix
  - Confusion Matrix
  - Confused Values for a Class
  - Most Confused Pair of Classes
- Curves
  - Precision Recall Curves
  - ROC Curve
- Model Interpretation
  - Gradient-based attribution
- Test Your Image

POST EVALUATION UI

Let’s take a tour of the UI

DEMO VIDEO

TECH STACK

Machine Learning

- Pytorch
- Albumentation
- Scikit-learn
- Matplotlib
- Google Colab

Website

- ReactJs
- NodeJs
- Material UI
- Docker
- Nginx

Server

- Python
- FastAPI
- Docker

Thank You