

Tracking of drone flight by neural network Siamese-RPN

Huan Zhou^{1,2} and Baorong Ni¹

¹ Graduate School of Engineering, Fukuoka Institute of Technology, 3-30-1, Wajiro-higashi, Higashi-ku, Fukuoka 811-0295, Japan

² School of Optical Engineering, Nanjing University of Science and Technology, Nanjing, Jiangsu Province 20094, China

1. Introduction

Nowadays, drone has become popular in many industries, such as delivery, photo shooting and pesticide spraying [1-2]. However drone may cause some accidents if it loses its location and gets off track. But there is still no technology which can perfectly avoid accidents. Recently, video object tracking is popular for tracking objects. Siamese-RPN is a new kind of neural network structure for video object tracking. It can be used to help track drones by assisting GPS technology.

2. Video object tracking technology

Video object tracking technology is used to track object in motion. There are a variety of algorithms that can track objects, each having strengths and weaknesses. Recently as convolutional neural network has been proposed, neural network keeps developing and plays an important role in image classification and some other fields. And it shows huge potential in video object tracking.

3. Siamese-RPN

Siamese-RPN is a off-line trained deep learning based tracker that has achieved better result than other state-of-the-art trackers. It consists of two parts, which are Siamese network and region proposal network. Siamese-RPN has its advantages in both accuracy and efficiency according to data shown by the authors [3].

3.1 Siamese Network

A Siamese network is made up of two branches which encode origin image into feature maps and judge by compare two branches of feature maps. Siamese networks have drawn great attention in visual tracking community because of their accuracy and speed. By using Siamese network, Siamese-RPN has high speed and high accuracy than other state-of-the-art correlation filter based methods.

3.2 RPN

Region Proposal Network (RPN) is a neural network proposed in Faster R-CNN to get regions of interest. RPN can get precise proposals because it use neural network to do classification and bounding box regression [4].

4. Approach of tracking drone

In this study, the part of tracking drone in video is completed by Siamese-RPN. To track drone, Siamese-RPN needs a template image for drone comparison. It is also important to choose a template image. And the result gotten by using different template images shows that template images truly affect the result. By using two trackers with different template images, results given were not exactly unanimous and can be total different, shown in Fig.1.

As people know that how neural network performs depends on training dataset. The Siamese Network used in this study was trained by a benchmark dataset. It performs well when the background is bright but can easily lost target when drone goes into dark background. And when drone flies across some dark points, wrong results are also given. Background images are shown in Fig.2.

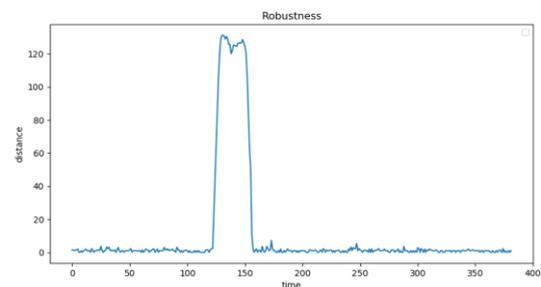


Fig.1 Dark background and bright background



Fig.2 Dark background and bright background

5. Conclusion

In this research, Siamese-RPN was used to track drones in videos. By using Siamese-RPN, drone can be tracked accurately and quickly. However, Siamese-RPN is not good at tracking high-speed moving object because there is no proper training dataset for tracking fast-moving drones. And in this research, it is found that the template image affects the result. In the future, a more complete database of drone flight will be established and it will be figured out whether Siamese-RPN can assist GPS to locate drones .

REFERENCES

- [1] Mogili UR, Deepak BB. "Review on application of drone systems in precision agriculture," *Procedia computer science* 133 (2018): 502-509.
- [2] Dorling K, Heinrichs J, Messier GG, Magierowski S. "Vehicle routing problems for drone delivery," *IEEE Transactions on Systems, Man, and Cybernetics: Systems*. 2016 Jul 14;47(1):70-85.
- [3] Li B, Yan J, Wu W, Zhu Z, Hu X. "High performance visual tracking with siamese region proposal network," *The IEEE Conference on Computer Vision and Pattern Recognition* 2018 (pp. 8971-8980).
- [4] Girshick R. "Fast r-cnn," *The IEEE International Conference on Computer Vision (ICCV)*, 2015, pp. 1440-1448