Probabilistic Robotics: From Fundamental Problems to Real-world Applications

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The ability to robustly deal with the inherent uncertainty in perception and action belongs to the fundamental preconditions for robotic systems that autonomously execute their tasks in real-world applications. In this presentation we will discuss a variety problems in which we successfully applied probabilistic reasoning methods paired with optimization and machine learning techniques for developing robust robotic systems. We will describe the corresponding methods and illustrate how we deal with the typically high dimensionality of the underlying problems. We will present several real-world applications from the context of multi-robot systems, mobile manipulation, autonomous navigation, perception, model learning, and activity recognition, in which our approaches lead to state-of-the-art solutions.