Real-Time Implementation of a Random Finite Set Particle Filter

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Abstract: In scenarios characterized by a high object density, data association is a demanding task due to several ambiguities. Especially the assumption that all objects move independent from each other may lead to physically impossible predicted states, in which two objects are closer to each other than feasible. Thus, avoiding such impossible states may simplify the data association. Within the random finite set statistics it is possible to easily incorporate constraints concerning object states and to integrate them into a multi-target Bayes filter. A drawback of the random finite set statistics is its computational complexity, especially in the corrector step. In this contribution, a fast approximation for the calculation of the multi-target likelihood function is proposed. This approximation is used to implement a real-time random finite set particle filter on a graphical processing unit using real world sensor data.