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Improved CAMshift Algorithm Based on Kalman Filter

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Abstract. In this paper, we describe a Continuously Adaptive Mean Shift (CAMshift) algorithm with a Kalman filter. A CAMshift algorithm does not consider an object's direction vectors and velocity. In addition, sometimes, CAMshift loses the tracked object when the color of the background is similar to that of the object. However, using a Kalman filter with the CAMshift algorithm can overcome these disadvantages and reduce image error compensation.

Keywords: CAMshift, Kalman Filter, Tracking

1 Introduction

CAMshift is an algorithm for tracking in real time. However, it has some disadvantages. For example, it is difficult to detect when an object moves quickly and when the color of the background is similar to that of the object. In this paper, a CAMshift algorithm with a Kalman filter is proposed. Through Kalman filtering, direction and prediction coordinates can be derived.

2 Related theory

In this section, CAMshift and Kalman filter theory are described.

2.1 CAMshift

The Continuously Adaptive Mean Shift (CAMshift) algorithm is based on the Meanshift algorithm [1][2]. The Meanshift algorithm works well on static probability distributions but not on dynamic ones, as in tracking movement. (CAMshift) can be summarized by the following steps [3]. First, set the region of interest (ROI) of the probability distribution image to the entire image. Second, select an initial location of the Meanshift search window. The selected location is the target distribution to be tracked. Third, calculate a color probability distribution of the region center at the Meanshift search window. Fourth, iterate the Meanshift algorithm to find the centroid of the probability image. Store the zeroth moment (distribution area) and centroid location. Last, for the following frame, center the search window at the mean location

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found in Step 4, and set the window size to a function of the zeroth moment (then go to Step 3).

2.3 Kalman filter

Kalman filtering, known as linear quadratic estimation (LQE), is an algorithm that uses a series of measurements observed over time, containing noise (random variations) and other inaccuracies, and produces estimates of unknown variables that tend to be more precise than those based on a single measurement alone 4]. The algorithm uses two steps: the predict step and the correct step [4].

3 Proposed method & results

We proposed system algorithm is following Fig. 1.

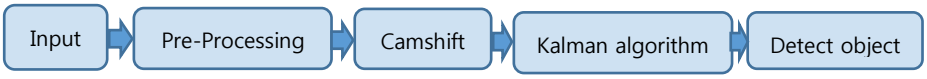

Fig. 1. Proposed method

The first processing step is getting the input image. Then, the input image is converted to remove noise. Next, CAMshift with the Kalman filter is used to track the object. From the result, we can detect an object. An example is given in Fig. 2.

(a) Without Kalman (b) With Kalman

Fig. 2. Final result

(a) Result without Kalman filter and (b) with Kalman filter. The red circle represents the tracking result. In (a), it is difficult to distinguish the object, but in (b), it is easy to distinguish the object. In this research, we know that CAMshift with Kalman help to detect objects stably.

Table 1. Kalman filter coordinates (note)

count	Predict coordinates(x,y)	Correct coordinates(x,y)	Measure coordinates(x,y)
Time 1	(0,0)	(120,68)	(118, 65)
Time 2	(120,67)	(118,72)	(115,68)
Time 3	(124,72)	(124,75)	(124,74)
Time 4	(126,74)	(123,75)	(126,75)
Time 5	(124,77)	(126,75)	(127,74)

When we see the Kalman filter calculation coordinates, it presents in Table 1.

Conclusion

In this paper, we use CAMshift with Kalman filter. When we use only CAMshift, it is difficult to detect when objects have various color. However, CAMshift with Kalman filter algorithm could detect when objects have various color. This mix could detect object stably.

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References

1. John, G., Allen, Richard, Y. D. Xu., Jesse, S.jin.: Object Tracking Using CAMshift Algorithm and Multiple Quantized Features Spaces. In: Proceeding VIP '05 Proceedings of the Pan-Sydney area workshop on Visual information processing, pp. 3-7, Darlinghurst (2014)
2. P. Hidayatullah, H. Konik.: CAMSHIFT improvement on multi-hue and multi-object tracking, In: Electrical Engineering and Informatics (ICEEI), pp. 1--6. 2011 International Conference on. IEEE, Bandung (2011)
3. Fahad Fazal Elahi Guraya, Pierre-Yves Bayle, Faouzi Alaya Cheikh. : People Tracking via a Modified CAMSHIFT Algorithm,1Department of Computer Science and Media Technology, Gjovik University College, 2Department of Computer Science, Universite de Bourgogne (2009)
4. Ristic, Branko, Sanjeev Arulampalam, Neil Gordon.: Beyond the Kalman filter: Particle filters for tracking applications, In: Artech House, London (2004)

