Image Classification on Caltech-256 Dataset

Springboard Data Science Capstone Project

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Overview

- Approach
- Caltech256
- Models
- Problems
- Conclusion

Approach

- Analyse the dataset
- Train different models on a small part of the dataset
- Take the best performing model and train it on the whole dataset

Caltech256

- http://www.vision.caltech.edu/Image_Datasets/Caltech256/
- 257 Categories
- 30607 images
- 15423 different resolutions

Dataset	*Released*	*Categories*	*Pictures*	*Pictures Per Category*			
			Total	*Min*	*Med*	*Mean*	*Max*
Caltech-101	2003	102	9144	31	59	90	800
Caltech-256	2006	257	30608	80	100	119	827

http://www.vision.caltech.edu/Image_Datasets/Caltech256/details.html

Caltech256 - Samples

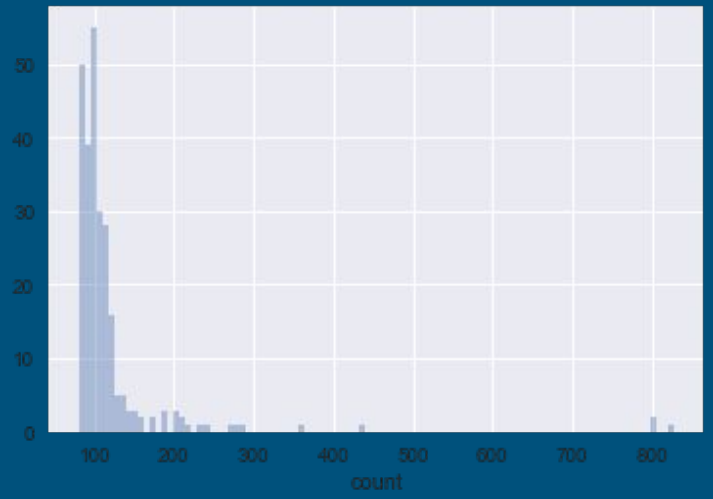




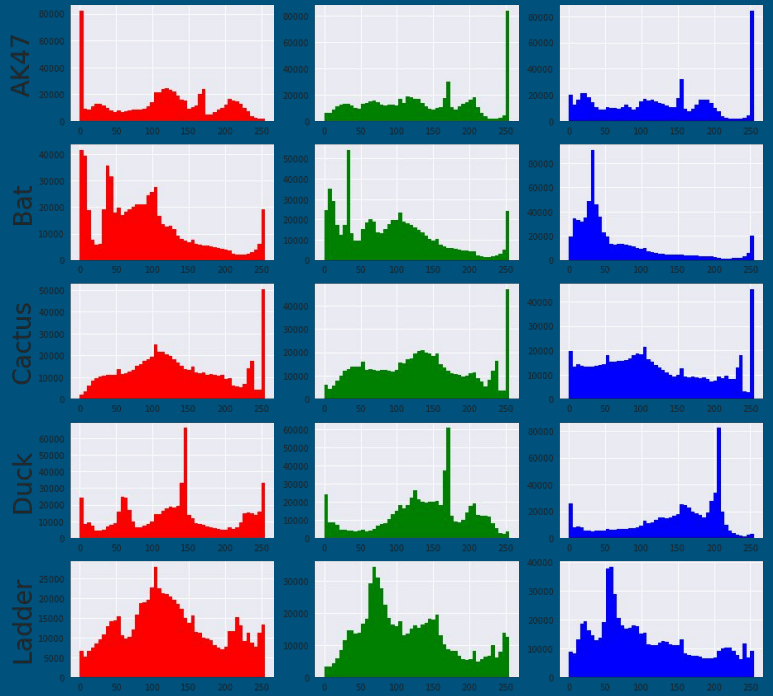




Caltech256 - Class distribution



RGB - Distribution of different classes



Models

- Trained on 10 classes
- Comparing the models
- Choose final model and train it on the whole data

Models

Library	Model	Train - Accuracy	Test - Accuracy
sklearn	K - Nearest	0.40	0.42
sklearn	SVM	0.19	0.16
Keras	CNN	0.64	0.51

CNN - Final Model

- VGG16 architecture (https://arxiv.org/pdf/1409.1556.pdf)
- Pre-trained weights (ImageNet)
- Replaced the last three fully connected layers
- Freezed the other layers
- Learning Rate, Decay and Momentum based on Paper
- Loading data in batches from directories

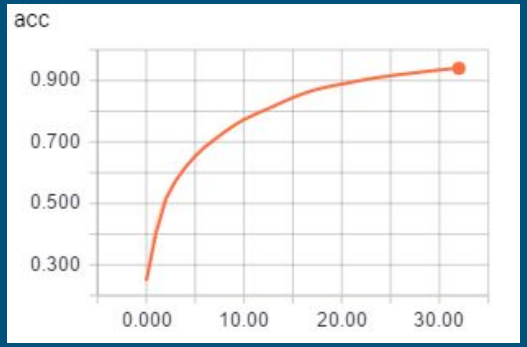
CNN - Final Model - Parameters

- Epochs 32
- Batch_size: 50
- Steps_per_epoch: training_samples / batch_size = 492
- Stochastic Gradient Descent
  - Learning rate: 0.01
  - Decay: 0.0005
  - Momentum: 0.9
  - Nestrov

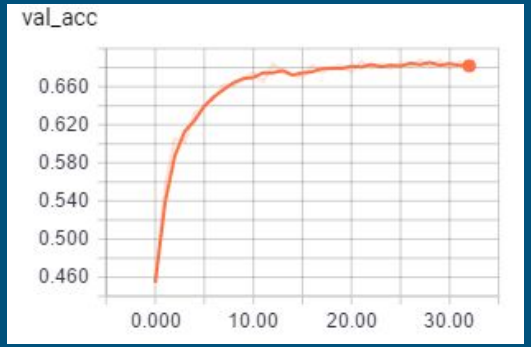
CNN - Final Model - Image Augmentation

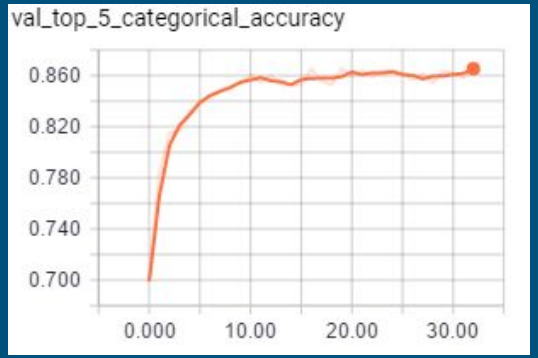
- rotation_range=40,
- width_shift_range=0.2,
- height_shift_range=0.2,
- rescale=1./255,
- shear_range=0.2,
- zoom_range=0.2,
- horizontal_flip=True,
- fill_mode='nearest'

CNN - Final Model Result

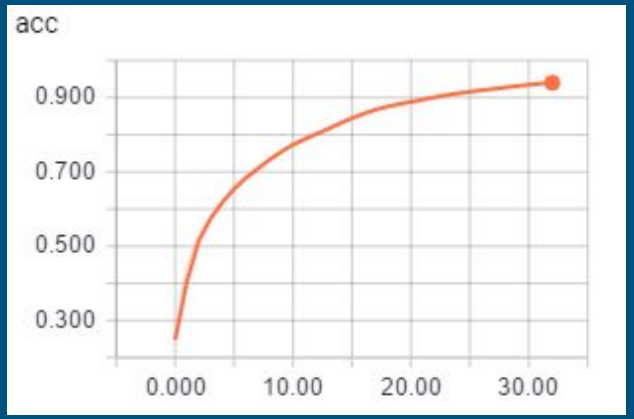


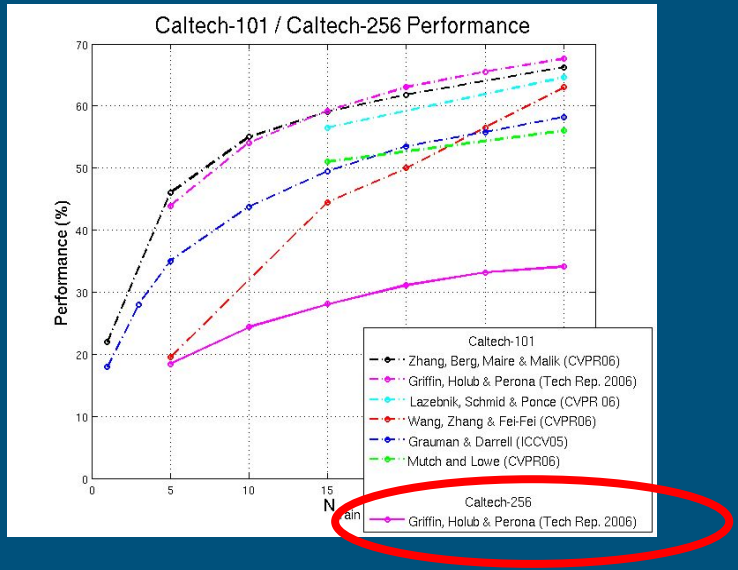
Accuracy:	0.93
Validation Accuracy	0.68
Top 5 Validation Accuracy	0.87





CNN - Final Model - Compared with benchmark





http://www.vision.caltech.edu/Image_Datasets/Caltech256/performance/performance.png

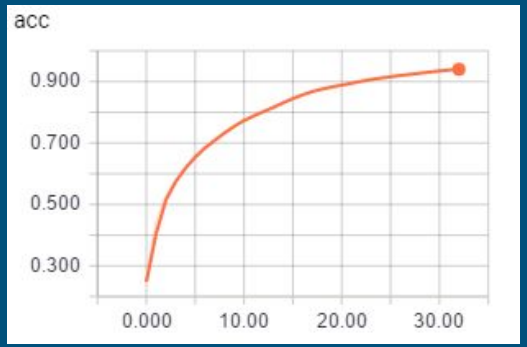
Problems

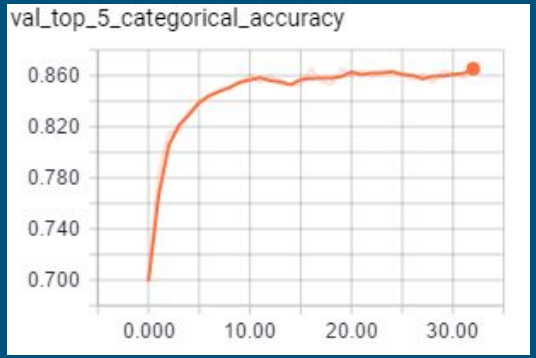
AK47	People
	

Problems

Billiards

Problems - Overfitting





Conclusion

- Beat Caltech256 benchmark
- Improvement with cleaner data
- More data augmentation
- Very easy with Keras
- Big training time improvement on GPU

Thank you