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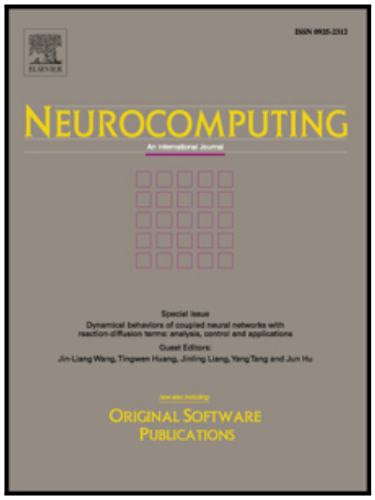

A hybrid tracking framework based on kernel correlation filtering and particle filtering

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A hybrid tracking framework based on kernel correlation filtering and particle filtering

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Abstract

Recently, the visual object tracking based on correlation filtering has achieved great success. However, there are still some problems need to be improved, such as the scale variation of the target, and so on. Particle filtering (PF) is another commonly used tracking technology. The drawback of PF is that a large number of particles is needed. In this paper, we propose a hybrid tracking framework based on a kernel correlation filtering model and a PF model to complement these two techniques. A local sparse coding is acted as the appearance model of the PF model. First, the kernel correlation filter model is used to obtain the preliminary position of the target. On the basis of the preliminary position of the target, the PF model is used to locate the target further and to capture the scale variation of the target. Finally, both qualitative and quantitative analyses on challenging benchmark with 100 sequences prove the effectiveness of our hybrid tracking framework.

Keywords: kernel, correlation filtering, sparse coding, visual tracking, particle filtering

1. Introduction

Visual object tracking [1] is a very challenge field in compute vision for complex application surroundings. Recently, benefited from the rapid development of the compute vision technology, the technology of visual object tracking has made great progress. However,visual object tracking is still very challenging for complex application surroundings, such as scale variation, background blur, illumination changes, and the target deformation due to the changes of camera view and so on. To deal with these complex application surroundings, researchers have put forward a variety of trackers. According to the predict strategy of the target, these trackers can be divided into generative model, discriminative model and hybrid model.

Trackers with generative model always locate the target by search for an appropriate window, which is lies around the target and is most similar to the target. Chiverton and Xie [2] propose an automatic online learning model based on an active-contour shape and bootstrapping stage. Liu et al. [3] propose an online learning tracking algorithm based on a hybrid model to extract multiple features, such as sketch,texture and flatness. Lu et al.[4] propose an subspace learning algorithm based on graph embedding. Recently, sparse coding [5 - 10] is used for visual object tracking and has achieved great succeed. The advantage of these trackers based on sparse coding is that sparse coding is good at scale change, partial occlusion, etc. The disadvantage of these trackers based on generative model is that the template learning of the target cause cumulative error to the target, which make the tracker drift the target periodically.

Recently, visual object tracking based on discriminative model has received great attention from scholars, which consider object tracking as a classification problem. Discriminative appearances models [11 - 13] are proposed to predict the target by online classifier with Statistical machine learning method. Benefit from the use of correlation filtering in visual object tracking [14, 15], visual object tracking based on discriminative model has been further developed. Henriques et al. [16, 17] propose a correlation filter based on kernel and circulant matrices, which achieve great success in both accuracy and effectiveness. In addition, trackers based on correlation filtering in recent years [18 - 22, 51] have achieved good performance also.

The visual object tracking method has its own characteristic based on generative model and discriminative model, respectively. Therefore, scholars propose hybrid model based on generative model and discriminative model. Aeschliman et al. [23] propose a hybrid model with a probabilistic framework, which infuse segmentation into the visual object tracking method. Wang et al. [24] learn sparse coding and a linear classifier from the original image block directly. Zhong et al. [25] combine with a sparsity-based discriminant classifier and a

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