

Thesis Title	Multiple Non-rigid Object Tracking by Robust Object Model, Improvement of Matching and Nearest Neighborhood Data Association
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Abstract

This thesis presents a method for object tracking based on an image sequence obtaining from a single fixed camera found in surveillance systems or related applications. The thesis focuses on non-rigid objects whose tracking information such as shapes, directions, and velocities frequently varies and is difficult to be measured accurately especially when objects are occluded. The novelty of this thesis is three-fold.

Firstly, a new object model for non-rigid objects is proposed based on the robustness of the model against the changes of shape, direction and velocity of the object. Whenever a new object appears in the camera's field of view, its model is formed using the four corner and the center points of the rectangle covering the whole body of the object. Together with the four corners points, the average size (the width and height) of the model is calculated and updated in every frame. This allows us to keep track of the object even if the object is occluded provided that at least one of the five points of the model is found.

Secondly, a more reliable prediction method is proposed. Instead of relying on only the information in the previous frame, the averages direction and speed of N previous frames are used to predict the next location of the object. The averages are updated in every frame.

Mahalanobis distance function between predicted locations of tracking objects and the newly detected objects are calculated. An assignment matrix whose elements are the calculated distances is constructed. The matching is performed by first eliminating redundant elements of the matrix and then pairs of a tracking object and a detected object are matched based on the nearest neighborhood data association.

The proposed methods are evaluated by various experiments. First, the prediction errors of the proposed method and the conventional method are compared in both simulation and experiment. The results show that the proposed method has less error especially for the cases of objects changing directions. The matching and modeling methods are tested together under the conditions of up to 3 tracking objects moving in various paths such as merging of multiple objects or partial occluding by static objects. The results show that 9 of 12 cases are correct. The incorrect tracking is caused by the error in detection and predictions. The prediction error is caused by suddenly changing of the object shape and the acceleration of the objects.

Keywords : Multiple Object Tracking / Video Surveillance System / Object Correspondence
/ Matching Method / Image Processing