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# Deployment and Evaluation of a Cooperative Fusion Algorithm on Real Vehicles

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*In autonomous vehicle applications, it is important to interpret the surroundings. This can be done with sensor systems such as cameras, Lidars or radars. A problem occurs when objects of interest are occluded and creating sensors to handle these cases would be expensive and in some cases impossible. Another approach is to make multiple cars work together in a cooperative fashion, by sharing objects of interest in a global frame. By doing this, cars can retrieve vital information of obstacles in its trajectory that was not possible before. To do this several tasks have to be tackled. One of these tasks is correct localization in the global frame and another is communication between the objects. In this project a cooperative fusion system is expanded upon. It consists of two vehicles that extracts objects from Lidar data. These objects are then fused to improve the accuracy of the estimated object position and provide information in occluded areas. The main focus of this work is to improve upon the system to enable better localization, object detection, tracking and cooperative fusion of targets.*

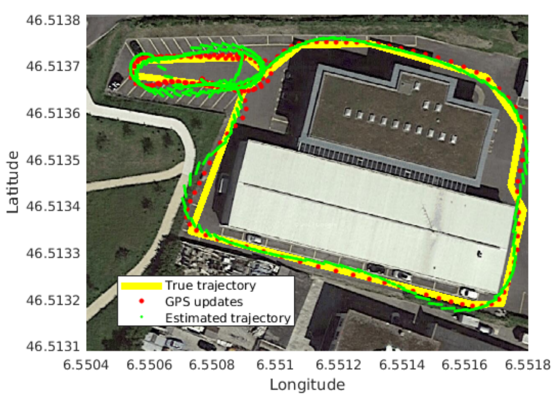


*Figure 1: Final Kalman filter adjustments*

The first task was to modify the Kalman filter for localization, fusing sensors from car 2. By adjusting parameters and rem oving sensors that caused large bias, it was possible to get a better trajectory for the vehicle.
The trajectory was not perfect, which is mainly due to the noisy sensors and that the GPS was used for both heading and position correction

In the object detection part it was possible to create a more robust corner or line fitting, but in scenarios where cars had a more round front or where laser measurements were reflected on the grill/headlights the assumption of considering the car as a rectangle shape did not hold.

We expanded the sensing model to include information from a Mobileye camera which showed to make the tracking more robust to falsely identified objects. By using the Mobileye as a birth component in the PHD filter a good combination of the camera object identification and the Lidar precision was obtained. After this was done a better approach for the cooperative fusion data association was created, by introducing a cost based approach with costs from the Mahalanobis distance of tracked objects. This proved to give good results and did not cause sudden jumps in position as the prior approach. Two test scenarios were then created and run 15 times each, to test the cooperative fusion. Interpreting these tests was not the scope of this project, but rather the test creation was.