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Bayesian Transfer Learning for modelling the hydrocracking process using kriging

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Hydrocracking process reaction takes place in presence of a catalyst, and when supplying a catalyst, a vendor must guarantee its performance. In this work, the linear and the kriging model are considered to model the process. The construction of predictive models is based on experimental data and experiments are very expensive. New catalysts are constantly being developed so that each new generation of a catalyst requires a new model that is until now built from scratch from new experiments. The aim of this work is to build the best predictive model for a new catalyst from fewer observations and using the observations of previous generation catalysts. This task is known as transfer learning.

The method used is the transfer knowledge of parameters approach, which consists in transferring regression models from an old dataset to a new one.
In order to adapt the past knowledge to the new catalyst, a Bayesian approach is considered. The idea of the approach is to take as prior a distribution centered on the previous model parameters. A pragmatic approach to chose the prior variance ensuring that it is large enough to allow parameter change and small enough to retain the information is proposed.

With the Bayesian transfer approach, the RMSE scores for the transferred models are always lower than those obtained without transfer, especially when the number of observations is low. Satisfactory models can be fitted with only five new observations. Without transfer, reaching the same model quality requires about fifty observations.

Keywords

Transfer Learning, Modelling, Gaussian Process regression

Special/invited session

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