A Study on the Gesture Recognition Based on the Particle Filter

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Abstract. The recognition of human gestures in image sequences is an important and challenging problem that enables a host of human-computer interaction applications. This paper describes a gesture recognition algorithm based on the particle filters, namely CONDENSATION. The particle filter is more efficient than any other tracking algorithm because the tracking mechanism follows Bayesian estimation rule of conditional probability propagation. We used two models for the evaluation of particle filter and apply the MATLAB for the preprocessing of the image sequence. But we implement the particle filter using the C++ to get the high speed processing. In the experimental results, it is demonstrated that the proposed algorithm prove to be robust in the cluttered environment.

1 Introduction

Gesture is one interesting subspace of human motion. For the purposes of this paper, we define gesture to be motions of the body that are intended to communicate to another agent. Recently human gesture has received much interest in computer vision field for the applications such as human interface, robot, medicine, animation, video database, intelligent surveillance and virtual reality.

In this paper, we focused into the development of human gesture recognition using particle filter. Particle filter[1] is based on the Bayesian conditional probability such as *prior* distribution and *posterior* distribution. First of all, we expanded the existing algorithm[2] to derive the CONDENSATION-based particle filter for human gesture recognition. Also, we adopt the two hand motion model to confirm the algorithm performance such as leftover and paddle.

MATLAB package is used to preprocess the raw image data and tracking algorithm is implemented by the C++ language. The overall scheme for the gesture recognition system is shown in Figure1.

This paper consist of as follows: Following the introduction, CONDENSATION algorithm and its related model is described in Section 2 and the motion

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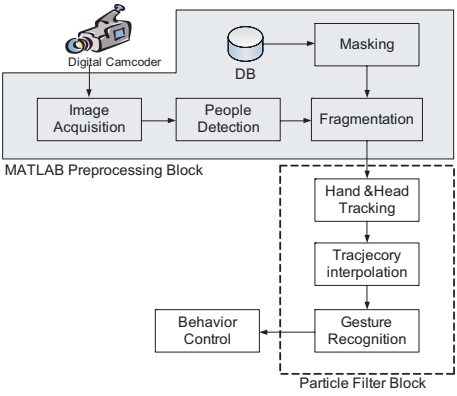

Fig. 1. Overall operation block diagram of recognition system

extraction process for the proposed algorithm test is explained in Section 3. In Section 4, the result of experiment for the proposed algorithm is described and finally, conclusion is followed.

2 Condensation Algorithm

2.1 Condensation Algorithm

The particle filter approach to track motion, also known as the condensation algorithm [1] and Monte Carlo localisation [**?**], uses a large number of particles to explore the state space. Each particle represents a hypothesised target location in state space. Initially the particles are uniformly randomly distributed across the state space, and each subsequent frame the algorithm cycles through the steps illustrated in Figure 2:

1. Deterministic drift: particles are moved according to a deterministic motion model (a damped constant velocity motion model was used).
2. Update probability density function (PDF): Determine the probability for every new particle location.
3. Resample particles: 90with replacement, such that the probability of choosing a particular sample is equal to the PDF at that point; the remaining 10throughout the state space.
4. Diffuse particles: particles are moved a small distance in state space under Brownian motion.

This results in particles congregating in regions of high probability and dispersing from other regions, thus the particle density indicates the most likely target states. See [3] for a comprehensive discussion of this method. The key strengths of the particle filter approach to localisation and tracking are its scalability (computational requirement varies linearly with the number of particles),