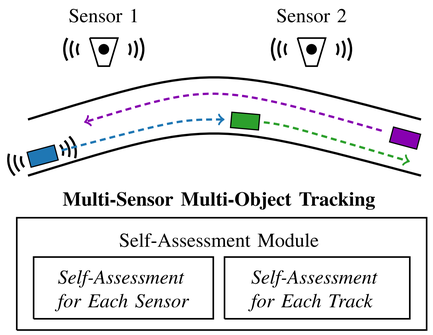
Thomas Griebel, Nikolas Dehler, Alexander Scheible, Michael Buchholz, and Klaus Dietmayer

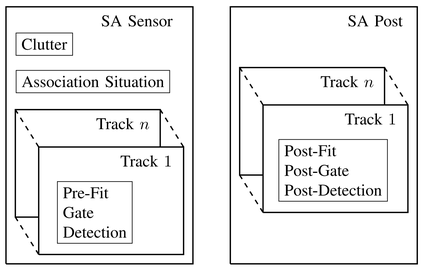
Self-Assessment for Multi-Object Tracking Based on Subjective Logic

Motivation



The proposed unified self-assessment module for multi-sensor multi-object tracking obtains self-assessment scores for each sensor and each track.

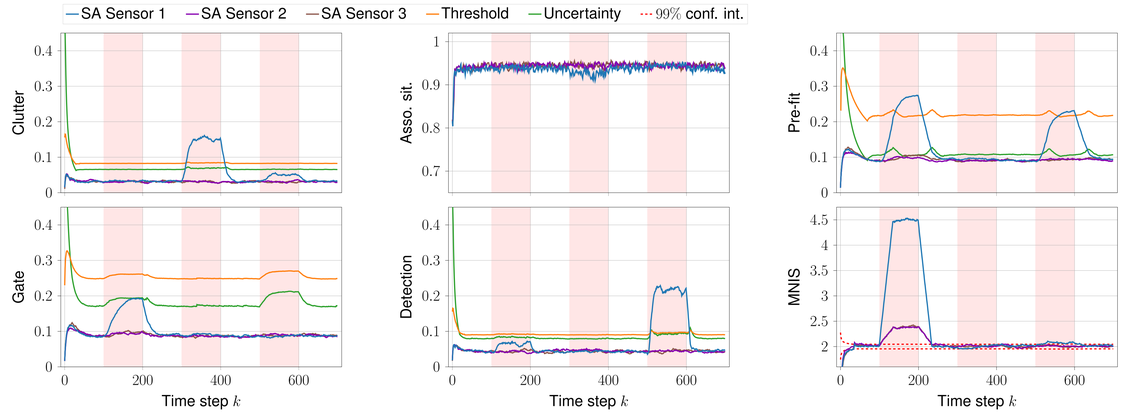
Proposed Self-Assessment Module



Overview of the implemented self-assessment (SA) module for multi-object tracking (MOT). The SA Sensor assesses each sensor's specific assumptions, and the SA Post assesses the algorithm's overall assumption fulfillment for each track.

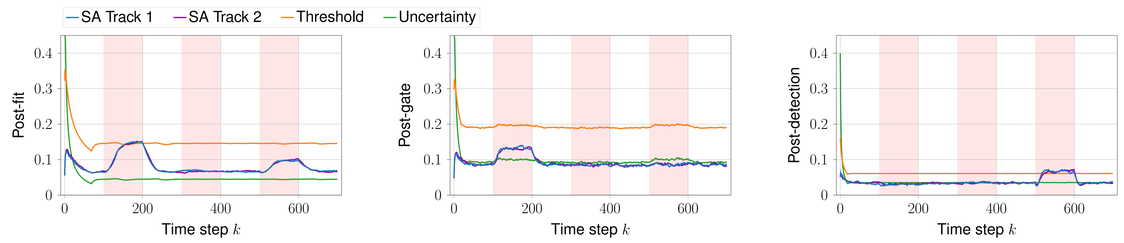
Simulation Results

Self-Assessment Module for Each Sensor



The full SA Sensor module results for all three sensors are shown and compared to the time-averaged multi-target normalized innovation square (MNIS) [1]. Sensor 1 is disturbed in its measurement noise, clutter rate, and detection probability assumptions, whereas Sensors 2 and 3 work properly. Red shadows indicate these disturbances, which are monitored by the SA module. A violation is reported when the SA measures exceed the thresholds or the confidence interval (conf. int.).

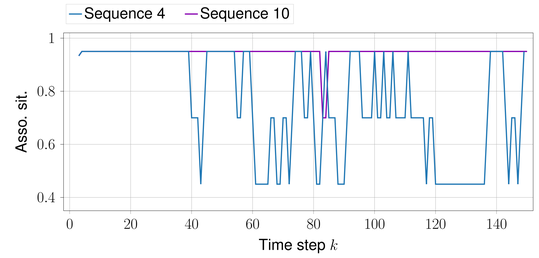
Self-Assessment Module Post for Each Track



The full SA Post module results are shown to monitor the overall tracking performance. Because the Sensor 1 disturbances influence both tracks, both SA measures increase, leading to small violation reports in the post-fit and post-detection opinions.

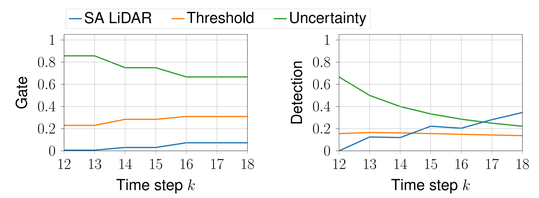
KITTI Evaluations

Association Situation



Association situation results of the LiDAR detections from the KITTI dataset [2] evaluated on Sequences 4 and 10. Sequence 4 has many cars parked close to the street, leading to many ambiguous association situations. In contrast, Sequence 10 is mostly a clear scenario where the ego vehicle follows another vehicle.

Initiation of a False-Positive Track



SA measures of a false-positive initiated track in Sequence 10 of the KITTI tracking dataset [2]. The false-positive track can be identified by the SA module. Firstly, the detection opinion exceeds the threshold before the deletion algorithm catches the track. Secondly, the uncertainty of the gate opinion remains high due to missed detection.

References

[1] R. Mahler, "Divergence detectors for multitarget tracking algorithms," in Signal Processing, Sensor Fusion, and Target Recognition XXII, vol. 8745. SPIE, 2013.

[2] A. Geiger, P. Lenz, and R. Urtasun, "Are we ready for autonomous driving? The KITTI vision benchmark suite," in 2012 IEEE Conference on Computer Vision and Pattern Recognition. IEEE, 2012.

Acknowledgment

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Contact

All authors are with the
Institute of Measurement, Control and Microtechnology,
Ulm University,
Albert-Einstein-Allee 41, 89081 Ulm, Germany
{firstname}.{lastname}@uni-ulm.de