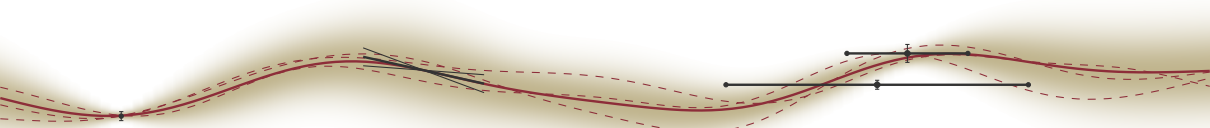
Ideas for a Probabilistic Numerics Framework

Session Introduction

Jonathan Wenger

ProbNum @ Alan Turing Institute
30 October 2019



About Me

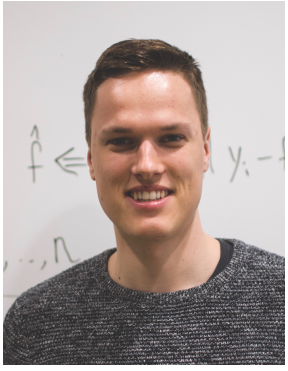
A Short Introduction

EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

Jonathan Wenger

- PhD Student at Universität Tübingen
- Advisor: Philipp Hennig
- Research Interest: Probabilistic Numerical Linear Algebra

- e-mail: `jonathan.wenger@uni-tuebingen.de`
- web: `jonathanwenger.netlify.com`



Vision of Probabilistic Numerics

Propagation of Uncertainty

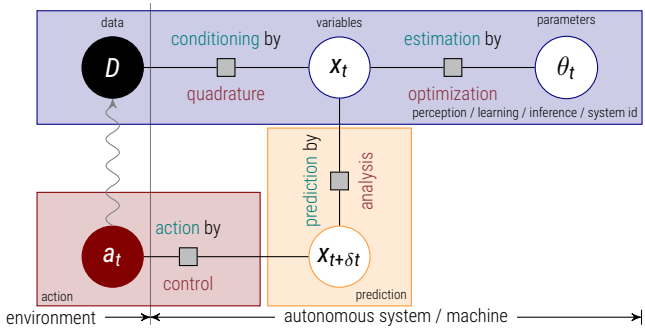


Figure: Sketch of an autonomous system (Hennig et al., 2015)

Implementation of PN routines needed. But: at what level and how?

Session Details

- Thursday, 31 October at 10:30 am
- Topics
  - goals
  - design
  - structure
  - implementation
- Outcomes
  - High-level **outline** for PN software
  - List of people interested in development

Framework Overview

Goals and Design

Goals

- PN methods for researchers and practitioners
- Promotion of PN
- Replacement of established numerics frameworks?

Design

- Target community: ML or Numerics?
- Framework type: probabilistic programming (Oates and Sullivan, 2019), …
- Computational budget scheduler
- Automated prior choice based on problem properties

Framework Details

Structure and Implementation

Structure

- What is already available in other frameworks?
- What core routines should be implemented?
- What could be implemented as of today?

Implementation

- Collaborative or domain-specific?
- Focus on efficiency?
- What is actually being propagated?
  - mean and covariance
  - distribution type and its parameters
- Language: Python, Julia, …

Linear Algebra	Bayesian Optimization
Quadrature	Differential Equations

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Ideas for further discussion points are most welcome!

References I

P. Hennig, M. A. Osborne, and M. Girolami. Probabilistic numerics and uncertainty in computations. **Proceedings of the Royal Society of London A: Mathematical, Physical and Engineering Sciences**, 471(2179), 2015.

C. Oates and T. Sullivan. A modern retrospective on probabilistic numerics. **Statistics and Computing**, 10 2019. doi: 10.1007/s11222-019-09902-z.