Object Detection System for Vehicles

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Project Definition

This is an image classification project for different types of land vehicles.

It classifies a vehicle from the photograph of the vehicle.

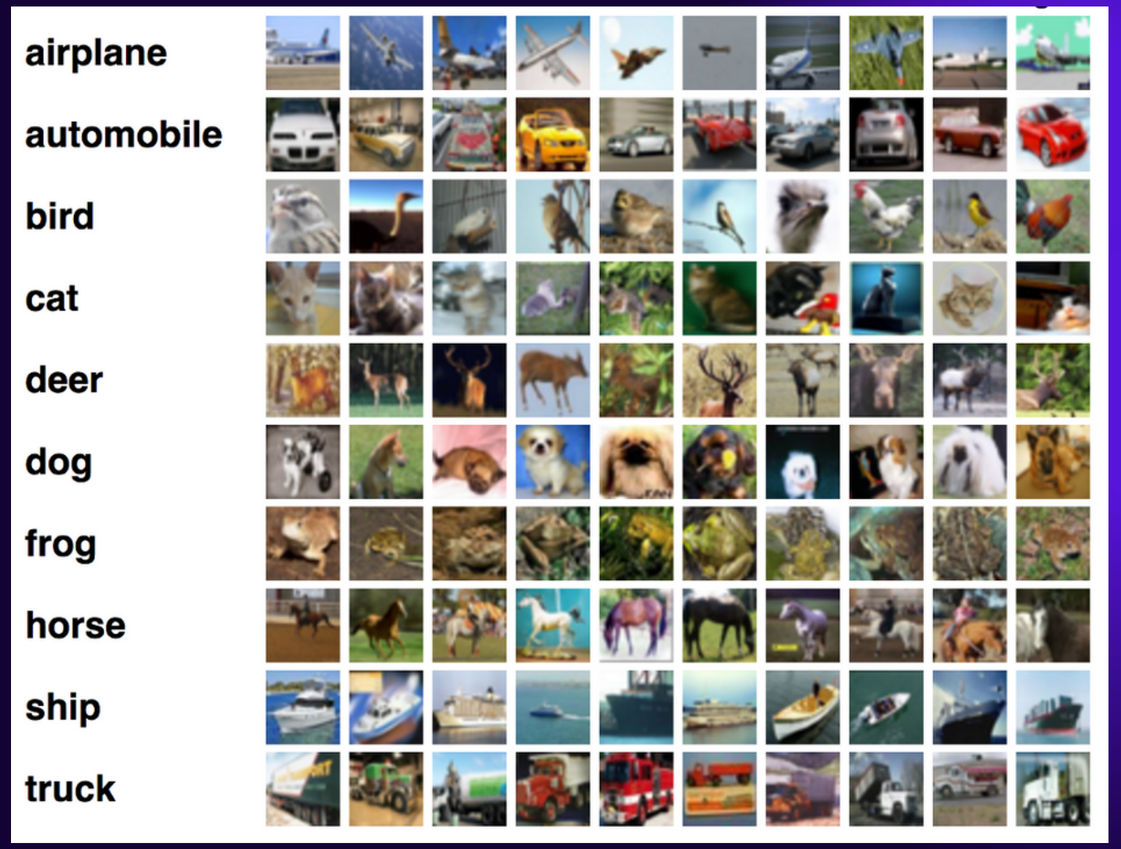

Figure 1. Example of image classification

Project Usage

It can be used in toll booths or parking lots.

Used Frameworks/ Technologies

Tensorflow [1]

Keras [3]

Python [2]

Matplotlib [4]

Scope & Constraints

Scope

The model will classify 8 types of vehicles.

Constraints

It will only classify from the images, not from any video or livestream.

Dataset Details

We found a dataset from kaggle.com [5].

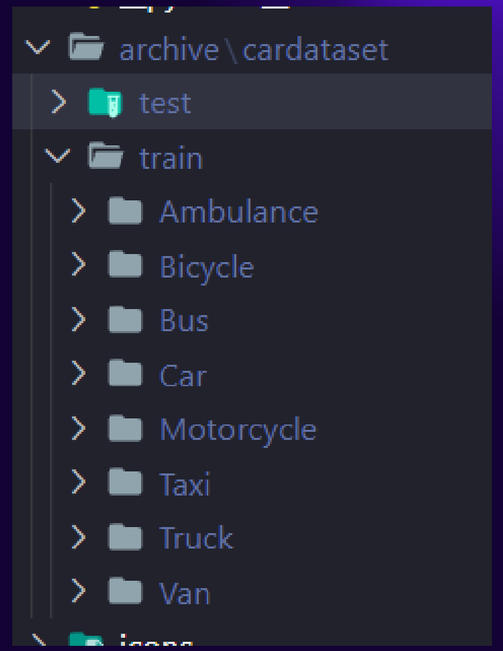

Figure 2. Dataset folder structure

It is more than 5 GB.

Implementation Details

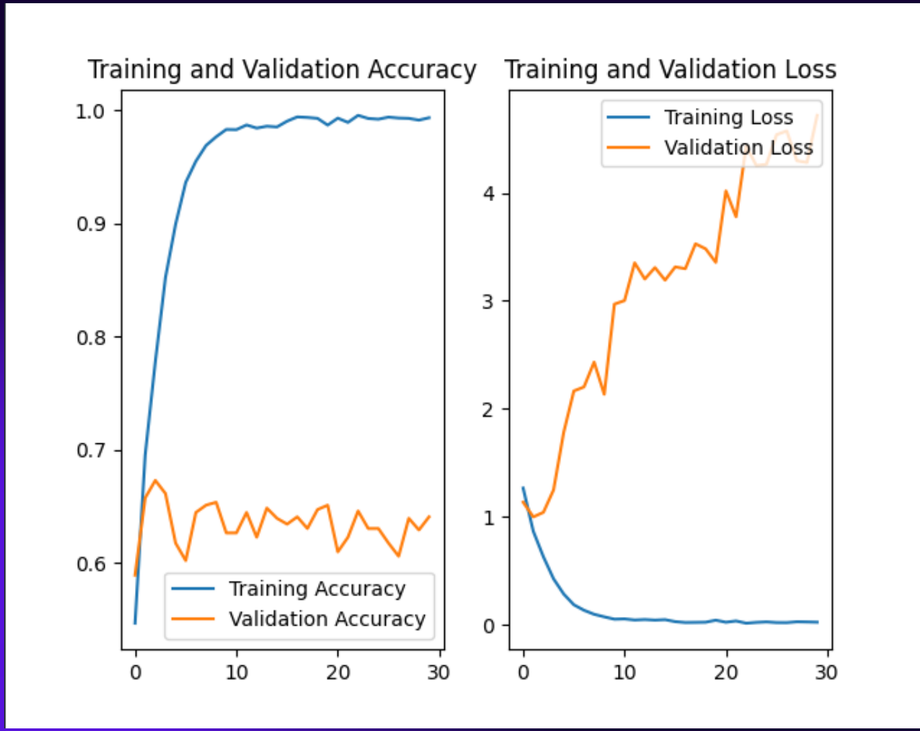

Figure 3. An example of overfitting

At first, when we train our model, using CNN's we had an overfitting issue, because of our small dataset.

We've overcome that issue by using data augmentation and dropouts.

Data Augmentation

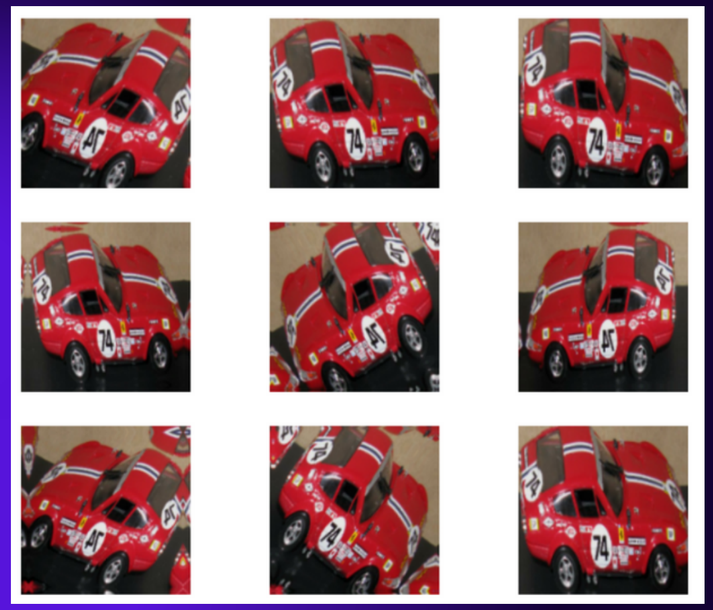

Figure 5. Data augmentation for car

```
# Use Data augmentation
data_augmentation = keras.Sequential(
    [
        layers.RandomFlip("horizontal",
                          input_shape=(img_height,
                                       img_width,
                                       3)),
        layers.RandomRotation(0.2),
        layers.RandomZoom(0.1),
    ]
)
```

Figure 4. Data augmentation in code

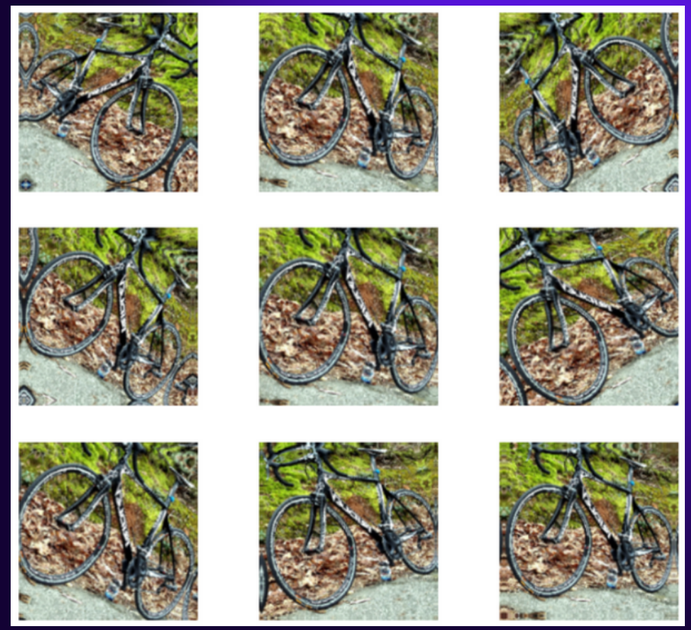

Figure 6. Data augmentation for bicycle

Dropout Layer

Dropout is a regularization technique that randomly drops out output units during training to prevent overfitting.

```
model = Sequential([
    data_augmentation,
    layers.Rescaling(1./255, input_shape=(img_width, img_height, 3)),
    layers.Conv2D(16, 3, padding='same', activation='relu'),
    layers.MaxPooling2D(),
    layers.Conv2D(32, 3, padding='same', activation='relu'),
    layers.MaxPooling2D(),
    layers.Conv2D(64, 3, padding='same', activation='relu'),
    layers.MaxPooling2D(),
    layers.Dropout(0.35),  # Add dropout
    layers.Flatten(),
    layers.Dense(128, activation='relu'),
    layers.Dense(num_classes, name="outputs")
])
```

Figure 7. Dropout application

Final Model

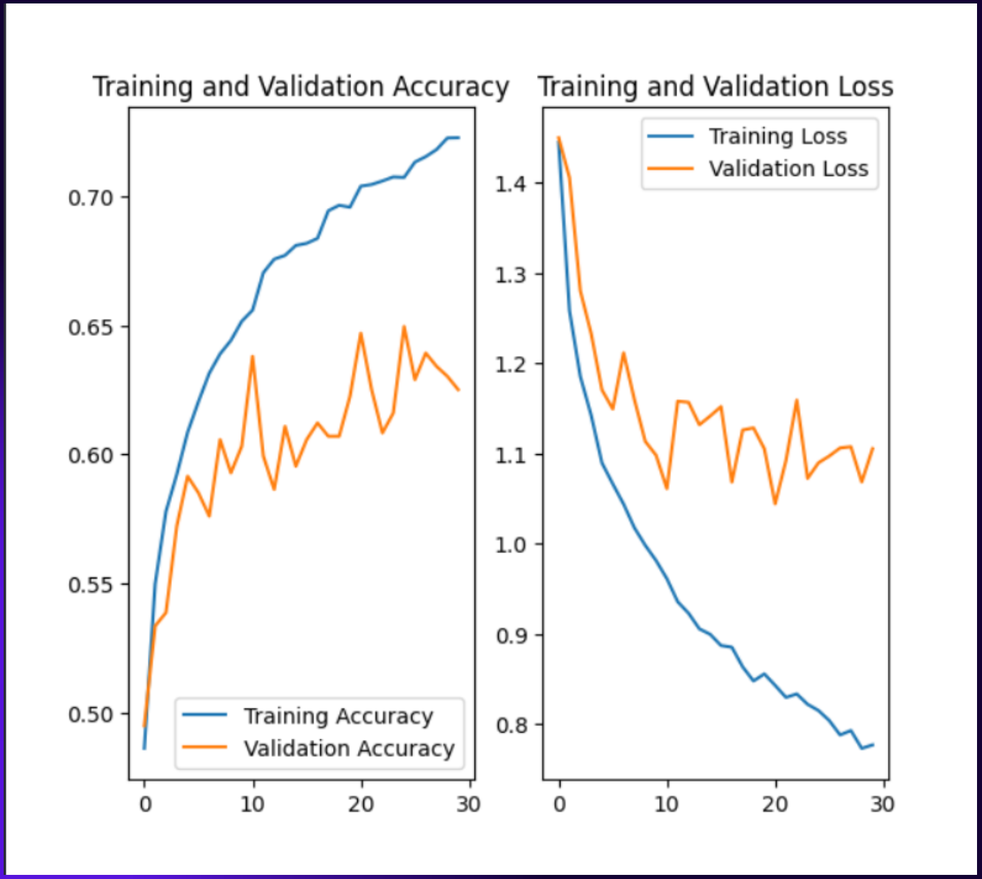

Figure 8. Accuracy of the final model

After applying data augmentation and adding a dropout layer, our model became much better as can be seen from figure 6.

Our final validation accuracy is around almost **65%** after **30** epochs.

Test Outputs

The program guessed the van correctly with **36.22%** confidence.

Test Outputs

The program guessed the truck correctly with **99.18%** confidence.

Test Outputs

The program guessed the motorcycle correctly with **70.06%** confidence.

Test Outputs

The program guessed the bus correctly with **90.74%** confidence.

Test Outputs

The program guessed the bus on the left correctly with **60.17%** confidence.

Test Outputs

The program guessed the car correctly with **91.75%** confidence.

Test Outputs

The program guessed the taxi correctly with **76.51%** confidence.

Test Outputs

The program guessed the ambulance correctly with **89.95%** confidence.

Test Outputs

The program could not guess the ambulance on the left.

Test Outputs

The program guessed the bicycle correctly with **86.58%** confidence.

Summary

In this project, we used Tensorflow Keras library to perform image classifcation

We learned a lot about Convolutional Neural Networks. And what to do when overfitting occurs, what is data augmentation etc.

List of References

1. https://www.tensorflow.org/
2. https://www.python.org/
3. https://www.tensorflow.org/tutorials/images/classification
4. https://matplotlib.org/
5. https://www.kaggle.com/datasets/iamsandeepprasad/vehicle-data-set?resource=download

THANKS FOR LISTENING