IE Decision Systems Engineering Spring '21 Seminar Series

"Sparsifying To Optimize Over Multiple Information Sources: An Augmented Gaussian Process Based Algorithm"

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Bio

Antonio Candelieri is Assistant Professor at University of Milano-Bicocca, Italy. His research interests and activities are focused on (Automated) Machine Learning, Statistical Learning, Bayesian Optimization, Decision Making and the interplay between Optimization and Machine Learning. He works on probabilistic models, such as Gaussian Processes and Random Forests, and their adoption in sampling and efficient optimization problems. He usually faced real-life problems characterized by "structured" data, mainly time series data and streaming data (e.g., online sensors data); main tasks are related to time series clustering/classification, anomaly detection or pattern search/query in data streams, forecasting.

Abstract

Optimizing a black-box, expensive and multiextremal function, given multiple approximations, is a challenging task known as Multi-Information Source Optimization (MISO), where each source has a different cost and the level of approximation (aka fidelity) of each source can change over the search space. While most of the current approaches fuse the Gaussian Processes (GPs) modelling each source, we propose to use GP Sparsification to select only "reliable" function evaluations performed over all the sources. These selected evaluations are used to create an Augmented Gaussian Process (AGP), whose name is implied by the fact that the evaluations on the most expensive source are augmented with the reliable evaluations over less expensive sources. A new acquisition function, based on Confidence Bound, is also proposed, including both cost of the next source to query and the location-dependent approximation of that source. This approximation is estimated through a model discrepancy measure and the prediction uncertainty of the GPs. MISO-AGP and the MISO-fused-GP counterpart are compared on two test problems and hyperparameter optimization of a Machine Learning classifier on a large dataset.

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