Multi-Objects Recognition and Tracking using the Fusion Algorithm in Robotic Space

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Abstract. The Robotic Space is the space where many intelligent sensing and tracking devices, such as computers and multi sensors, are distributed. According to the cooperation of many intelligent devices, the environment, it is very important that the system knows the location information to offer the useful services. In order to achieve these goals, we propose a color model based method for tracking multi-robot using a networked camera system in robotic space as a human-robot coexistent system. An intelligent space is a space where many intelligent devices, Experiments are carried out to evaluate the proposed performance.

1 Introduction

Detection of moving objects has been utilized in industrial robotic systems, for example, in the recognition and monitoring of unmanned systems that also require compression of moving images [1],[2],[3],[4]. Trajectory prediction of moving objects is required for a mobile manipulator that aims at the control and observation of motion information such as object position, velocity, and acceleration. Prediction and estimation algorithms have generally been required for industrial robots.

Fig. 1. Robotic space by distributed network camera
The robotic space has to track the objects without failure and to get the location of objects by network sensors seamlessly for these services. Seamless tracking and localization of objects must be achieved in order that the robotic space works properly. In this paper, color appearance based object representation for the networked vision system in the robotic space is described [5].

2 Tracking of Multi-Objects

2.1 Extraction of Object

Classifying the moving-objects pattern in the dynamically changing unstructured environment has not yet been tackled successfully. Therefore, in this research, the camera was fixed on a stable platform in order to capture static environment images. To estimate the states of the motion characteristics, the trajectory of the moving object was pre-recorded and analyzed. Fig. 2(a) and Fig. (b) represent the object images at (t-1) instance and (t) instance, respectively [6].
As recognized in the images, most parts of the CCD image correspond to the background. After eliminating the background, the difference between the two consecutive image frames can be obtained to estimate the moving-object motion. To compute the difference, either the absolute values of the two image frames or the assigned values can be used. The difference method is popular in image pre-processing for extracting desired information from the whole image frame, which can be expressed as

$$\text{Output}(x, y) = \text{Image}_1(x, y) - \text{Image}_2(x, y)$$

The difference image between Fig. 2(a) and Fig. 2(b) is represented in Fig. 2. When the difference image for the whole time interval can be obtained, the trajectory of the moving object can be calculated precisely. Figure 3 presents a typical eigenvector of three human as objects in a convoy.

![Fig. 3. Color models of three objects](image)

### 3 Conclusions

In this paper, the proposed tracking method adds an adaptive appearance model based on color distributions to particle filtering. The color-based tracker can efficiently and successfully handle non-rigid and fast moving objects under different appearance changes. Moreover, as multiple hypotheses are processed, objects can be tracked well in cases of occlusion or clutter. This research proposes estimation and tracking scheme for a moving object using images captured by multi cameras.

This paper presents a representation of color model based on the proposed Mean Shift Tracking Process (MSTP), in which the structure of the tracking process could be construct with Kalman filter. Then, the local color model and the global color model was proposed based on extracting the objects by background subtraction and creating color histogram. The application of this model achieves the robust tracking of multiple objects seamlessly among different cameras. In the experiments, the comparison method of the global models obtained by different cameras will be described. Effec-
tiveness of the global model for seamless tracking will be also evaluated quantitatively. Integrating discriminant analysis and the Kalman framework, the proposed MSTP algorithm offers a means to relax the assumption of probabilistic structures of data distribution. In addition, the proposed global color based algorithm is able to tracking a good color space automatically. Some promising color-based tracking results were also achieved by the MSTP approach.

As future research, selection of a precise learning pattern for SOM in order to improve the estimation accuracy and the recognition ratio, and development of an illumination robust image processing algorithm, remain.

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References