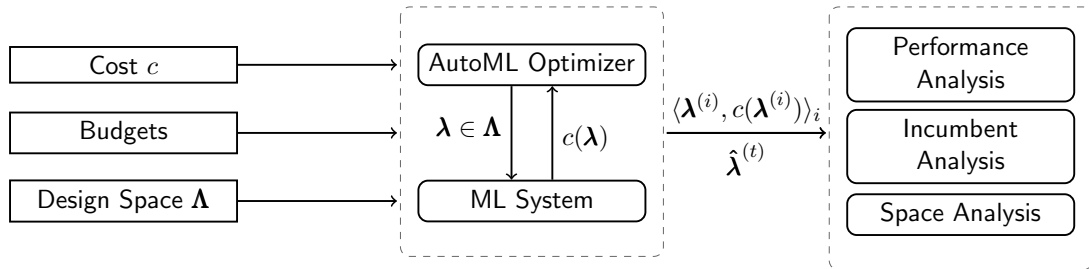


AutoML: Interpretability

Studying the AutoML Optimization Process

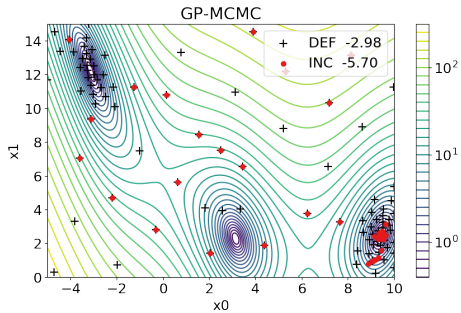
Bernd Bischl Frank Hutter Lars Kotthoff
Marius Lindauer Joaquin Vanschoren

Idea



~> focus on how the AutoML optimizer samples from the design space Λ

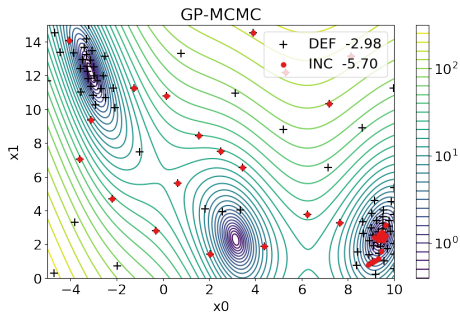
Analyzing the Sampling Behavior



- Plot of a 1D or 2D function

Source: [Lindauer et al. 2019]

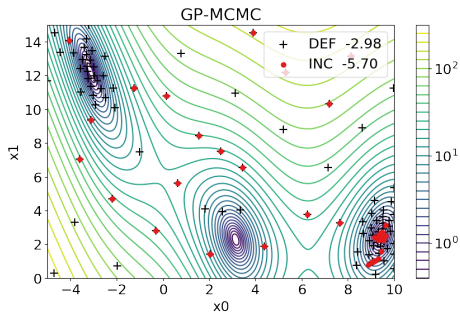
Analyzing the Sampling Behavior



- Plot of a 1D or 2D function
- Background shows the ground truth (real function values)

Source: [Lindauer et al. 2019]

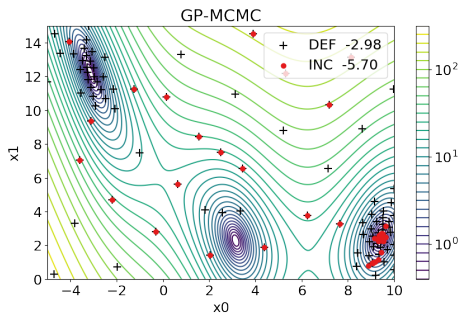
Analyzing the Sampling Behavior



Source: [Lindauer et al. 2019]

- Plot of a 1D or 2D function
- Background shows the ground truth (real function values)
- Dots are sampled points in the search space

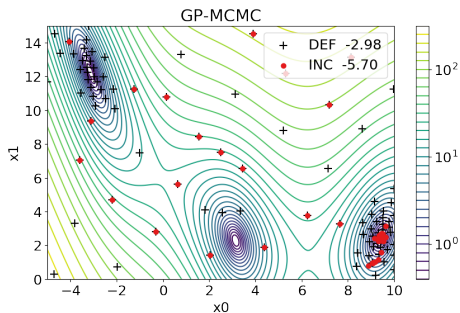
Analyzing the Sampling Behavior



Source: [Lindauer et al. 2019]

- Plot of a 1D or 2D function
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- Typical approach in Bayesian Optimization community

Analyzing the Sampling Behavior

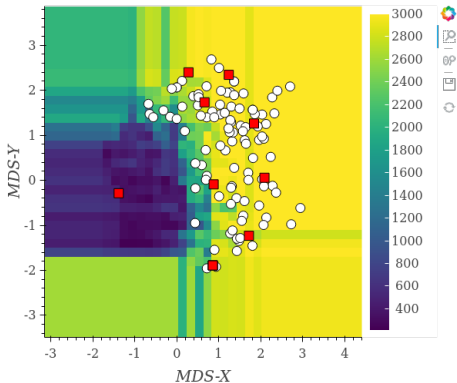


Source: [Lindauer et al. 2019]

- Plot of a 1D or 2D function
- Background shows the ground truth (real function values)
- Dots are sampled points in the search space
- Typical approach in Bayesian Optimization community

~> Impossible for higher dimensional problems?

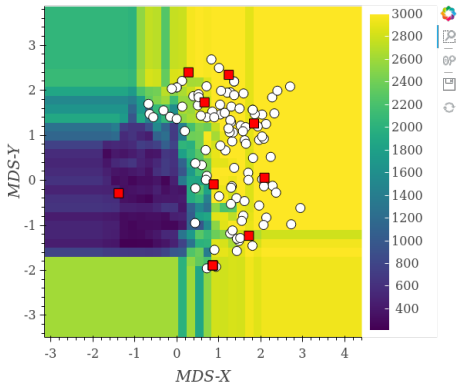
Analyzing the Sampling Behavior in N -D



- Same idea as before
but we have to project N -D into 2-D

Source: [Lindauer et al. 2019]

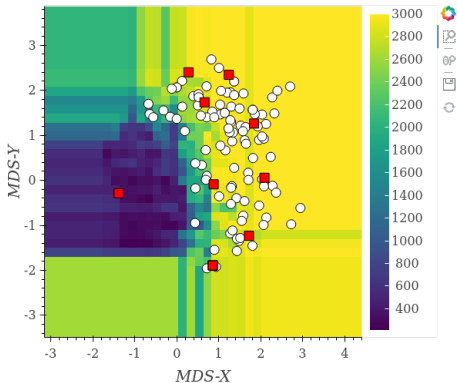
Analyzing the Sampling Behavior in N -D



Source: [Lindauer et al. 2019]

- Same idea as before
but we have to project N -D into 2-D
 - 1 Use an MDS to project down to 2-D

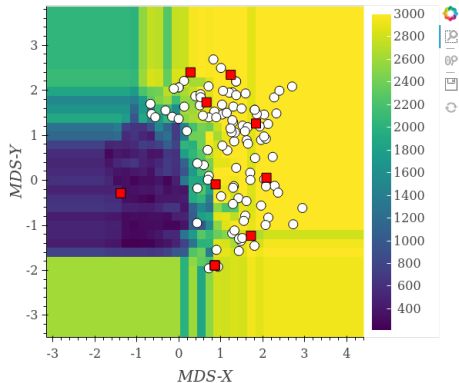
Analyzing the Sampling Behavior in N -D



Source: [Lindauer et al. 2019]

- Same idea as before
but we have to project N -D into 2-D
 - 1 Use an MDS to project down to 2-D
 - 2 Each dot is single hyperparameter configuration

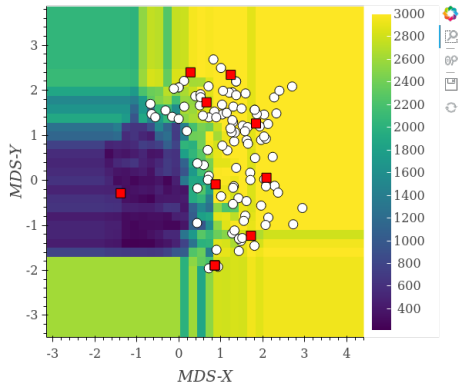
Analyzing the Sampling Behavior in N -D



Source: [Lindauer et al. 2019]

- Same idea as before
but we have to project N -D into 2-D
 - 1 Use an MDS to project down to 2-D
 - 2 Each dot is single hyperparameter configuration
 - 3 Red squares are intermediate incumbents

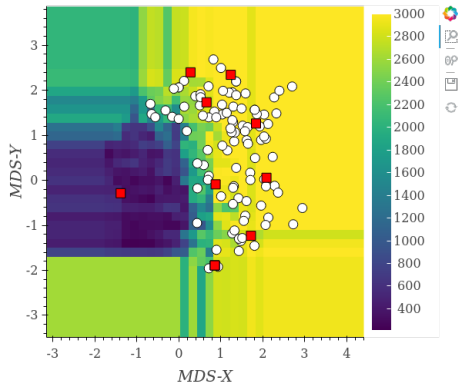
Analyzing the Sampling Behavior in N -D



Source: [Lindauer et al. 2019]

- Same idea as before
but we have to project N -D into 2-D
 - 1 Use an MDS to project down to 2-D
 - 2 Each dot is single hyperparameter configuration
 - 3 Red squares are intermediate incumbents
 - 4 The background is colored wrt a performance-estimate (e.g., reusing model fitted during BO)

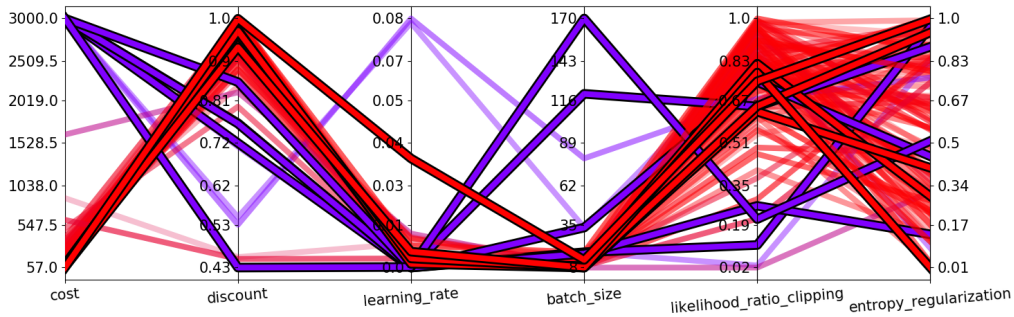
Analyzing the Sampling Behavior in N -D



Source: [Lindauer et al. 2019]

- Same idea as before
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 - 1 Use an MDS to project down to 2-D
 - 2 Each dot is single hyperparameter configuration
 - 3 Red squares are intermediate incumbents
 - 4 The background is colored wrt a performance-estimate
(e.g., reusing model fitted during BO)
 - 5 Extension: Animation by showing
how points get added over time

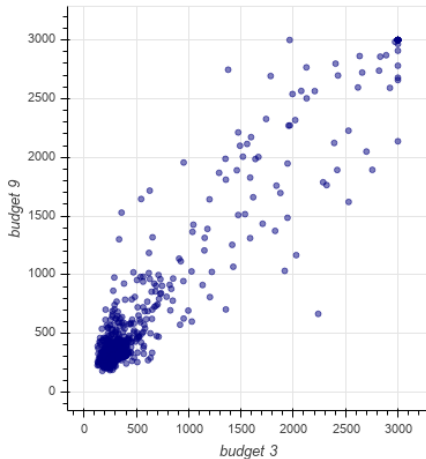
Parallel Coordinate Plot [Golovin et al. 2017]



Source: [Lindauer et al. 2019]

- Each coordinate is one hyperparameter;
- Except the most left one: cost or loss

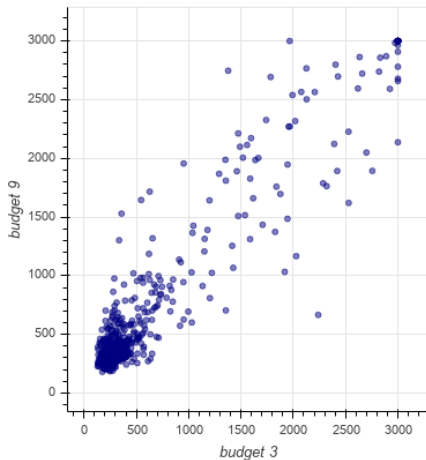
Multi-Fidelity Checks



- Challenge of multi-fidelity approaches:
 - ▶ How to choose the fidelities (a.k.a. budgets)

Source: [Lindauer et al. 2019]

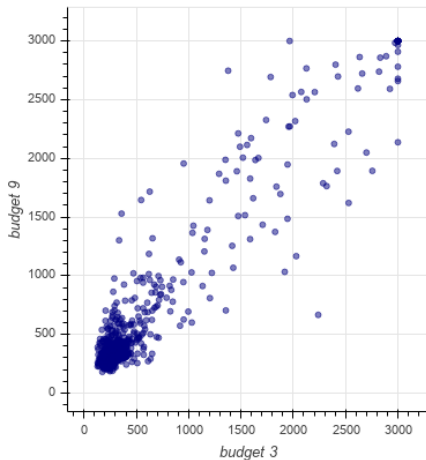
Multi-Fidelity Checks



- Challenge of multi-fidelity approaches:
 - ▶ How to choose the fidelities (a.k.a. budgets)
- Important Property:
 - ▶ Decisions on small budgets should be reasonable for higher budgets

Source: [Lindauer et al. 2019]

Multi-Fidelity Checks



Source: [Lindauer et al. 2019]

- Challenge of multi-fidelity approaches:
 - ▶ How to choose the fidelities (a.k.a. budgets)
- Important Property:
 - ▶ Decisions on small budgets should be reasonable for higher budgets
- Analysis:
 - 1 Scatter plot of performance on Budget X vs. Budget Y
 - 2 Each dot is sampled hyperparameter configuration
 - 3 Compute rank correlation (here: 0.69)