# Moving Object Tracking Algorithm Design for Unmanned Aerial Vehicle Platform

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***Abstract*-- The unmanned aerial vehicle (UAV) has been continuously developed for military uses, agricultural applications and various livelihood activities. This study proposes a moving object tracking algorithm suitable for UAV that help it automatically tracks the designated object. The prototype algorithm can be divided into three steps: 1) object detection; 2) object feature pixel extraction; and 3) feature pixel matching. The experimental result shows that the execution time can be achieved up to 24 fps under the resolution of 1280x720.**

## I. INTRODUCTION

In recent years, many scholars have proposed UAV-related researches. Yang and Lu proposed an object tracking algorithm using superpixel [1] as the appearance model, but the appearance model has deviation from the beginning and is prone to errors. Wang an Lu further presented an improved object tracking algorithm [2] which can copes with the issues such as light and shadow changes and partial masking especially that it can be easily interfered by background information. In addititon, Li and Yan [3] proved that the objects can be tracked simply by using the background information, and it changed everyone's thinking that the object tracking requires extraction of object information first. The experimental results also show that while the aforementioned method can cope with issues such as dynamic and static backgrounds, illumination change and partial masking as well as achieving excellent tracking accuracy. However, the usage of Principal Components Analysis (PCA) results in excessive amount of computation, and therefore real-time consideration cannot be easily achieved. Meanwhile, Yuan and Fang proposed a tracking algorithm [4] based on the combination of superpixel and depth image. It divides the superpixel area into eight blocks and describes the object using sparse Superpixel-based Discriminative Appearance Model (SSDA). Although this algorithm can deal with issues such as complex background, it requires using color and depth information at the same time to achieve good results.

In this short paper, we propose object detection, feature pixel extraction, and feature pixel matching to overcome the shortcoming of the real-time issue.

## II. OBJECT TRACKING ALGORITHM

### *A. Object detection*

As shown in figure 1 below, this step transfers the image to gray level and divides the pure background region into *n* number of blocks. Similarly, object window is also divided into *m* number of blocks. This step will compare $BG^n$ and $Obj^m$ one by one using SSD(Sum of Squared Differences), so a total of $n*m$ times of comparison will be required.

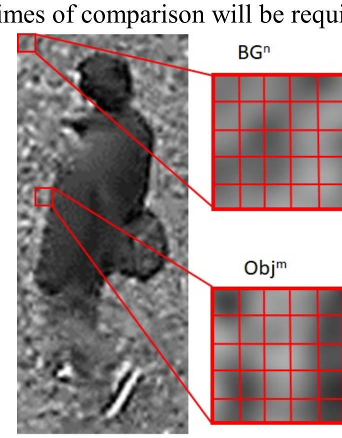


Fig. 1. Object detection SSD.

### *B. Object feature pixel extraction*

Theoretically, we can regard each pixel in figure 2 as the feature pixel, but it will result in excessive amount of computation. To reduce the amount of computation, this step extracts the object feature pixel (OFP) from the object block. The object tracking will be completed through the comparison between OFP and the search window (SW). In this step, since the object is composed of each block the center points of these blocks can be treated as OFP. Figure 3 shows the result of object feature pixel extraction.

## C. Object feature pixel matching

In this paper, this step establishes a SW with the size of $M \times M$ in the current frame. Note that the SW and the object window (OW) have the same center point. Furthermore, the area of the SW must be larger than that of the OW, so this step uses SW($u$,$v$) to represent the search window, with $u$ and $v$ ($u$ = 1 ~ $M$; $v$ = 1 ~ $M$) being the coordinates of the search window.

Since we have obtained the feature pixels of the object, the purpose of this step is to search for a region with a center coordinate at match($u$,$v$) in the search window, and the aforesaid region will have the highest similarity with the object window.

Fig. 2. Object detection.

Fig. 3. Object feature pixel

# III. EXPERIMENTAL RESULT

As shown in Fig. 4, this paper realized the aforementioned algorithm in a PC equipped with an Intel i7 CPU using c language. The test video has the resolution of 1280x720, and the average execution speed could be up to 24 fps.

Fig. 4. Tracking result.

# IV. CONCLUSION

This paper proposes an object tracking algorithm for UAV. The background information is used to detect the object area, and ensures that the extracted feature comes from the object itself. In addition, this algorithm can quickly obtain representative object feature pixels and use them to locate the candidate area with smaller color variation pixels in the SW through computation. That area will be the object area. The experimental results show that the proposed algorithm can achieve real-time image processing in 1920x1080 sequence images.

# REFERENCES


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