Sensor Model Identification via Simultaneous Model Selection and State Variable Determination (Abstract Reprint)

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Abstract

We present a method for the unattended gray-box identification of sensor models commonly used by localization algorithms in the field of robotics. The objective is to determine the most likely sensor model for a time series of unknown measurement data, given an extendable catalog of predefined sensor models. Sensor model definitions may require states for rigid-body calibrations and dedicated reference frames to replicate a measurement based on the robots localization state. A health metric is introduced, which verifies the outcome of the selection process in order to detect false positives and facilitate reliable decision-making. In the second stage, an initial guess for identified calibration states is generated, and the necessity of sensor world reference frames is evaluated. The identified sensor model with its parameter information is then used to parameterize and initialize a state estimation application, thus ensuring a more accurate and robust integration of new sensor elements. This method is helpful for inexperienced users who want to identify the source and type of a measurement, sensor calibrations, or sensor reference frames. It will also be important in the field of modular multiagent scenarios and modularized robotic platforms that are augmented by sensor modalities during runtime. Overall, this work aims to provide a simplified integration of sensor modalities to downstream applications and circumvent common pitfalls in the usage and development of localization approaches.

References

Brommer, C.; Fornasier, A.; Steinbrener, J.; and Weiss, S. 2025. Sensor Model Identification via Simultaneous Model Selection and State Variable Determination. *IEEE Transactions on Robotics*, 41: 4902–4921.