Poster #236:
Tue 6:30pm
@ Pacific Ballroom

A Framework for Bayesian Optimization in Embedded Subspaces

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ICML 2019

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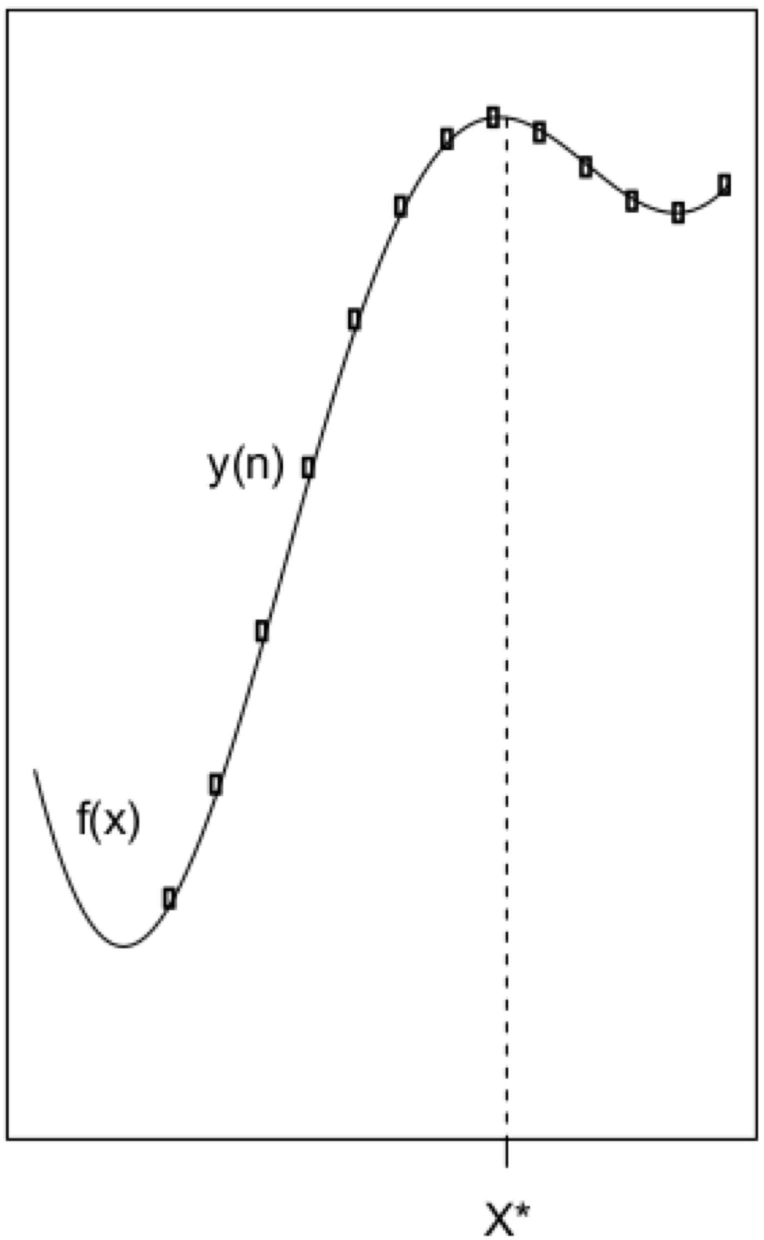
Bayesian Global Optimization of Expensive Functions



The Goal

Optimize an expensive-to-evaluate, black-box function **f(x)** over a feasible region of parameter vectors **x** specified in **D** dimensions.

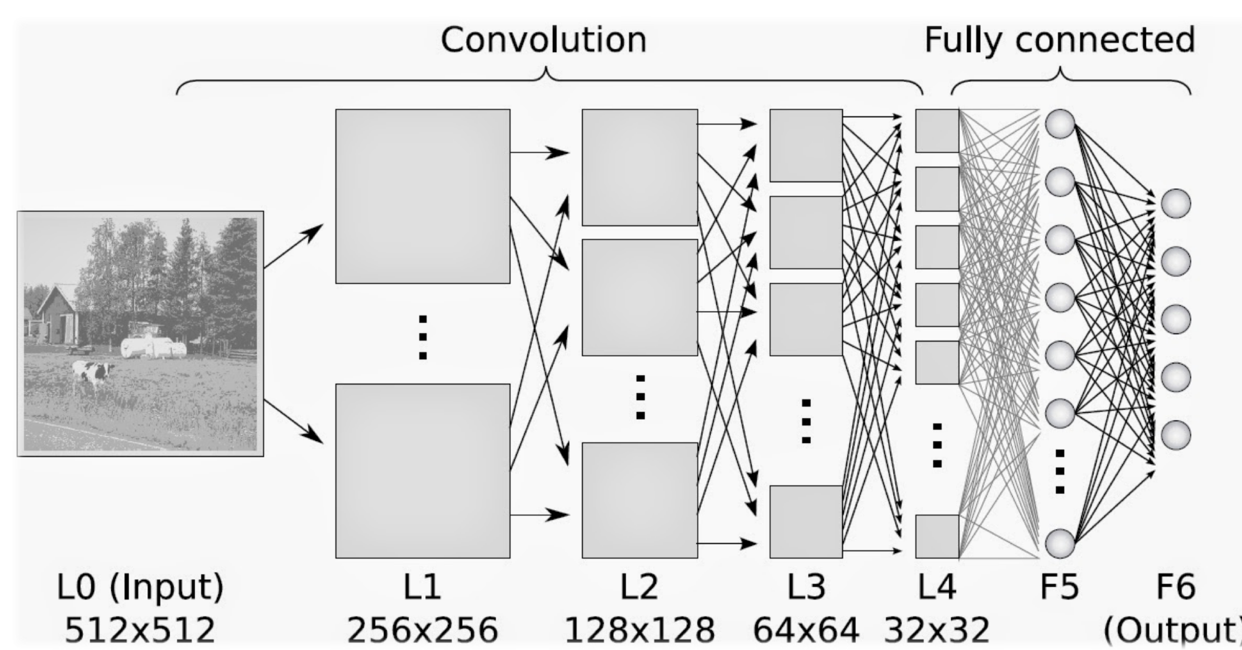
We can access for any **x** the value of **f(x)** possibly with some noise, i.e., **f(x)+ε**.

Typically: D < 20.

Here: **D** large, but **f(x)** depends only on a **d**-dimensional active subspace.

Applications of high-dim. BO are ubiquitous

- Policy search in Reinforcement Learning
- Aerospace design
- Network architecture search
- Calibration of simulations to observed data
- Control of chemical processes
- Drug design



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The HeSBO Framework for high-dimensional BO

Theorem: Active subspace embedding accurately preserves GP-prior (with constant probability)

- For a variety of popular kernels: linear, polynomial, (squared) exponential, Matérn.
- The embedding can be combined with many GP-based BO algorithms, e.g., Knowledge Gradient (KG), BLOSSOM, Expected Improvement (EI).

Experiments demonstrate

- Efficient and easy to code using hash functions.
- Robustness to ambient dimension **D.**
- Outperforms **state-of-the-art:** REMBO, BOCK, EBO, additive BO.

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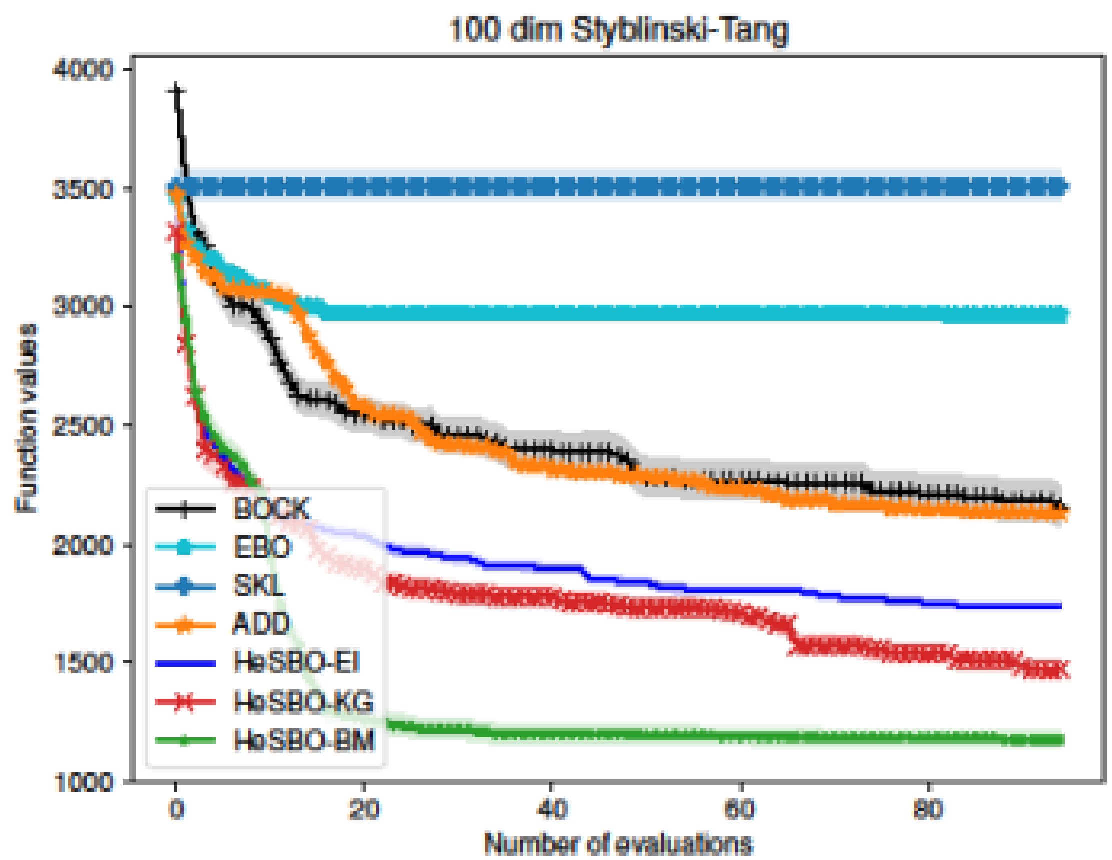
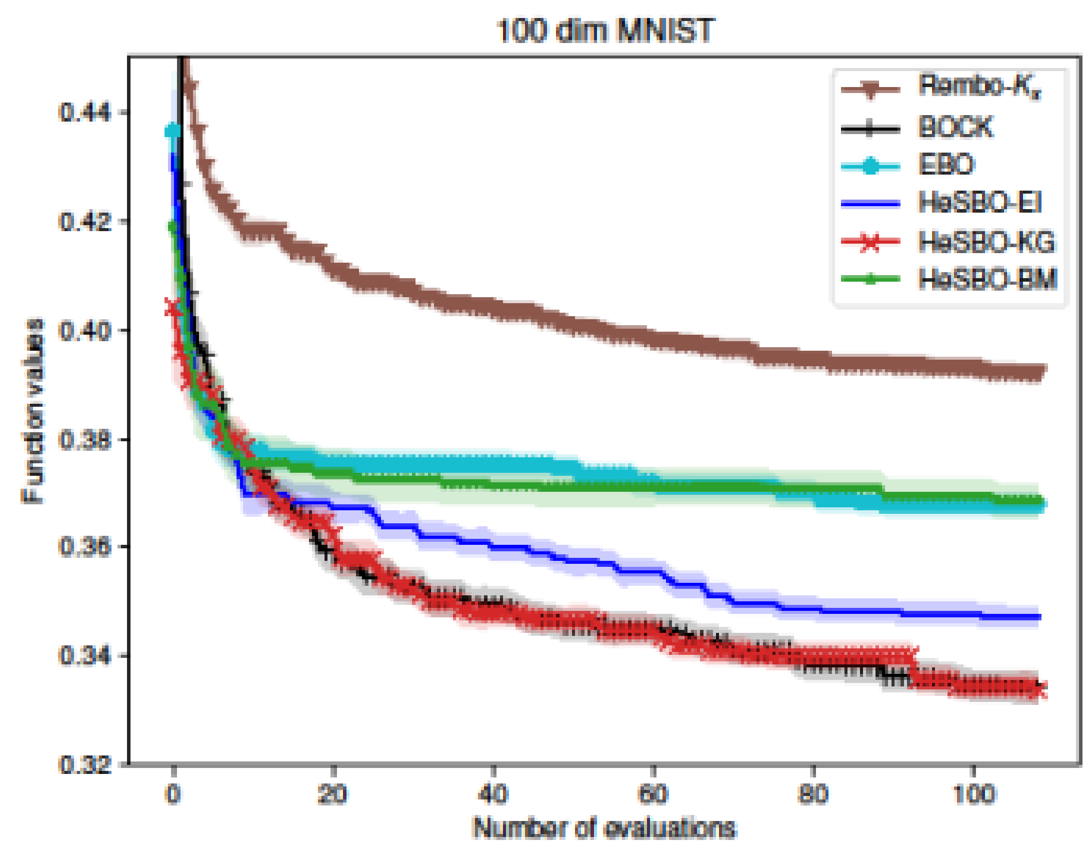
Great performance even if subspace assumption **not met,** e.g., for

100-dim. Styblinski-Tang Function



Neural Network Parameter Search (Oh, Gavves, and Welling '18)



Visit https://github.com/aminnayebi/HesBO for HeSBO for KG, BLOSSOM, and EI.

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