

BOSCH'S TRAFFIC SIGN RECOGNITION

INTER IIT TECH MEET'21



Motivation

Deep learning is a great tool for solving image recognition Tasks

Autonomous driving domain needs highly accurate results

Analyzing results and pitfalls of the models is not easy

Need to ensure that AI is exposed to difficult images, likely to be seen in real-world scenario



Create a complex dataset



Train additional images on the fly



View model performance



Highlight failures and reiterate



Explainable AI solutions

Solution Outline

Addition of New Classes

- The original dataset (GTSRB) contains 43 classes with 40,490 images.
- One of our main tasks is to make the dataset more difficult.
- We added 7 more classes to the existing 43 classes.



Augmentations

To ensure that our dataset is hard enough and is usable in a real-world scenario we add augmentations extensively but not exclusively related to weather conditions, like snow, rain or solar flare.

Fog



Rain



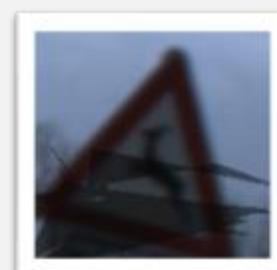
Snow



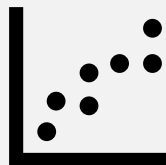
Sun-Flare



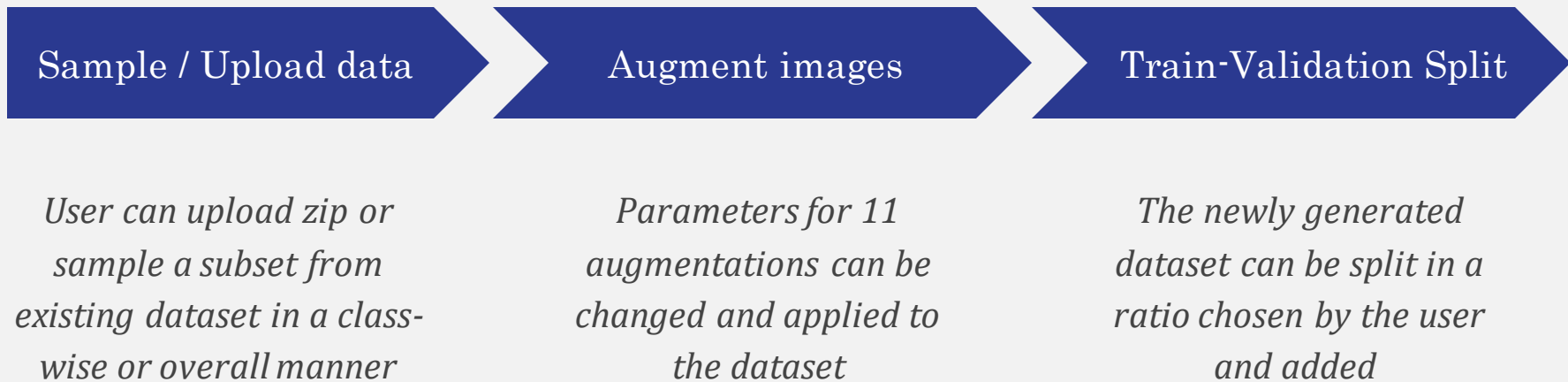
Shadows



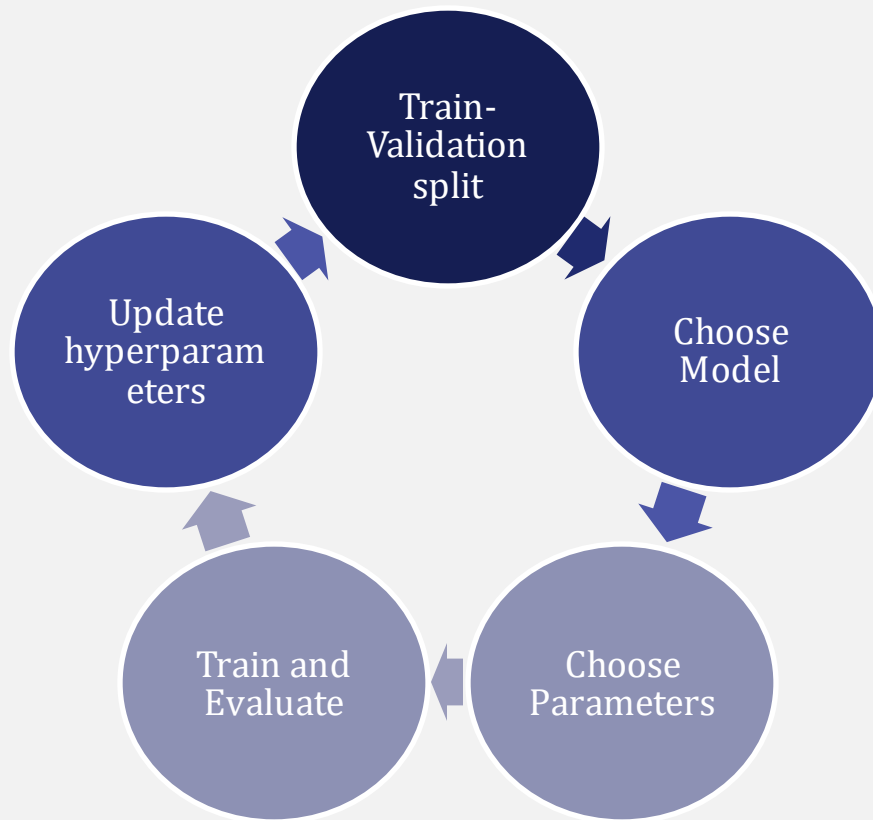
*Gaussian
Noise*



Dataset Creation and Modification UI



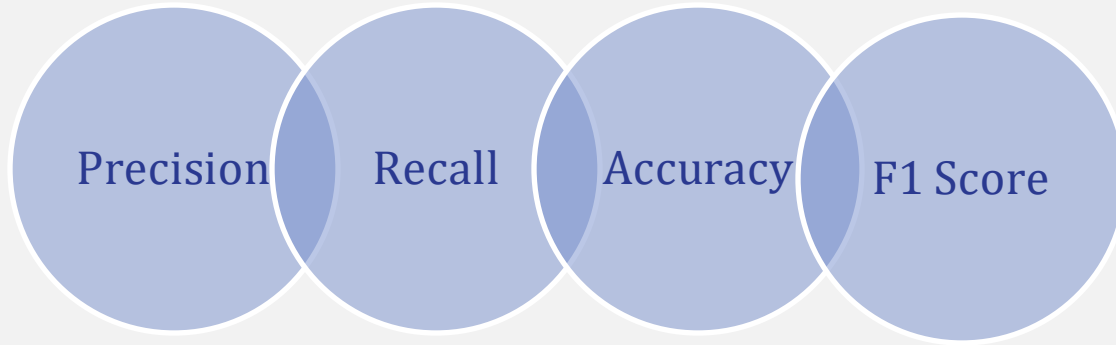
Model Training UI



Model Performance Summary

	Accuracy	Precision	Recall	F1_score
Baseline Augmented	0.38	0.97	0.23	0.37
Resnet50	0.8359	0.9237	0.8072	0.8613
MobilenetV3	0.886	0.9535	0.8631	0.9058
InceptionV3	0.8878	0.9567	0.8675	0.9097

Metrics Displayed



- ❖ The user can select any experiment to see the above values change graphically.
- ❖ Additionally, there is an option to see the image of the model architecture.

Post Experimental Evaluation UI

Confusion Matrix

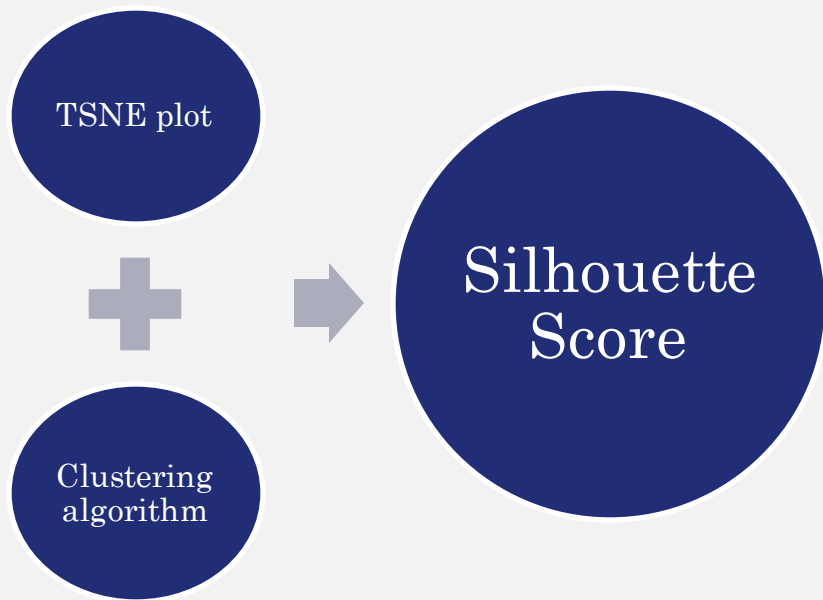
Class-wise comparison of model results in terms of predictions

t-SNE Plot

Helps measure the separability between classes

Suggestions

Based on live loss & accuracy curves and mis-predicted classes



T-SNE plot

*The silhouette score is a measure of
inter class separability and intra
class cohesion*

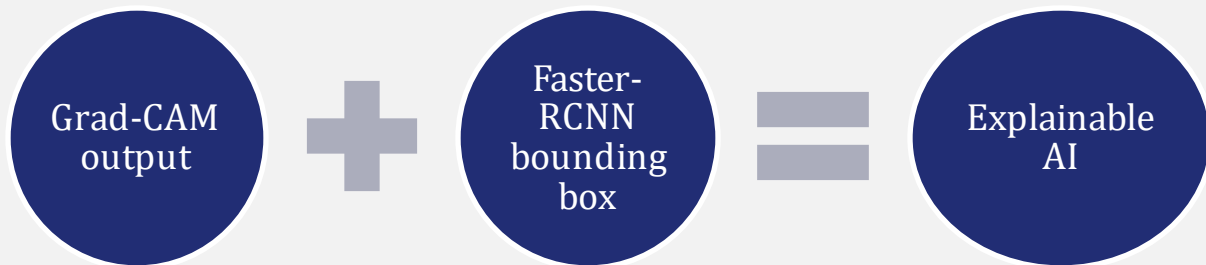
Grad-CAM

- ❖ Pick the last conv layer in the network
- ❖ Examine the flow of gradients into that layer

Output is a heatmap of where our model is focusing on, which can be used to explain the model decision making and why it might be failing

Using Grad-CAM as an Explainable AI Solution

- ❖ Combine grad-cam with a Faster-RCNN model which predicts bounding boxes
- ❖ Intersection of grad-cam output with bounding box quantifies model efficacy





THANK YOU