Distributed PDE Constrained Exploration in a Probabilistic Framework

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Mobile multi-agent systems are perfect platforms for exploration or monitoring tasks in hazardous or inhospitable environments, where a human operator would be at risk. This pertains to emergency scenarios caused by nuclear or toxic accidents as well as to exploration scenarios in extraterrestrial environments. The presentation addresses the development of an efficient information gathering and exploration strategy for robotic missions. The focus of this talk is a multi-agent system - or a swarm - which consists of several mobile sensing platforms with the goal to identify the parameters of a spatio-temporal process modeled by a Partial Differential Equation with sparsity constraints. A probabilistic approach for the PDE modelling with factor graphs, a sparse Bayesian learning methods for modeling sparsity constrains in a probabilistic setting , and a message passing algorithm for PDE identification problem are shown. Presented results from first simulations demonstrate the potential of the approach.

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