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Optimal Design for Model Autocompletion

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Most experimental design methodology focuses on parameter precision, where the model structure is assumed known and fixed. But arguably, finding the correct model structure is the part of the modelling process that takes the most effort.

Experimental design methodology for model discrimination usually focuses on discriminating between two or more known model structures. But often part of the model structure is entirely unknown, and then these techniques cannot be applied.

Recently, techniques such as sparse identification of nonlinear dynamics and symbolic regression have been used to complete models where a part of the model structure is missing. However, this work focussed on recovering the true model from a fixed dataset.

In this talk, I propose an adaptive data gathering strategy which aims to perform model autocompletion with as little data as possible. Specifically, symbolic regression is used to suggest plausible model structures, and then a variant of the T-optimal design criterion is used to find a design point that optimally discriminates between these structures. A new measurement is then gathered, and new regression models are constructed. This loop continues until only one model structure remains plausible.

Keywords

Optimal design of experiments; model autocompletion

Classification

Mainly methodology

Primary author: STROUWEN, Arno

Presenter: STROUWEN, Arno

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