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Data Association in Multi Target Tracking Using Cross Entropy Based Algorithms

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Abstract

Multiple-target tracking (MTT) in the presence of spurious measurements poses difficult computational challenges related to the measurement-to-track data association problem. Different approaches have been proposed to tackle this problem, including various approximations and heuristic optimization tools. The Cross Entropy (CE) and the related Parametric MinxEnt (PME) methods are recent optimization heuristics that have proved useful in many combinatorial optimization problems. They are akin to evolutionary algorithms in that a population of solutions is evolved, however generation of new solutions is based on statistical methods of sampling and parameter estimation. In this work we apply the Cross-Entropy method and its recent MinxEnt variant to the multi-scan version of the data association problem in the presence of misdetections, false alarms, and unknown number of targets. We formulate the algorithms, explore via simulation their efficiency and performance compared to other recently proposed techniques, and show that they obtain state-of-the-art performance in hard scenarios.

Index Terms

Target tracking, data association, combinatorial optimization, Kalman filtering, cross-entropy method, Monte-Carlo methods

I. Introduction

Multiple-target tracking (MTT) is an essential component of surveillance-related systems. A general formulation of the problem assumes an unknown and varying number of targets that are continuously moving in a given region. In the single-sensor version, the states of these targets are sampled by the sensor and the noisy measurements are provided to the tracking system. The detection probability is not perfect and the targets may go undetected at some sampling intervals. In addition, there are spurious reports of possible targets, or clutter measurements which arise independently of the targets of interest. A primary task of the MTT system is data association,

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