Karlsruher Institut für Technologie

Simultaneous Localization and Monitoring with Gaussian Processes

State of the Art Vortrag von Oliver Neumann

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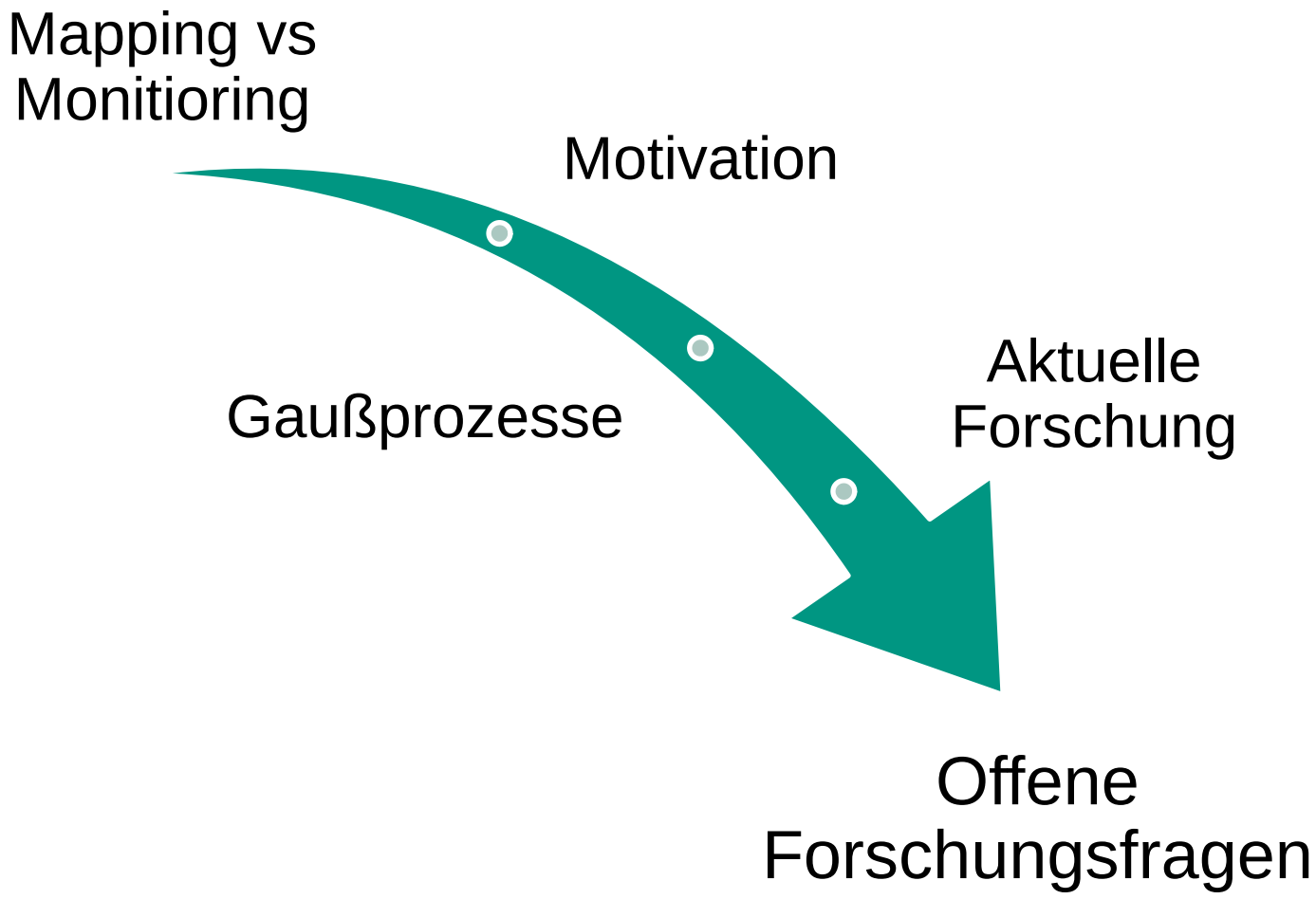
[Kok Solin 2018]

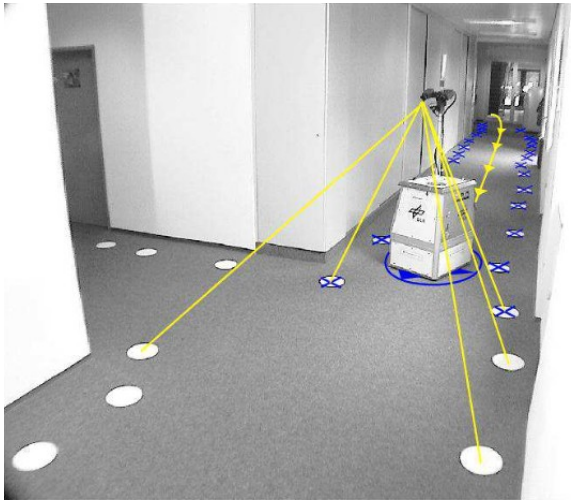
Agenda


Mapping vs
Monitioring
Motivation
Gaußprozesse
Aktuelle
Forschung
Offene
Forschungsfragen

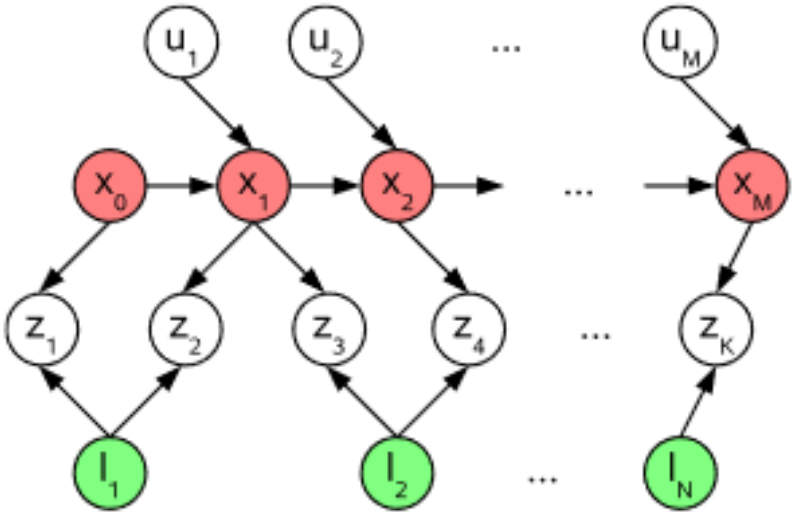
Mapping vs Monitoring

SLAM: [Grisetti et al 2010]

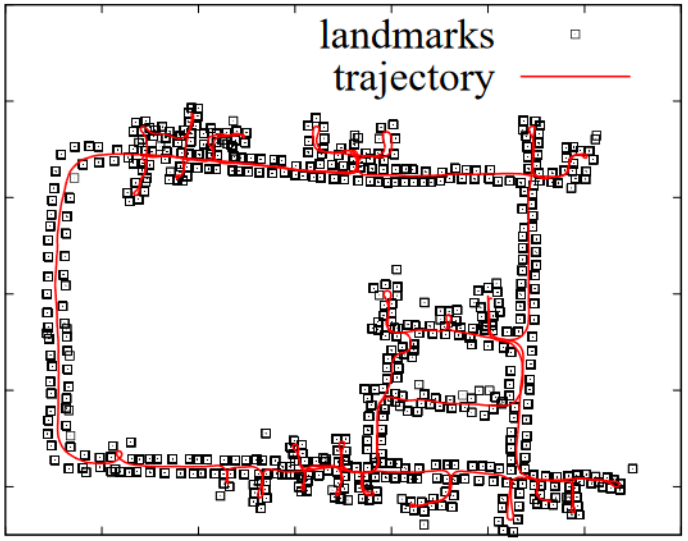
- Unbekannte Karte (**Mapping)**
- **Lokalisierung** in Karte
- Probabilistisches Verfahren
- Filtering vs Smoothing
- Graph basiert



[Grisetti et al 2010]

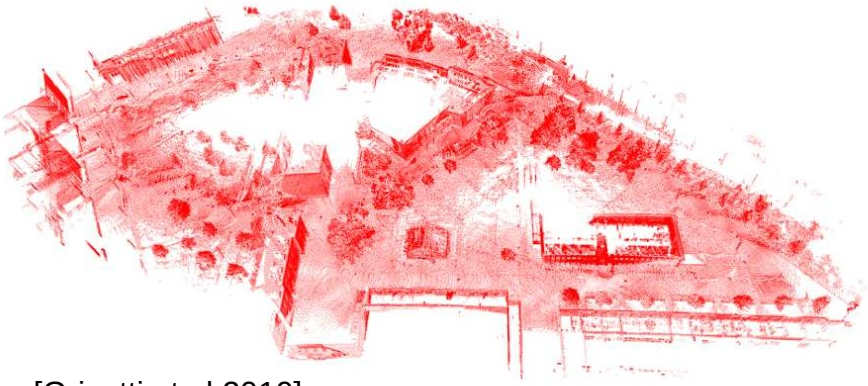


[Kaess et al 2008]

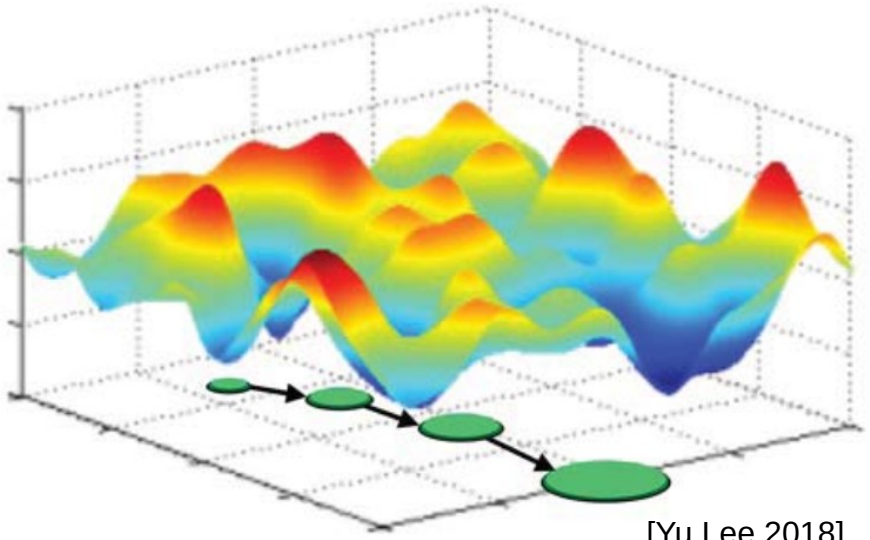


[Grisetti et al 2010]

Mapping vs Monitoring



[Grisetti et al 2010]



[Yu Lee 2018]

Diskrete Landmarken

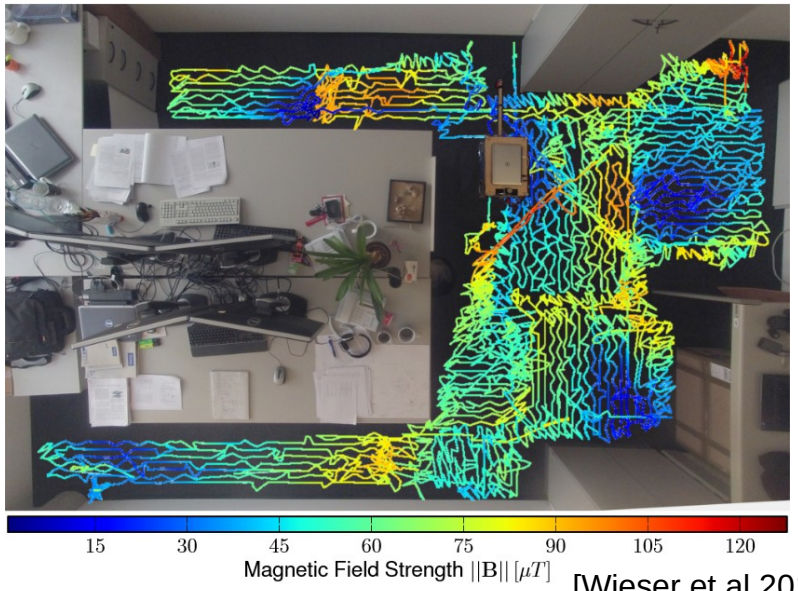
Kontinuierliche Funktion

Motivation

- Herausforderung
  - SLAM für **kontinuierliches Phänomen**
  - **Kein Wissen** über zugrundeliegende Funktion
  - **Unsicherheiten**
  - **Vorhersagegenauigkeit**
  - **Wenig Messungen**

Gauß-prozess

[Image-Web1]



[Wieser et al 2014]

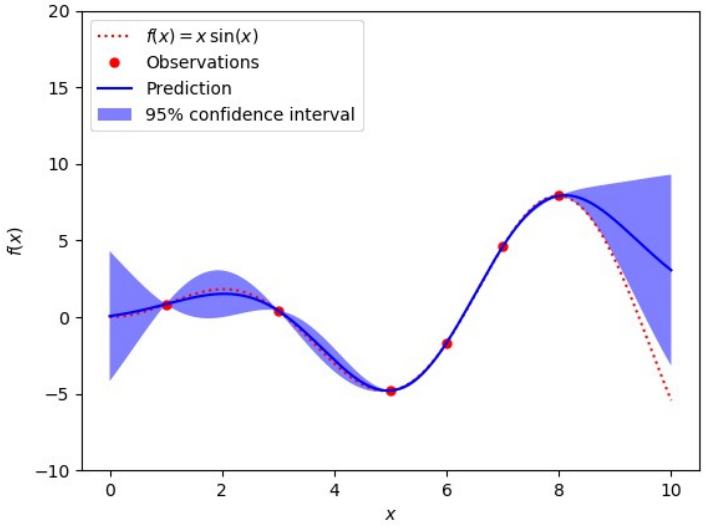
Gaußprozesse

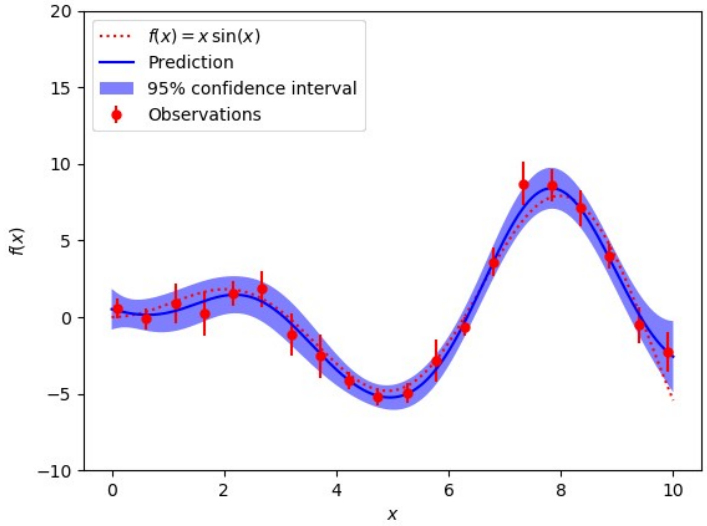
- Stochastischer Prozess
- Definiert über
  - Erwartungswert

$$m(t)$$

  - Kovarianzmatrix

$$k(x_i, x_j) = \begin{pmatrix} k(x_0, x_0) & \cdots & k(x_0, x_n) \\ \vdots & \ddots & \vdots \\ k(x_n, x_0) & \cdots & k(x_n, x_n) \end{pmatrix}, \qquad \mathrm{i,j} \in \{0, \ldots, n\}$$



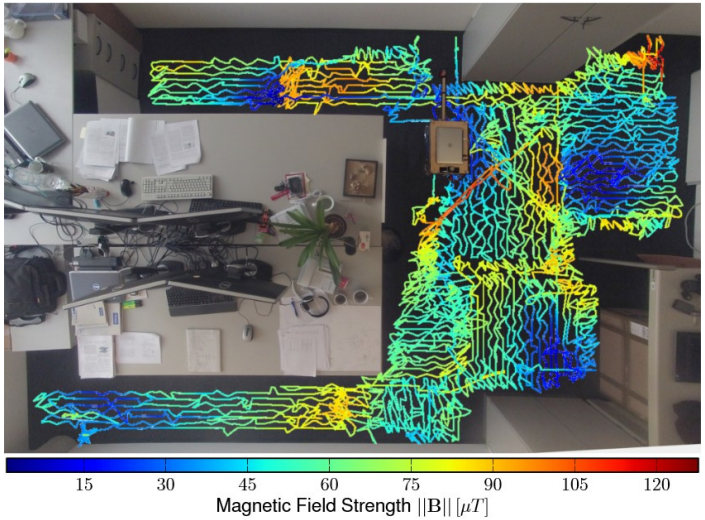


Aktuelle Forschung

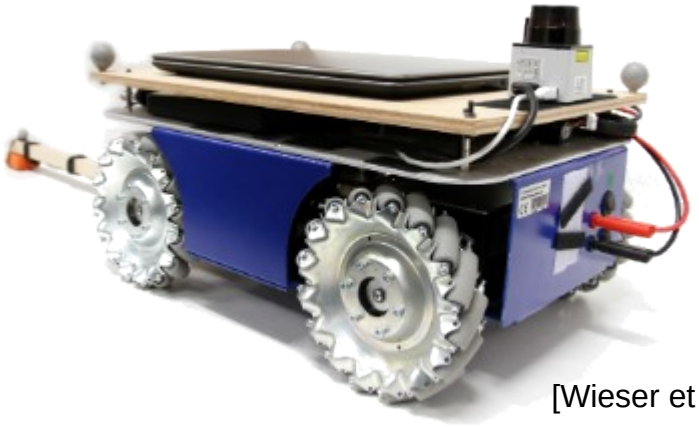
[Kok Solin 2018]

Aktuelle Forschung

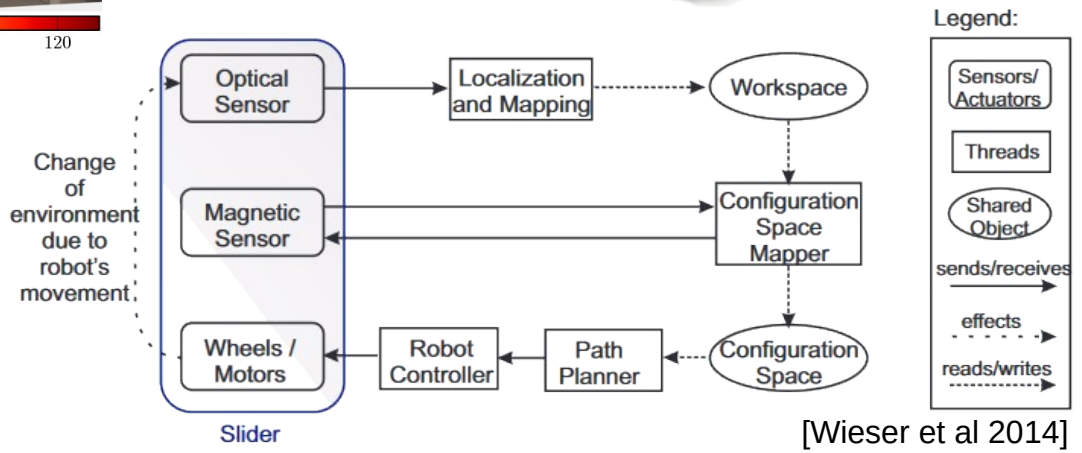
Autonomous Robotic SLAM-based Indoor Navigation for High Resolution Sampling with Complete Coverage



[Wieser et al 2014]



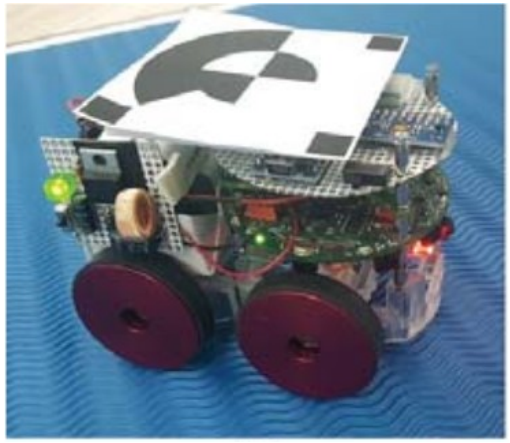
[Wieser et al 2014]



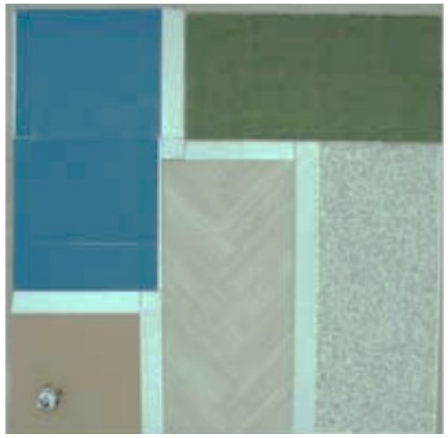
[Wieser et al 2014]

Aktuelle Forschung

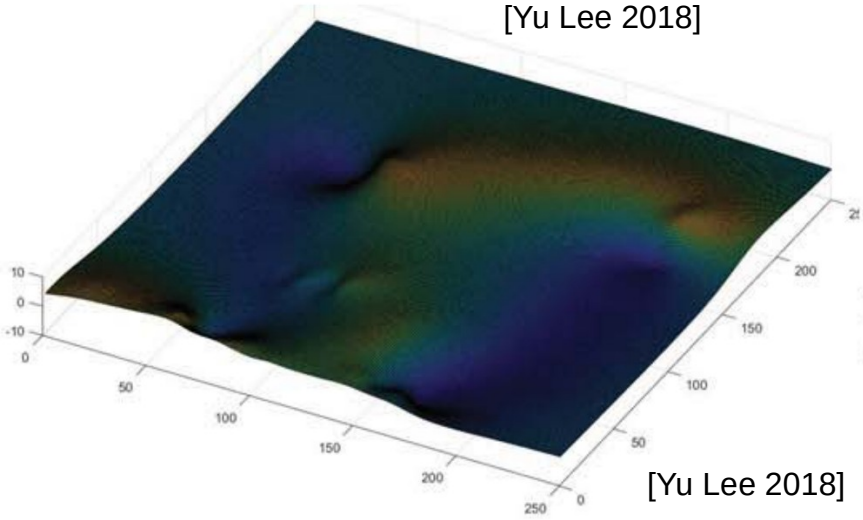
Terrain field SLAM and Uncertainty Mapping using Gaussian Process



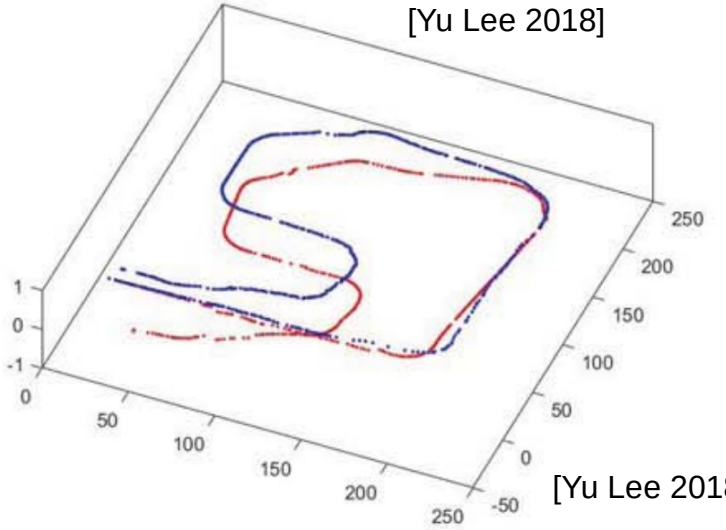
[Yu Lee 2018]



[Yu Lee 2018]



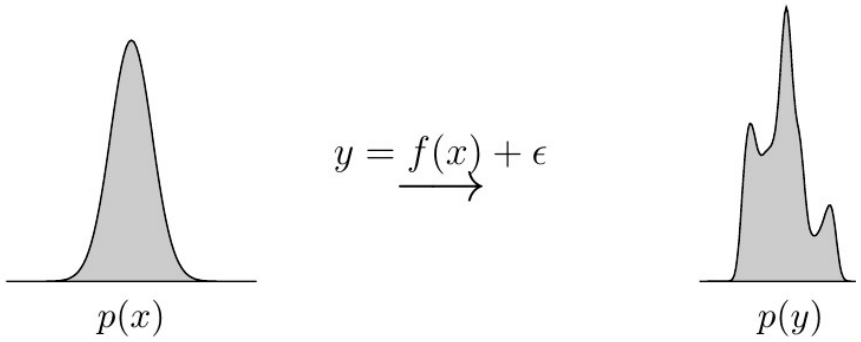
[Yu Lee 2018]



[Yu Lee 2018]

Aktuelle Forschung

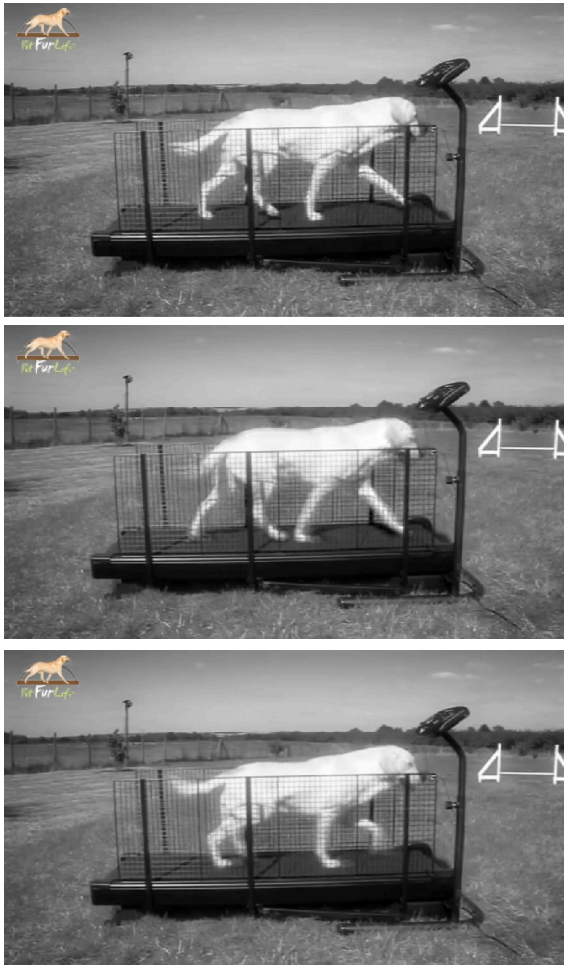
Variational Inference for Uncertainty on the Inputs of Gaussian Process Models



[Damianou et al 2014]

$$\mathbf{z}_{i,:} = \mathbf{x}_{i,:} + \boldsymbol{\epsilon}_x,$$

$$p(\mathbf{X}|\mathbf{Z}) = \prod_{i=1}^{n} \mathcal{N}\left(\mathbf{x}_{i,:}|\mathbf{z}_{i,:}, \boldsymbol{\Sigma}_z\right)$$



[Damianou et al 2014]

Offene Fragen

- Kombination Monitoring und SLAM
- Mathematische Formulierung des Problems (SLAM)
- Online Fähigkeit für SLAM mit Monitoring
- Unsicherheiten in Eingabe und Ausgabe
  mit abnehmender Unsicherheit

Quellen

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[Image-Web1] Anusuya Datta 2018;
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