THE SUMMARY OF Ph. D. DISSERTATION

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Title

Spatio-temporal image processing methods based on the motion direction of objects, and their application to road surveillance technology

In this study, I have proposed spatio-temporal image processing methods based on the motion direction of objects in order to create road surveillance sensors. These methods deal with the following two road surveillance cases:

- Objects moving on a nearly constant path of a plane that are constrained to some extent.

- Objects moving at random.

For the first case, I proposed a Directional-Temporal plane Transform (DTT) method, which transforms spatio-temporal images to 2-D data and onto a directional-temporal plane. I also clarified the properties of DTT. Transformation is achieved by projecting the feature data of objects in a processing area to a directional axis roughly parallel to the moving loci, and by placing the projected data streams side by side in temporal order.

For the application of DDT to road surveillance, I proposed an algorithm that recognizes vehicles from binarized DTT images. In addition, to reduce errors caused by vehicles driving in other lanes, I demonstrated a technique that adaptively changes the processing

areas by comparing the areas' positions with the positions of 3-D vehicle models.

I also proposed an algorithm that measures the velocity for a group of vehicles by matching patterns of DTT data at specific points. This algorithm is applied when vehicles overlap each other in the images.

Moreover, I proposed an algorithm that classifies the traffic flow (including some incidents) through a neural network using the edge-directional histogram of the DTT image.

For the second road surveillance case, I proposed a method that extracts objects that are a regular distance apart from each other in spatio-temporal data, and then calculates their spatio-temporal distribution. I demonstrated an algorithm of snowfall detection as an application of this method.

Products using some of these application algorithms have already been utilized as road surveillance sensors.