Dual Control of Chemical Processes using Knowledge-informed Gaussian Process

TECHNISCHE UNIVERSITÄT DARMSTADT

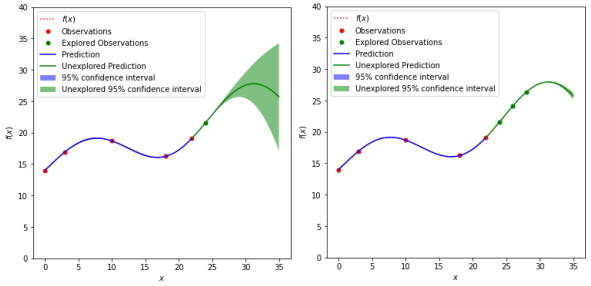
Proposal for a Master's Thesis Project

Developing dynamic models of chemical processes are essential for the simulation, control, and optimisation of the process. Confidence in the model's prediction is important for implementation but large datasets are costly to generate for chemical processes. Gaussian process regression is a Bayesian approach that is capable to provide the uncertainty with the predictions while having a good modelling performance on small datasets. The accuracy of the predictions can be improved by including knowledge from the process such as mass and energy balances. The model is capable of providing uncertain predictions that might be the optimal operating point. The uncertainty from the model can also be reduced by sampling at those points. The challenge is safe exploration of the potential optimal.

Dual control deals with the control of a system whose characteristics are initially unknown where the objective is twofold: 1) control the system using current knowledge and 2) explore to learn the system behaviour and improve the knowledge. The scope of this project is to use Gaussian process regression that is informed by process knowledge in a dual control strategy for learning and controlling the process at its optimal point.

The following prerequisites will be useful for the project:

Experience with / knowledge about:	Gaussian process regression and Dual control
Programming skills:	Python or Matlab
Language:	English



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CCPS Control and Cyber-Physical Systems