Cost pressure and substantial size and power constraints are a common challenge in robotics and embedded systems as they lead to severe computational restrictions paired with limited sensors. For the fusion of noisy and ambiguous sensor data, probabilistic filters are popular means, but they require accurate models and extensive computational power to compute probability density functions. Similar complexity challenges apply to kinodynamic planning on high-dimensional state spaces - particularly when substantial state estimation uncertainty has to be taken into account.

Using the examples of autonomous navigation for miniature indoor airships and quadrotors, we present advanced methods to probabilistically cope with ambiguous sensor information and very limited computational power. We describe an autonomous navigation system, which can generate kinematically feasible trajectories in complex environments in an online fashion. To cope with state estimation uncertainty during planning, we present an approach to efficient trajectory optimization that generates locally optimal, risk-aware trajectories. Finally, we will discuss how these topics are relevant and applicable to autonomous cars.

Short Bio:
Joerg Mueller is a postdoctoral research associate at the University of Southern California in Los Angeles working in the Robotic Embedded Systems Laboratory headed by Gaurav Sukhatme. He received his PhD in 2013 from the University of Freiburg, Germany, supervised by Wolfram Burgard. He studied computer science at the University of Freiburg and received his diploma degree in 2008. His research interests include state estimation techniques and autonomous navigation for resource-constrained embedded microsystems in the context of robotics.

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