DISTRIBUTED ALGORITHMS FOR CAMERA NETWORK LOCALIZATION AND MULTIPLE TARGET TRACKING USING MOBILE ROBOTS

By

Seema Kamath

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Prof. Volkan Isler
Thesis Adviser

Rensselaer Polytechnic Institute
Troy, New York

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ABSTRACT

Camera networks are gaining popularity due to the information rich sensing modality of cameras. Some important problems arise while migrating from traditional sensor networks to networks that use cameras as their primary sensing modality. One such problem is that of localization. Localization is the process of finding the pose (position and orientation) of objects in a common frame of reference. It is studied in two different contexts; localization of the cameras/sensors themselves and then localization of targets which the camera network is tracking.

Distributed algorithms are developed for both the problems in this thesis. A fully automated static camera network calibration strategy is proposed and simulated. The algorithm uses probabilistic methods to account for the errors in state updates and measurements. A distributed multi-target tracking application is studied for a mobile camera network. Two algorithms, based on Loopy Belief Propagation (LBP) and Tree Re-Weighted (TRW) algorithm, are evaluated to solve the problem of tracking targets in a network of cameras that have pairwise dependencies. LBP was found to perform better than TRW in our simulations. A prototype of the tracking algorithm using LBP is implemented to show the feasibility of the algorithm in practice.