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Optimising Injection Efficiency at Diamond Light Source using Gaussian Processes with Non-Gaussian Likelihoods - 15'+5'

Wednesday 9 April 2025 08:50 (20 minutes)

A general Bayesian optimisation tool is being developed at Diamond Light Source to improve machine performance by constructing surrogates from Gaussian Process (GP) models. Priors are placed on covariance kernel hyperparameters to guide an optimiser and prevent overfitting. The model has been integrated with the machine control system. During an experiment aimed at improving injection efficiency by changing magnet currents, hysteresis was identified and compensated. Multiple measurements were taken at each current to determine the measurement error. However, large variations in the error with respect to current were observed; this heteroscedastic behaviour was handled robustly with non-Gaussian likelihoods incorporated into the inference step. The injection efficiency was increased running the model in less time than a manual scan from operators.

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