AcId

Aircraft Identification

CS 230: Emilio Botero (ebotero@Stanford.edu)

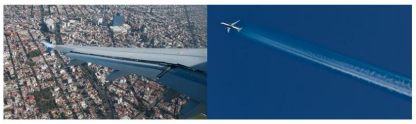
Predicting

Aircraft Identification can be a tricky task given the relative similarity of commercial aircraft and yet the wide variance of between products. Here we train convolutional neural nets to discern between the two major airframers of airliners. This requires capturing small stylistic differences that are common throughout an airframers product catalog. Two different convolutional neural nets are trained to show the validity of this idea. We scraped airplane spotter imagery to classify airplanes as either a Boeing or an Airbus product. This is a highly varied data set.

Data

The data set was obtained by scraping the website jetphotos.com. A custom automated script crawled the site for images. This crawler was made using a python tool, Scrapy. The size of the images is 400x225 RGB jpegs. In total 100,000 images were scraped of both Airbus and Boeing aircraft of various models, airlines, and angles. Images over and under a certain size were excluded as they were found to be inconsistent with the majority of the data. Images were downsized to 200x123 for VGG-16.

Typical Airbus vs. Typical Boeing (jetphotos.com)



Removed Large Data Size Image and Small Data Size Image (jetphotos.com)

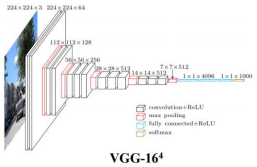
Distinctive Features[4]

Models

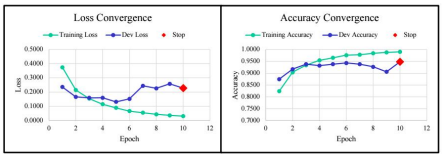
Two different convolutional neural networks were examined. First was a basic CNN, the second was VGG-16 with transfer learning learning applied for a total of 18 layers.

The first network for testing consisted of 16 channels in one block containing conv->batch norm->relu->maxpool->dense>dense. This network was mostly used for validation of the training set.

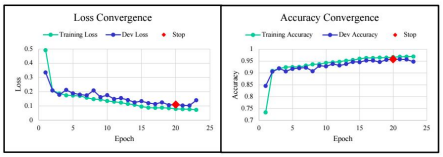
Starting from weights trained on ImageNet transfer learning was performed on VGG-16. The first 13 layers were held frozen and two layers of fully connected layers were added.



VGG-16[4]



Simple CNN



VGG-16 with Transfer Learning

Results

	568 Test Images
Simple CNN	80.30%
VGG-16 Transfer Learning	98.24%

	VGG-16 Transfer Learning Accuracy
Airbus	99.30%
Boeing	97.17%

Discussion

The results indicate that starting with VGG-16 with ImageNet weights and performing transfer learning performed better as expected. The high accuracy on the independent test indicates that the training generalizes to unseen data. The simple CNN doesn't apply well to unseen data, despite converging to a very low loss. This indicates that it is easily over-trained.

Future Work

Expand the brands that are trained to beyond the big 2 manufacturers and to include model type.

How does the algorithm perform on future aircraft? Can manufacturers use this information to know to design stylistically similar vehicles?

Future Airbus vs. Future Boeing

References

[1]Olga Russakovsky*, Jia Deng*, Hao Su, Jonathan Krause, Sanjeev Satheesh, Sean Ma, Zhiheng Huang, Andrej Karpathy, Aditya Khosla, Michael Bernstein, Alexander C. Berg and Li Fei-Fei. (* = equal contribution) ImageNet Large Scale Visual Recognition Challenge. *IJCV*, 2015.

[2]Simonyan, Karen, and Andrew Zisserman. "Very deep convolutional networks for large-scale image recognition." *arXiv preprint arXiv:1409.1556* (2014).

[3]How Can I Tell Apart an Airbus from a Boeing? https://aviation.stackexchange.com/questions/1436/how-can-i-tell-apart-an-airbus-from-a-boeing/2742

[4]VGG-16 Image: https://heuritech.files.wordpress.com/2016/02/vgg16.png?w=940