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Bachelor's Thesis / Master's Thesis / Studienarbeit

Properties of Excitation Signals for Dynamic Machine Learning

The performance of machine learning models is highly dependent on the quality of the data used for model training. Nonetheless, the generation of adequate excitation signals for non-linear dynamic processes (dynamic machine learning) is an under-researched field. It is well established that the point coverage of the regressor space (spanned by the previous $u(k-1)$ and the previous output $y(k-1)$) as well as the excited spectrum (frequency coverage) are pivotal determinants of excitation quality. However, the precise interrelations between these two properties remain opaque.

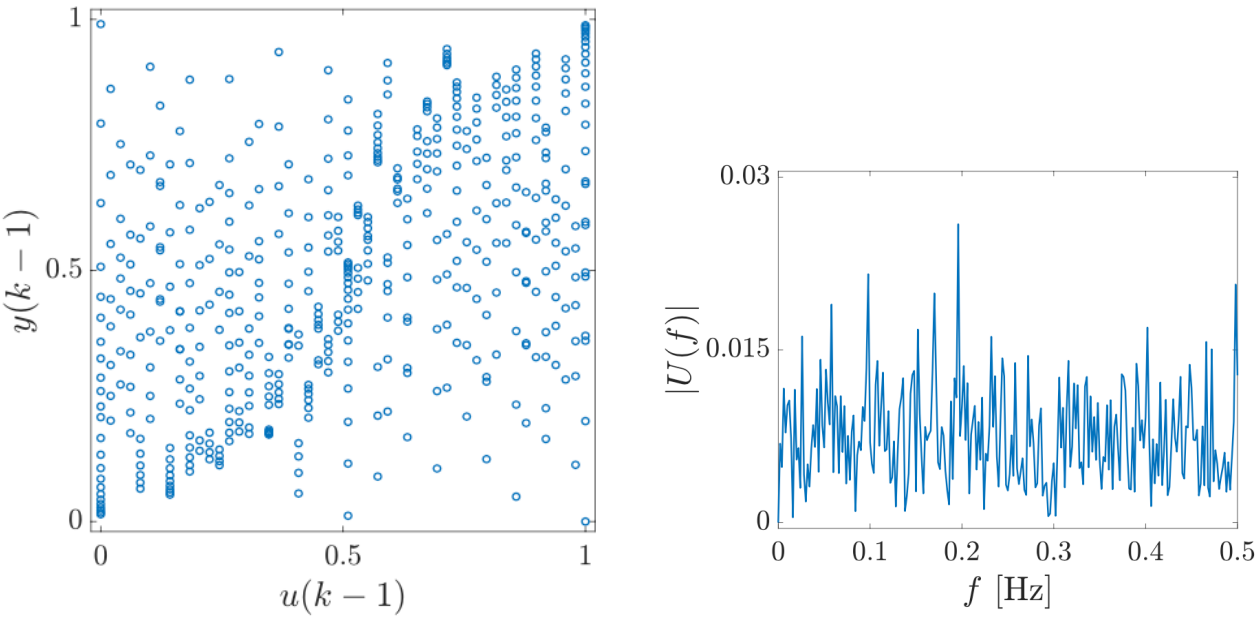

Fig.: Exemplary regressor space and frequency coverage.

A recent paper suggests that good point coverage of the regressor space also leads to good frequency coverage [1]. This conjecture requires a systematic investigation. Therefore, in this work, numerous excitation signals for nonlinear dynamic processes shall be investigated and compared with respect to point and frequency coverage using appropriate criteria.

Work packages:

- Familiarization with the topic of excitation signals for nonlinear dynamic processes and corresponding appropriate evaluation criteria.
- Establish and execute a detailed analysis for a variety of excitation signals in terms of their point coverage of the regressor space and their frequency coverage.

References:

[1] Smits, Volker, and Oliver Nelles. "Genetic Optimization of Excitation Signals for Nonlinear Dynamic System Identification." ICINCO. 2021.

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