

Statistical Model for Tracking with Applications

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ABSTRACT

We propose a new tracking model that allows for birth, death, splitting and merging of targets. Targets are also allowed to go undetected for several frames. The splitting and merging of targets is a novel addition for a statistically based tracking model. This addition is essential for the tracking of storms, which is the motivation for this work. The utility of this tracking method extends well beyond the tracking of storms. It can be valuable in other tracking applications that have splitting or merging, such as vortexes, radar/sonar signals, or groups of people. The method assumes that the location of a target behaves like a Gaussian Process when it is observable. A Markov Chain model decides when the birth, death, splitting, or merging of targets takes place. The tracking estimate is achieved by an algorithm that finds the tracks that maximize the conditional density of the unknown variables in the data. The problem of how to quantify the confidence in tracking estimate is addressed as well. Finally, some sufficient conditions for consistency of this tracking estimate are presented and an almost sure convergence of the tracking estimate to the true path is proved. The practical suitability of this method is then demonstrated on simulated and real data.

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