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AN EFFICIENT MULTIPLE CUES SYNTHESIS FOR HUMAN TRACKING USING A PARTICLE FILTERING FRAMEWORK

Md. Zahidul Islam, Chi-Min Oh and Chil-Woo Lee*

School of Electronics and Computer Engineering
Chonnam National University
Gwangju, South Korea
{ zahid; sapeyes }@image.chonnam.ac.kr
*Corresponding author: leecw@chonnam.ac.kr

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Abstract. *In visual tracking situations, the appearance of both humans and the surrounding scenes may experience enormous variations due to changes in the scale and viewing angles, partial occlusions or in the interactions of a crowd. These challenges may weaken the effectiveness of a dedicated target observation model, even when based on multiple cues. Towards this end, we propose a new way to integrate a multiple cues synthesis for effective human tracking in video sequences by using particle filtering to process the features from video frames. We adapt the method used to combine specifically devised models based on different cues in this tracker in order to enhance the discriminative power of the integrated observation model in its local neighborhood and to minimize the occlusion problem. This is achieved by an efficient observation model that is formulated from multiple visual cues, namely the color and the edge shape, which are described using highly non-linear models. There is difficulty in representing the human spatial shape in a cluttered background; this is the main barrier in constructing an efficient observation model. This difficulty can be minimized by representing the human body using a Multi-Part Histogram (MPH) combined with a Distance Transform (DT) image. The reference and target objects are represented by a sub-region using integral image techniques. Each region has its own histogram; we calculate the weight of each particle based on its regional position in the target object. The most weighted particle settles on the central position of the bounded target and gradually decreases the particle weight vertically and horizontally from this central position. The advantages of this are an increased robustness and an improved accuracy against false target tracking and severe occlusions. An extensive evaluation of the proposed algorithm was investigated and compared to another color based human tracker using the CAVIAR and the perceptiVU databases, as well as our own.*

Keywords: Particle filter, Multi part histogram, Distance transform, Multi cues, Tracking

1. **Introduction.** Human tracking has a great significance in many vision applications, such as human-computer interfaces, road traffic control, security and visual surveillance systems. This paper addresses the problem of human tracking in video sequences, with an emphasis on false target tracking and occlusions in a cluttered dynamic background. Even though many recent vision algorithms are very successful, they lack robustness, since they are typically restricted to a particular circumstance. Therefore, it is appealing to fuse multiple cues into one observation model. In this paper, we investigate the concept that an efficient multiple cues synthesis using a particle filtering framework can significantly increase the robustness of vision based tracking systems using a single monocular camera.

Recently, particle filters have been applied successfully to various state estimation problems, such as visual object tracking [1-4,9,12], since they have recently been proven to be