Predicting planes in Microsoft Flight Simulator

Oliver Bollverk, Richard Nõmm, Ludvig Leis, Jon Hendrik Aruväli

Github: https://github.com/o-bollverk/msf
The goal and the problem

- Combining data from MSF and jetphotos.com
- Goal: to classify plane types
- A way to simulate plane type classification in the real world as MSF graphics are very realistic (air traffic control)

What is the model of this plane?
Balanced data (subset)

Train/test split

Image augmentation

Custom CNN

Resnet34

Resnet18

Resize (64x64)

Train/test split

Resnet34

Custom CNN

Resize (64x64)

Accuracy scores (train accuracy and loss + test accuracy)

Accuracy (96%)

Accuracy (79%)
## Methods/models comparison (balanced subset)

<table>
<thead>
<tr>
<th>Model</th>
<th>Augmentation</th>
<th>Top test accuracy (with 15 epochs, balanced data)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>3.5k images (80/20 ratio)</td>
</tr>
<tr>
<td>Resnet50</td>
<td>-</td>
<td>80%</td>
</tr>
<tr>
<td>Resnet34</td>
<td>-</td>
<td>76%</td>
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<tr>
<td>Resnet18</td>
<td>-</td>
<td>69%</td>
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<tr>
<td>Resnet18</td>
<td>Background elimination</td>
<td>69%</td>
</tr>
<tr>
<td>Resnet18</td>
<td>Mean filtering</td>
<td>69%</td>
</tr>
<tr>
<td>Resnet18</td>
<td>Dense image wrap</td>
<td>59%</td>
</tr>
<tr>
<td>Resnet18</td>
<td>Random hsv (color change)</td>
<td>70%</td>
</tr>
<tr>
<td>Resnet18</td>
<td>Rotation</td>
<td>68%</td>
</tr>
<tr>
<td>Custom CNN*</td>
<td>Image resize 64x64</td>
<td>66%</td>
</tr>
<tr>
<td>Custom CNN*</td>
<td>Image resize 64x64, mean filtering, wrap transform</td>
<td>65%</td>
</tr>
</tbody>
</table>

* Custom CNN used more epochs (128).
Results on unbalanced set

Resnet18 test with unbalanced data (5 epochs) - 29k images (80/20 ratio) - 94% accuracy on test set.
Resnet34 test with unbalanced data (5 epochs) - 29k images (80/20 ratio) - 96% accuracy on test set.
Custom CNN (Image resize 64x64) with unbalanced data - 29k images (80/20 ratio) - 80% accuracy on test set.
Image augmentation techniques

Mean filtering

Dense image wrap

Random HSV in YIQ

Rotation
Expectations vs results

**Expectations:**
- 90+ percent accuracy
- Image augmentation will improve accuracy
- Background elimination will increase accuracy 5%
- Custom CNN accuracy 80%-90%

**Results:**
- Some augmentations decreased accuracy (wrap, grayscaling)
- Mean transform, background elimination and random hsv didn’t change accuracy
- Higher resnets performed better
- Difference in accuracy on models trained on entire unbalanced dataset vs balanced subset was 70% to 94% (resnet18)
- Custom CNN performed worse than resnet18 on subsets (best ca 80% accuracy)
Lessons learned

* Competing with Resnet is difficult with custom CNNs
* Image augmentation technique selection is complicated and some methods may easily decrease accuracy (edge fading, grayscaling)
* Test and training set should be from the same distributions
* Online data collection challenges
* FastAI library is not to be recommended for building custom CNNs
* Image resize can be crucial to model efficiency
* Performance issues with Fastai (correct tensorflow versions, GPU drivers, etc)
* Personal PC > Google Colab
Thank you!