Multi-sensor on-the-fly localization: Precision and Reliability for Applications

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1. What has been done in the paper? What is the purpose of the paper? What does the paper contribute with?

2. The authors use as features infinite long vertical and horizontal lines – what causes a vertical respective horizontal line?

3. The authors mention one important thing that is needed if it should be possible to fuse the sensor data from several sensor systems – what is this important thing?

4. Section 4 describes the Extended Kalman filter (EKF) used for the multi-sensor localization system. The localization cycle is divided into five steps – which are these steps and what do the do? What parameters (i.e. vehicle position, sensor positions, sensor reading, uncertainties etc.) affect the different steps?

5. Especially the Matching step is by the authors considered very important – why? What could go wrong if the Matching step fails? How is the Matching step carried out?

6. The Matching step uses the Mahalanobis distance as a validation gate – what is actually validated? What parameters affect the validation? What happens if more than one feature passes the validation gate? Why is it a problem with several features passing the validation gate? What do z_1 and $\hat{z}_1$ in Equation 10 (the validation gate) represent (illustrates this with a small example)? Why should we use the Mahalanobis distance instead of the simple Euclidian distance?

7. The time stamps play an important role – why? The problem with a localization system built on multiple sensors is that the execution times differ between different sensors. How do they keep track of the position and how do they update the position on-the-fly?

8. In the experiment carried out at the Computer 2000 Event the robot (occasionally) couldn't make any observations of the environment (because of people blocking the sensors) – how was the localization system affected by this?