

Car Classifier

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Goal and Inspiration

- We have all tried to guess the make and model of a car
- We want to see if it is possible to turn a machine into a car enthusiast
- Many car companies and designers take inspiration each other so this task is very challenging for certain vehicles
- For instance, a Tesla closely resembles Porsche, Lotus, and Aston Martin
- Will a machine be able to tell the difference?

Cayenne

Macan

911

Taycan

718

Panamera



Porsche's Current Lineup

Tesla vs Porsche



Our Baseline

A Toyota Tacoma Pickup Truck



Machine Learning Approach



Collecting data (web scraping)



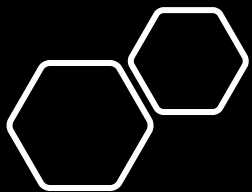
Datasets (100 - 400 images for each vehicle)



Neural Networks using TensorFlow and Keras



5 Neural Layers



Layer Structure (Sequential vs Functional)

```
model = Sequential([  
    layers.Rescaling(1./255, input_shape=(img_height, img_width, 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.Flatten(),  
    layers.Dense(128, activation='relu'),  
    layers.Dense(num_classes)  
])
```

Parameters

- `learning_rate` = 0.0005 (affects runtime)
- `epochs` = 15 (number of iterations through NN)
- `batch_size` = 16 (size of batches for each epoch)
- `train_with_ratio` = 0.9
- `validation_split` = 1 - `train_with_ratio`
- `img_height` = 180
- `img_width` = 180

Results

Models	Number of Images	Training Time	Accuracy
Porsche (911 and Macan) vs Tesla (Model Y and Model 3)	388 / 307	27s x 20 epochs (9 minutes)	72.46%
Porsche Taycan vs Porsche Macan	267 / 193	17s x 20 epochs (6 minutes)	66.67%
Porsche Taycan vs Tesla Model 3	267 / 184	18s x 20 epochs (6 minutes)	68.89%
Porsche Taycan vs Toyota Tacoma	267 / 203	19s x 20 epochs (6 minutes)	78.26%
Tesla Model 3 vs Tesla Model Y	184 / 122	13s x 20 epochs (4 minutes)	56.67%
Tesla Model 3 vs Toyota Tacoma	184 / 203	16s x 20 epoch (5 minutes)	89.47%

Improvements

- A better dataset
 - Way more images and Cleaner Datasets
- More computing power (lower learning rate)
- Better Image Processing
 - Use different layer structure for NN: different pooling instead of max pooling
 - Edge detection
 - Inception model
 - Different NN altogether: DarkNet or AlexNet
 - Different optimization algorithm (currently using Adam)
- NOT ENOUGH DATA: We need to avoid overfitting
 - augmentation - generation of new data from existing data
 - dropout - randomly drop out / set activation of random unit to 0 on a layer

What we learned

- Machine learning still requires a lot of human work
 - Clean data
 - No junk images
 - Ensure all images are specific enough
 - How tweaking the parameters affect the accuracy of the model

Questions