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[2009-0166] 基于 SMC-PHDF 的部分可分辨的群目标跟踪算法

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摘要

文提出一种基于粒子概率假设密度滤波器(Sequential Monte Carlo probability hypothesis density filter, SMC-PHDF)的部分可分辨的群目标跟踪算法.该算法可直接获得群而非个体的个数和状态估计. 这里群的状态包括群的质心状态和形状.为了估计群的个数和状态,该算法利用高斯混合模型(Gaussian mixture models, GMM)拟合 SMC-PHDF 中经重采样后的粒子分布,这里混合模型的元素个数和参数分别对应于群的个数和状态. 期望最大化(Expectation maximum,EM)算法和马尔科夫链蒙特卡洛(Markov chain Monte Carlo, MCMC)算法分别被用于估计混合模型的参数.混合模型的元素个数可通过删除,合并及分裂算法得到. 100次蒙特卡洛(Monte Carlo, MC)仿真试验表明该算法可有效跟踪部分可分辨的群目标. 并且相比EM算法,MCMC算法能够更好地提取群的个数和状态,但它的计算量要大于EM算法.

关键词 群目标跟踪 粒子概率假设密度滤波器 高斯混合模型 期望最大化算法 马尔科夫链蒙特卡洛算法

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[2009-0166] Tracking Partly Resolvable Group Targets Using SMC-PHDF

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Abstract

This paper proposes to track the partly resolvable groups using sequential Monte Carlo probability hypothesis density filter (SMC-PHDF). The estimate of the number and the states of the groups, rather than the individuals, is directly derived by the algorithm. The state of a group here consists of its centroid state and shape. In order to estimate the number and the states of the groups, the proposed algorithm fits the distribution of the resampled particles of the SMC-PHDF via %by application of Gaussian mixture models (GMM), whose component number and parameters correspond to the number and the states of the groups. Expectation maximum (EM) and Markov chain Monte Carlo (MCMC) algorithms are respectively used to estimate the parameters of the mixture. The component number of the mixture is derived by the strategy of pruning, merging and splitting. 100 Monte Carlo (MC) simulations show that the proposed approach can track the partly resolvable groups effectively. Besides, the MCMC algorithm outperforms the EM algorithm significantly in extracting the number and the states of the groups, although its computational requirement is larger than the EM algorithm.

Key words

group targets tracking (GTT) sequential Monte Carlo probability hypothesis density filter (SMC-PHDF) Gaussian mixture models (GMM) expectation maximum (EM) Markov chain Monte Carlo (MCMC)

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