Task

Detect ships on satellite images
Why

Because we can
Why

Because we can

Piracy

Pollution

Accidents

Drug trafficking

etc...
Data

30GB data

Satellite images & annotations

Skewed dataset
Framework

Data Loader
- Download Data
- Convert annotations RLE to CoCo [2]

Training
- Resnet34 - Classifier [1]
- Mask-RCNN (multistage + Data Augmentations) [1][2][9]

Predictions
- Classifier -> Mask-RCNN [1][2]
- Speed.

Submit
- Convert pixel masks to RLE [2]
Training (Mask)

Preprocessing
Training (Mask)

Preprocessing

Split 95% / 5%

Data Augmentations

Train data - only images with ships*.

Validation - both
Rotate (+/- 20°)

Flips 50%

Random Lighting 0.1STD [9]
### Training (Mask)

<table>
<thead>
<tr>
<th>Preprocessing</th>
<th>256x256</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Split</strong></td>
<td>95% / 5%</td>
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<tr>
<td><strong>Data Augmentations</strong></td>
<td></td>
</tr>
<tr>
<td>Train data</td>
<td>only images with ships*</td>
</tr>
<tr>
<td>Validation</td>
<td>both</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>1st stage</th>
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<tbody>
<tr>
<td>Validation every 5k iterations</td>
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</table>

Split: 95% / 5%

Data Augmentations:
- Train data: only images with ships*
- Validation: both
## Training (Mask)

<table>
<thead>
<tr>
<th>Preprocessing</th>
<th>256x256</th>
<th>512x512</th>
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<tbody>
<tr>
<td><strong>Split 95% / 5%</strong></td>
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<td>Validation - both</td>
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</tbody>
</table>

### 1st stage
- Validation every 5k iterations

### 2nd stage
- Validation every 5k iterations
Training (Mask)

Preprocessing

Split 95% / 5%

Data Augmentations

Train data - only images with ships*

Validation - both

<table>
<thead>
<tr>
<th>Stage</th>
<th>Preprocessing</th>
<th>1st stage</th>
<th>2nd stage</th>
<th>3rd stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>256x256</td>
<td>Validation every 5k iterations</td>
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<tr>
<td>512x512</td>
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<tr>
<td>756x756</td>
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</table>
Training & Validation metrics

Tensorboard (live)

Detectron2 (example)

Karl Kaspar Haavel | Anti Kivi | Kaarel Roopärg | Niyi Solomon Adebayo | github.com/ka5par/ML_ShipDetection
Predictions
Results

Submission and Description
submit_50_anchortest3.csv
a day ago by haavel
mask+classifier, smaller anchors (trained more)

1.5% from best private result

Example solutions

- **Classifier + Ensemble: 4x**
  - Pseudolabels, Classifier
  - 3x Resnet + Unet
  - 1x Mask RcNN

- **Classifier + DL + Post processing**
  - New labels, Classifier, Staged training
  - Unet densenet169
  - Post-processing

- **Ensemble: 2x**
  - Staged training
  - Unet + Mask RCNN
Conclusions / Lessons learned

Combine models. Mono-purpose.
Deeper doesn't always mean better.
Detailed metrics pinpoint weak-points.
Customize tool-boxes at the cost of own sanity. (fast.ai / detectron2)

Top tip: Turn on Automatic Mixed Processing (AMP) [4]
Thank you!

Questions

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ML_ShipDetection | cutt.ly/ship_detection
References

[9] ImageNet Classification with Deep Convolutional Neural Networks
[https://papers.nips.cc/paper/2012/file/c399862d3b9d6b76c8436e924a68c45b-Paper.pdf]