Overviews

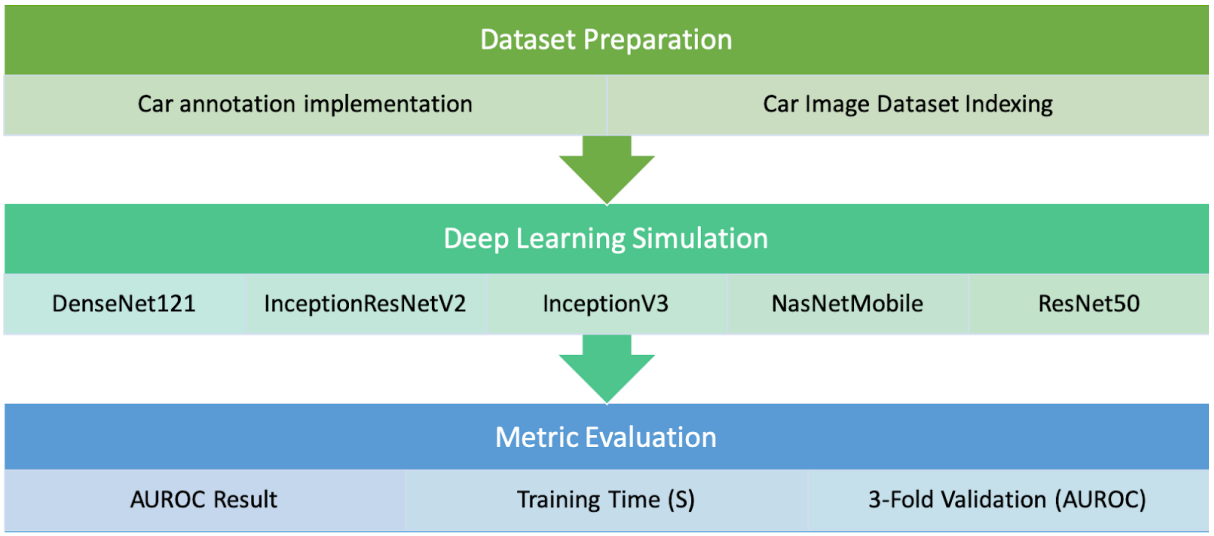


Figure 1: Car make and model detection process

The implementation for detecting car make and model is started by doing data preprocessing to obtain car label for training and testing. The next step is to train the deep learning model for car make and model detection. After training the model, car make and model detection is performed from testing dataset.

The method for detect car make and model is implemented by using Inception-V3 network by Google. The training and testing code is borrowed from https://github.com/brucechou1983/CheXNet-Keras with a modification. Data preprocessing is implemented using Python. Keras is also used to implement the model for the deep learning method. For evaluation, Sklearn is used to compute accuracy, precision and recall.

Data Preparation

Image annotation is performed before feeding the training data to the model. For each image in dataset, the car object is cropped from the background. The reason to perform

cropping on the image is to minimize the noise from the background.

Figure 2: Original Image

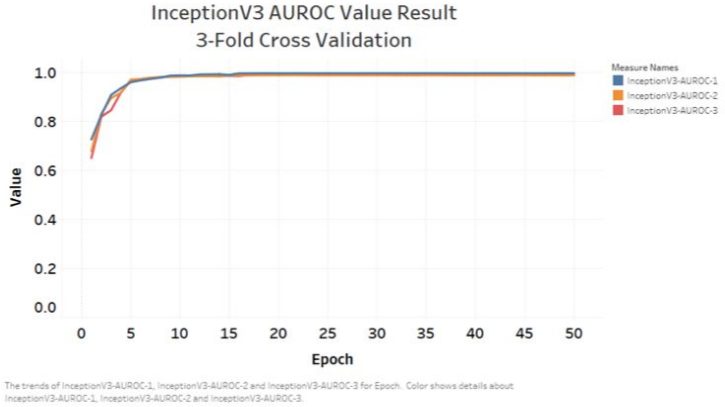
Figure 3: Cropped Image

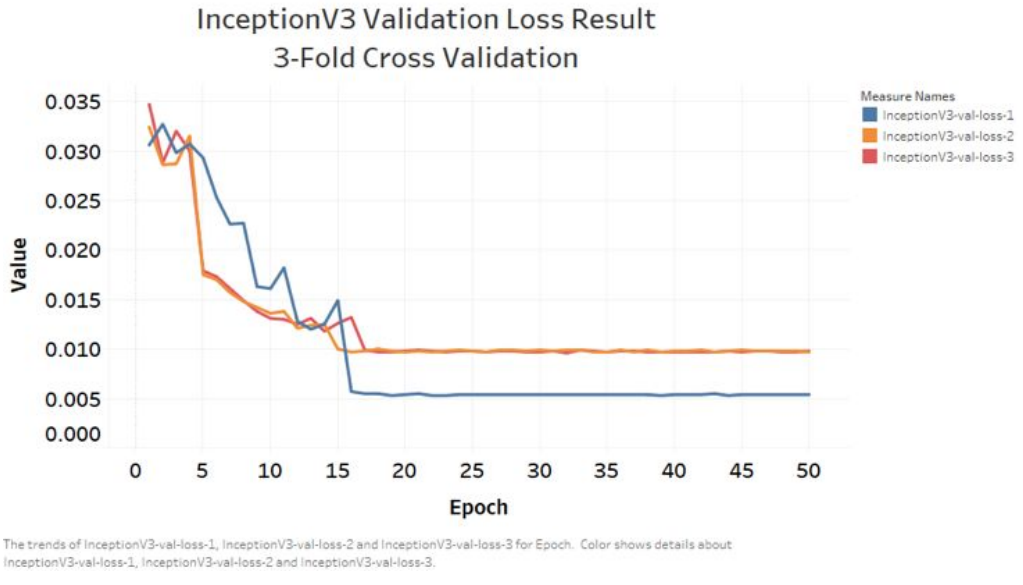
After cropping the car object from the label, the next step is to index each image to their correct label accordingly. There are 196 labels for the dataset. Each label is the representation of the car make, model and model year. **Dodge Challenger SRT8 2011** is the example of the label for the dataset where **Dodge** is the car make, **Challenger SRT8** is the car model, and **2011** is the car model year. The dataset is represented in .csv file. The table below is the representation of the dataset in the .csv file.

Image Index	Finding Labels	Car Label 1	.....	Car Label *N*
123.jpg	Car Label 1	1	.....	0
.....	.....	0	.....	0
999.jpg	Car Label *N*	0	.....	1

Model Training

For training the model, training file provided by https://github.com/brucechou1983/CheXNet-Keras is used. 3-fold cross-validation strategy is also used to train the model. The model training is validated using Area Under the Receiver Operating Characteristic Curve (ROC AUC). Below is the graph for the model training evaluation using Inception-V3 network.

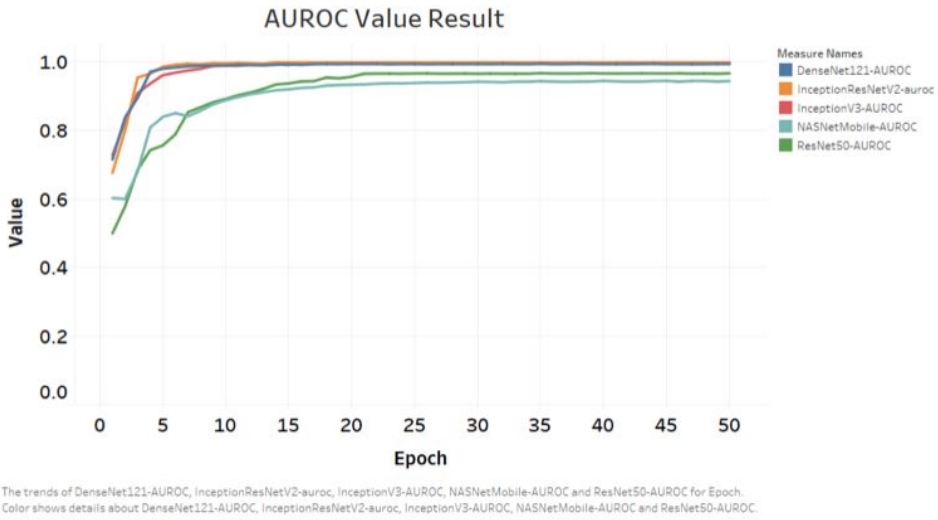


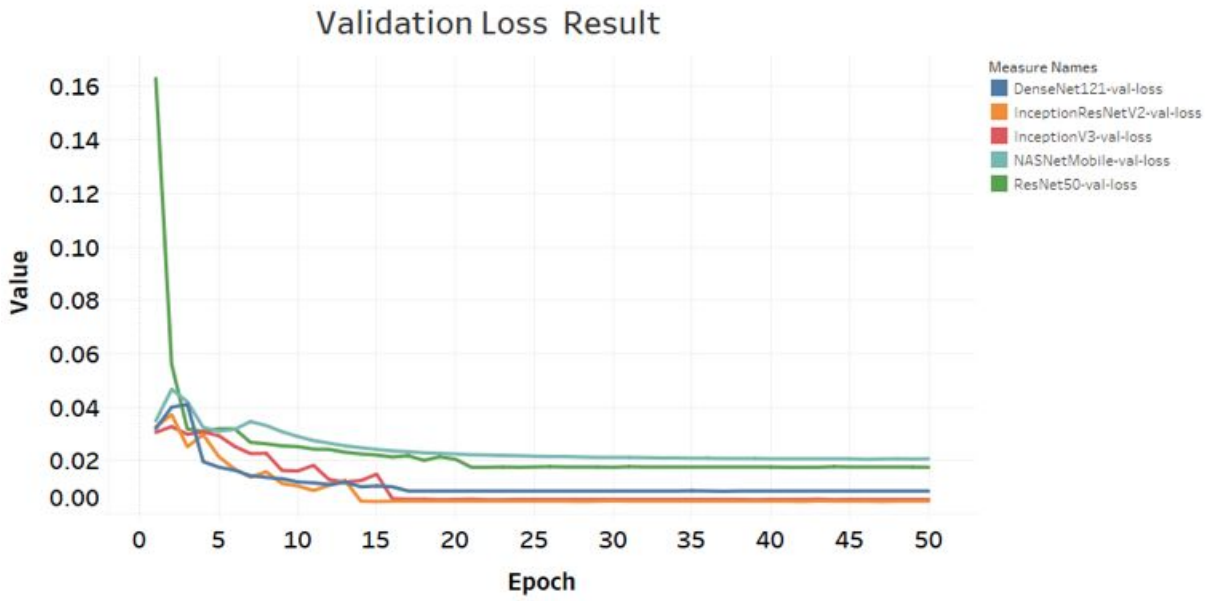


Car Make and Model Detection

Car detection is performed by running the test.py file and using test.csv dataset. To perform car make and model detection by using **custom dataset**, please put the new dataset to **/all-car-data** folder and then create **test.csv** according to test.csv file from the dropbox link provided in the repository.

Result





The trends of DenseNet121-val-loss, InceptionResNetV2-val-loss, InceptionV3-val-loss, NASNetMobile-val-loss and ResNet50-val-loss for Epoch. Color shows details about DenseNet121-val-loss, InceptionResNetV2-val-loss, InceptionV3-val-loss, NASNetMobile-val-loss and ResNet50-val-loss.