FAST AIRCRAFT DETECTION BASED ON REGION LOCATING NETWORK IN LARGE-SCALE REMOTE SENSING IMAGES

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Abstract

Nowadays, we get more and more remote sensing (RS) images which cannot be well processed by manual analysis or existing automatic methods. What's more, the object detection technology has greatly developed, especially after the usage of CNN in object detectors. In this paper, we introduce an extra Region Proposal strategy named Region Locating Network (RLN) to improve the Faster RCNN[1] framework. Extensive experiments show that the proposed method has oblivious improvement in recall rate, accuracy and computing efficiency.

Challenges

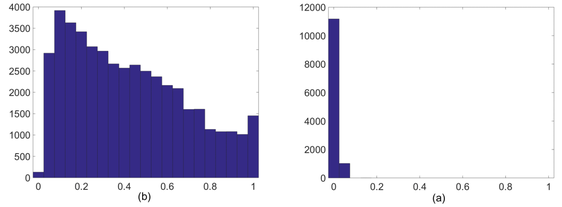


Fig.1 *The sizes of annotated objects compare to the image sizes. The abscissa axis is the relative ratios and the vertical axis is the number of annotated objects. (a) is the ratios in our dataset, (b) is in Pascal VOC 2012.*

Seeing Fig 1 , compared to the common object detection, the aircrafts in airports are too small to be detected after the image resized to small ones.

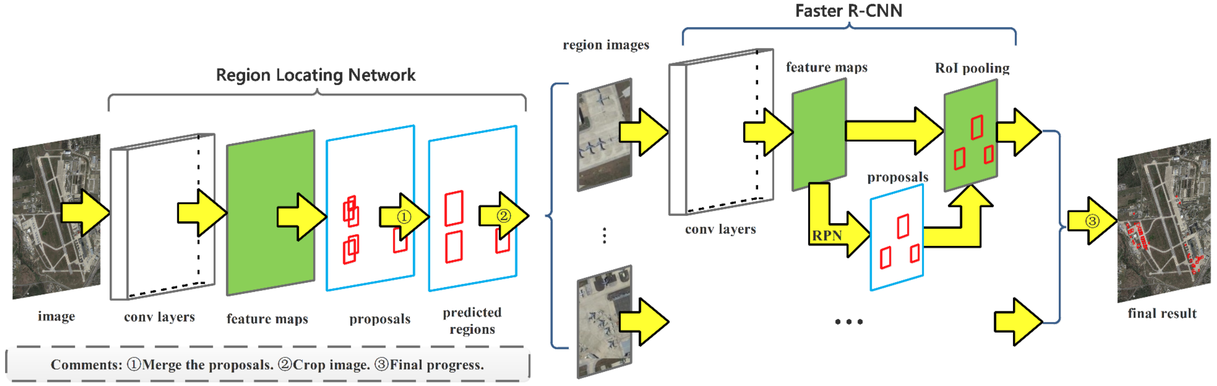


Fig.2 *The structure of the aircraft detector with proposed RLN*

Our Method

In general, the proposed algorithm includes mainly three steps:

- locate the regions of aircrafts using Region Locating Network (RLN) and extract these regions from the original image.
- locate aircrafts with trained Region Proposal Network(RPN) for aircraft detection.
- classify the aircrafts with Fast RCNN[2] and final process.

To transform the object location into the region location, we use clustering algorithm to combine several adjacent bounder boxes into one field boxes. What's more, the RLN is a fully convolutional network that predicts the region bounds and the objectiveness scores. Its structure is the same as the RPN in Faster R-CNN (VGG16[3]).

Results

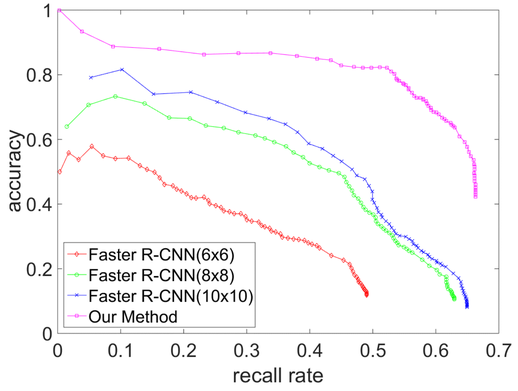
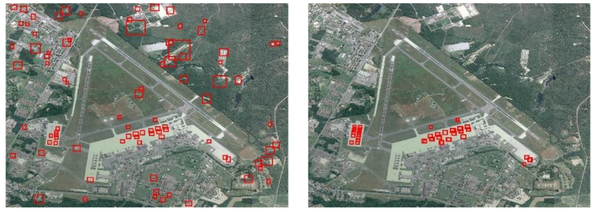


Fig.3 *P-R curves of several methods*

Table.1 Result compare

	Accuracy	Recall Rate	Mean Time
Our Method	**53.64%**	**65.71%**	**1.506s**
F.RCNN(6x6)	19.04%	46.73%	4.872s
F.RCNN(8x8)	17.46%	61.56%	8.445s
F.RCNN(10x10)	13.84%	63.87%	13.166s



(a) (b)

Fig. 5 *Compare between two methods. (a) is the result of Faster R-CNN(6x6), (b) is from our method.*

As the Table 1, Fig 3 and Fig 4 show, compared to the simple separation methods, the RLN based method has many advantages: less running time, higher recall rate and higher accuracy.

References

[1] S. Ren, K. He, R. Girshick, and J. Sun, "Faster r-cnn: Towards real-time object detection with region proposal networks," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. PP, no. 99, pp. 1–1, 2016.
[2] R. Girshick, "Fast r-cnn," in *2015 IEEE International Conference on Computer Vision (ICCV)*, Dec 2015, pp.1440–1448.
[3] Karen Simonyan and Andrew Zisserman, "Very deep convolutional networks for large-scale image recognition" *CoRR*, vol. abs/1409.1556, 2014.