

## DOTA 2019 Challenge Solution

### 1. Main Framework

Advanced Faster-RCNN (Rotated region proposals) .

We use faster-rcnn as our main framework to detect the objects.

We made an improvement based on faster-rcnn to adjust to the oriented objects. Specifically, we use rotated region proposals to predict the groundtruth bounding box of the object. At the same time, we also predict the horizontal bounding box to accelerate the convergence of the training process. According to the examples of the dataset, we designed several appropriate aspect ratios (ranging from 1:7 to 7:1)

### 2. Tricks on training & testing

1) We used online hard example mining during the training

process to stabilize the training process and accelerate the convergence.

2) We made a balance on the original dataset, which is extremely

imbalanced. The long tail effect may cause a bad effect to the model and may cause an over-fitting.

- 3) We adopted a warm-up strategy on the setting of the learning rate. Specifically, we increased the learning rate from  $1e-8$  to an appropriate value according to the loss at the beginning of the training and then decreased the learning rate with the increase of the training step.
- 4) We made some augmentations on the dataset including random flipping, random noise, random brightness, random saturation and so on.
- 5) We made a multi-scale testing strategy to improve the recall of false negative samples. We used 0.6x, 0.8x, 1.0x, 1.3x, 1.5x scales during the test process.