Professorship of Business Analytics & Intelligent Systems
TUM School of Management
Technical University of Munich

Literature Review: Surrogate Models in the Mobility Sector

Motivation
The mobility sector often relies on simulations to compare the impact of not yet implemented mobility measures, like traffic bans or ring roads, on the mobility behavior. However, due to the complexity of these simulations, it is computationally expensive to compare many different measures. To circumvent this problem, one can train surrogate models, like Gaussian process regressions or artificial neural networks, to approximate the outcome of the costly traffic simulations. One can then use these surrogate models in surrogate-assisted optimization approaches to identify the best mobility measure among a set of candidate measures.

Aims and scope of the thesis
This work focuses on reviewing state-of-the-art surrogate approaches used in the mobility sector and clustering them according to their application and methodological approach. To summarize, the work consists of the following research tasks:

1. Literature review on surrogate models
2. Identifying relevant surrogate models used in the mobility sector
3. Identifying relevant surrogate models used in surrogate-assisted optimization approaches
4. Clustering and comparing the different surrogate models

Requirements
This thesis targets students from the TUM School of Management with a background in informatics and machine learning. Knowledge of optimization and statistical models is advantageous. The thesis should be written in English.

Related Research

- Bhosekar, A., & Ierapetritou, M. (2018). Advances in surrogate based modeling, feasibility analysis, and optimization: A review. Computers and Chemical Engineering, 108, 250-267.
- Pfrommer, J., Zimmerling, C., Liu, J., Kärger, L., Henning, F., & Beyerer, J. (2018). Optimisation of manufacturing process parameters using deep neural networks as surrogate models. Procedia CIRP, 72, 426-431.
- Tripathy, R., & Bilionis, I. (2018). Deep UQ: Learning deep neural network surrogate models for high dimensional uncertainty quantification. J. Comput. Phys., 375, 565-588.
- Lepretre, F., Fonlupt, C., Verel, S., Marion, V. (2019). Combinatorial Surrogate-Assisted Optimization for Bus Stops Spacing Problem. Biennial International Conference on Artificial Evolution (EA 2019).
- Cervellera, C., Macciò, D., & Rebora, F. (2021). Deep Learning and Low-discrepancy Sampling for Surrogate Modeling with an Application to Urban Traffic Simulation. 2021 International Joint Conference on Neural Networks (IJCNN), 1-8.

Begin: as soon as possible

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Application: See `https://www.ot.mgt.tum.de/osm/education/bachelor-thesis/`