

Exploring Methods to Apply Gaussian Processes in Industrial Anomaly Detection

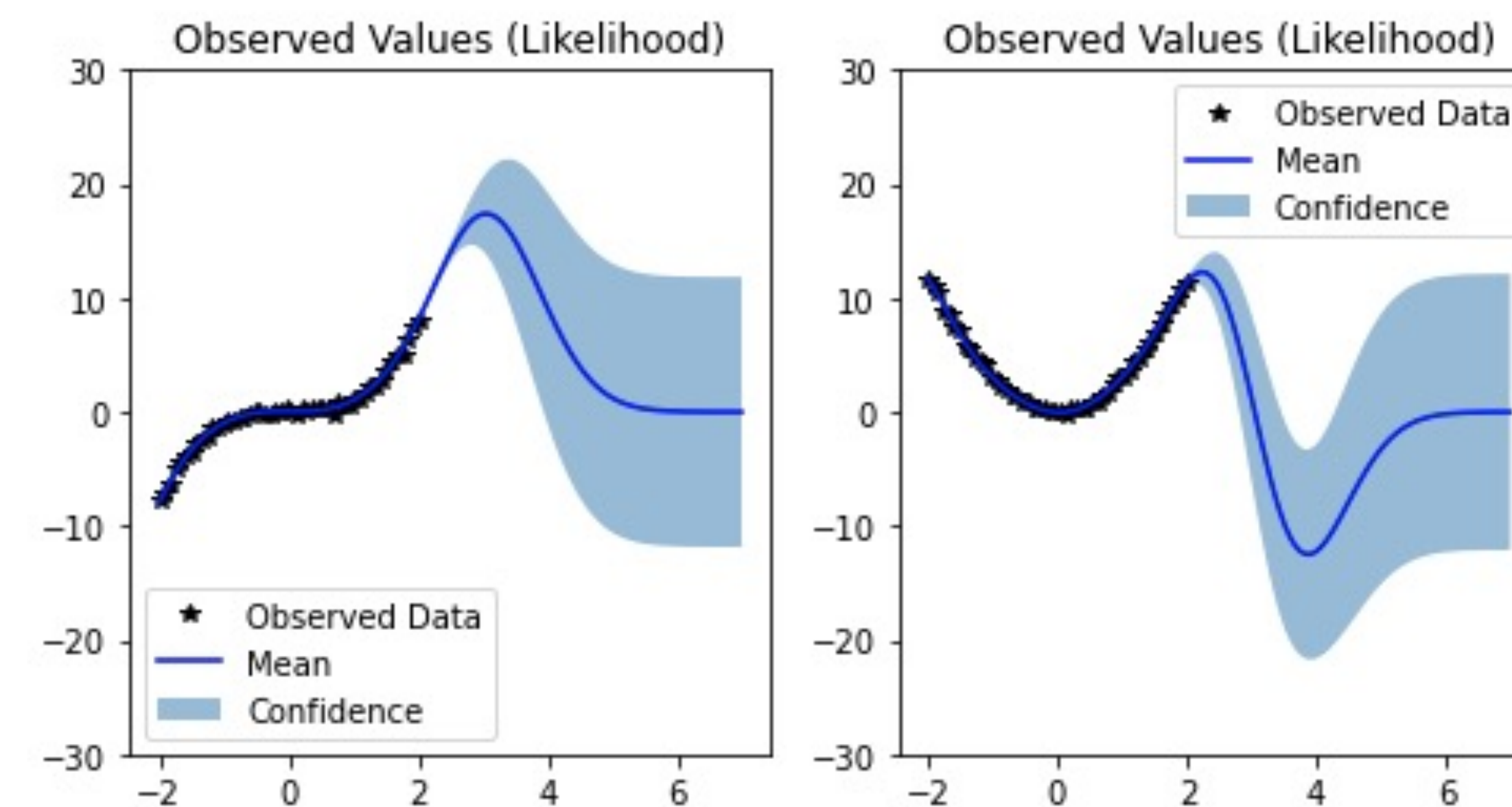
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Introduction

- Gaussian Processes (GPs) offer noise-resistant, interpretable ML models [1]
- They can be used for automated anomaly detection in time series data [2]
- They model given data's behaviour using a multitude of kernel functions
- We want to generate kernels from dynamical systems [3]
- We want to expand automatic kernel searches to online data streams

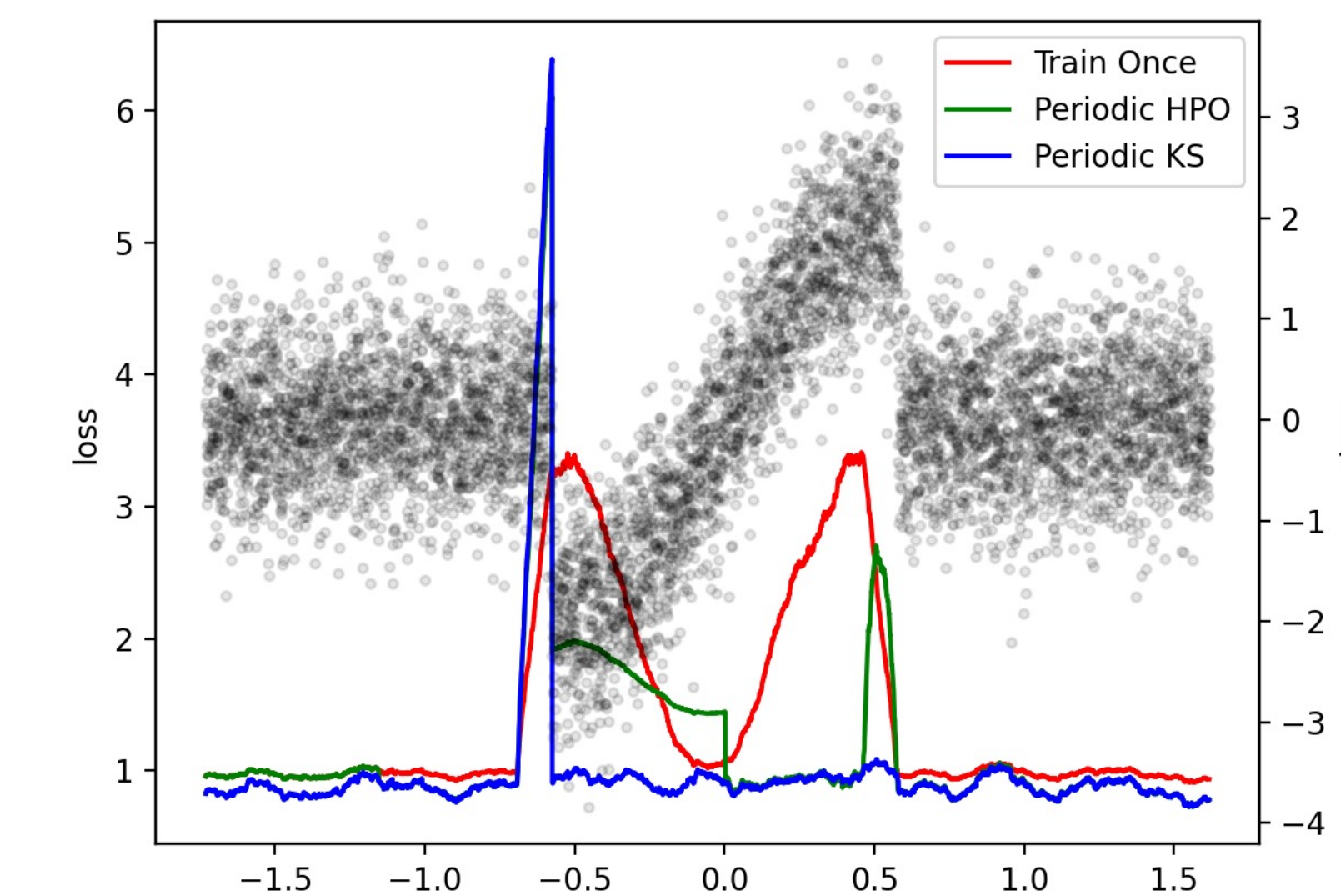
Physical-driven GP Models

Given information on the underlying physical process of a given time series, we construct a matrix kernel to accurately model the systems behaviour.



Streaming Kernel Search

Kernel Search methods that allow for segment-wise processing can not easily be transferred to an online setting [4]. We propose a method that enables fast adaptations of the kernel to changes in the data



Outlook

- We will further improve the presented methods
- We will combine this research with methods for GP based anomaly detection.
- Finally, we will use the inherent interpretability of GPs to extract information on any found anomaly

References

- [1] Lloyd, J.R., Duvenaud, D., Grosse, R., Tenenbaum, J.B., Ghahramani, Z.: Automatic construction and natural-language description of nonparametric regression models. In: Twenty-Eighth AAAI Conference on Artificial Intelligence 2014
- [2] Hüwel J.D., Besginow A., Lange-Hegermann M., Beecks C.: On Kernel Search Based Gaussian Process Anomaly Detection. In submission
- [3] Lange-Hegermann M.: Algorithmic Linearly Constrained Gaussian Processes. In: NeurIPS.2018, pp. 2141–2152.
- [4] Berns F., Schmidt K., Bracht I., Beecks C.: 3CS Algorithm for Efficient Gaussian Process Model Retrieval. In: 25th International Conference on Pattern Recognition, ICPR 2020

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