Using a Probabilistic Hypothesis Density filter to confirm tracks in a multi-target environment

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Abstract: In this paper, we aim to perform scalable multi-target particle filter tracking. Previously, the authors presented an approach to track initiation and deletion which maintains an existence probability on each track, including a "search track" which represents the existence probability and state distribution of an unconfirmed track. This approach was seen to perform well even in cases of low detection probability and high clutter levels, but modelling all unconfirmed tracks by a single-target search track can be problematic if more than one target appears in a sensor's field of view at the same time. To address this, we replace the search track with a Probabilistic Hypothesis Density (PHD) filter which can maintain a density over several unconfirmed tracks. A method is proposed to derive probabilities of measurements originating from targets, allowing us to confirm tracks when these probabilities reach a threshold. We observe that in so doing, we implicitly solve the track-labelling challenge that otherwise exists with PHD filters. This is shown to maintain good tracking performance for high-clutter, low-detection scenarios while addressing the shortcomings of the single-target search track approach. We also show results from a scenario with obscured regions where the target cannot be detected, and show that targets can be tracked through the obscurations.