ABB SWITZERLAND CORPORATE RESEARCH CENTER

Empirical Evaluation of AutoML Algorithms For Motor Health Prediction

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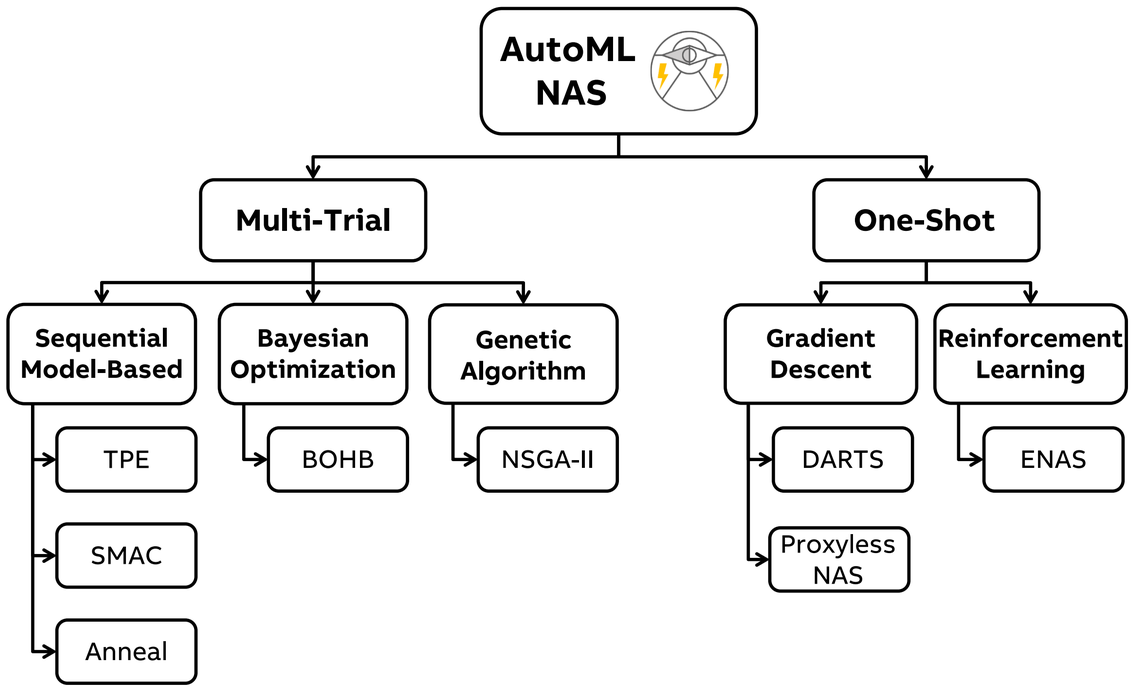
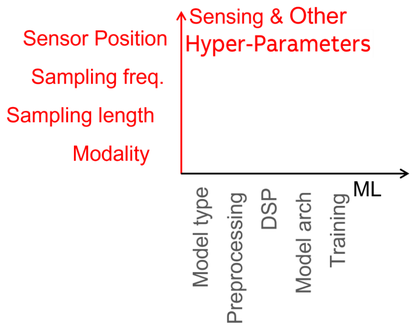
AutoML Algorithms Overview



Motivation for Industrial Benchmarking

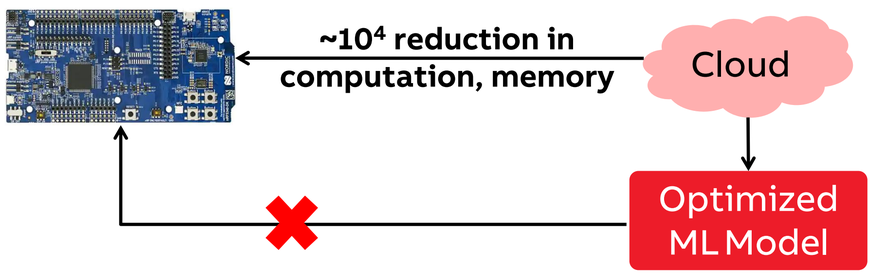
Existing AutoML algorithms –

- **focus mainly on image datasets for benchmarking:**

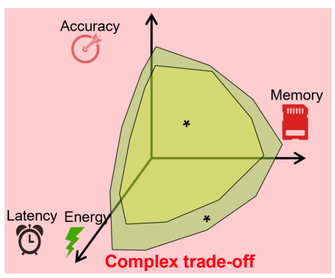


Lack of performance benchmarking for evaluating Hyper-Parameters specific to other datasets

- **optimize models for cloud or GPU clusters:**



- **support multi-objective optimization in a minimal way:**



Lack of performance benchmarking for evaluating complex trade-offs specific to the problem

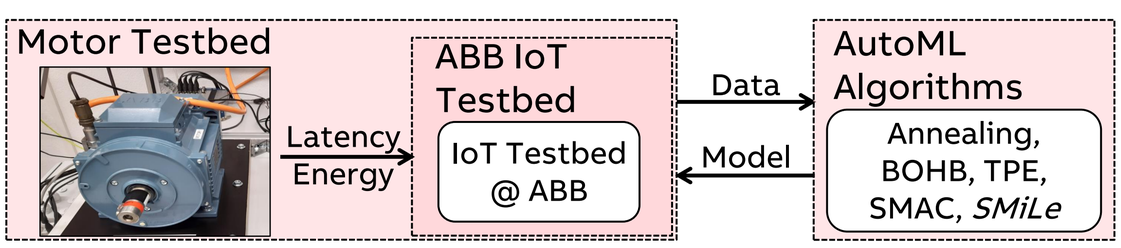
Motor Health Prediction

- **Bearing Fault Creation:** Add 0g, 0.25g and 1g of metallic dust to 3 different bearings; **3-class classification problem**

Remove load-side bearing

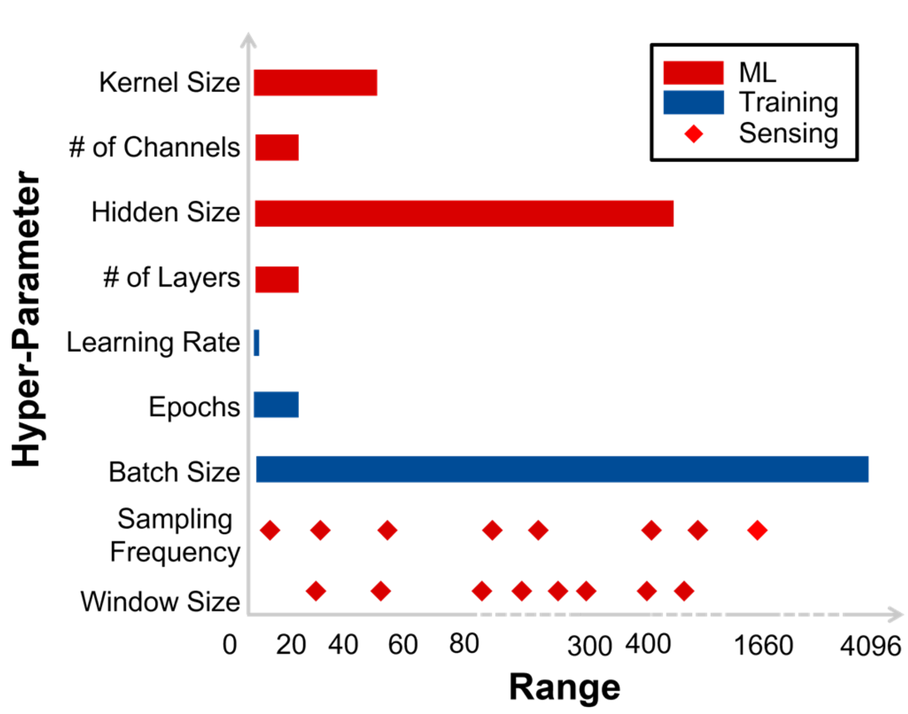
Add «metallic-dust» to the bearing

- **Input Data:** Acceleration
- Measure **Latency** and **Energy** consumption on Nordic nRF5340

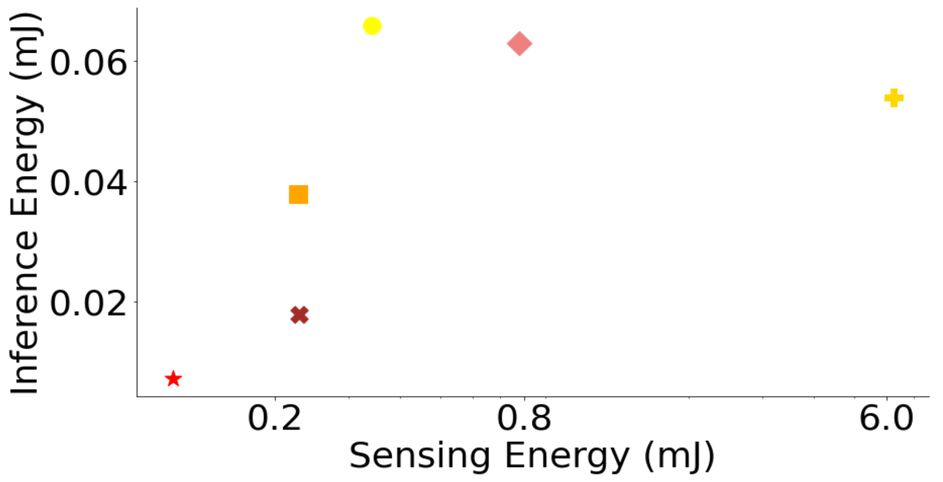


- Optimize complex trade-offs between Accuracy, Energy, Latency and #Parameters for **Edge Analytics**

Experimental Evaluation

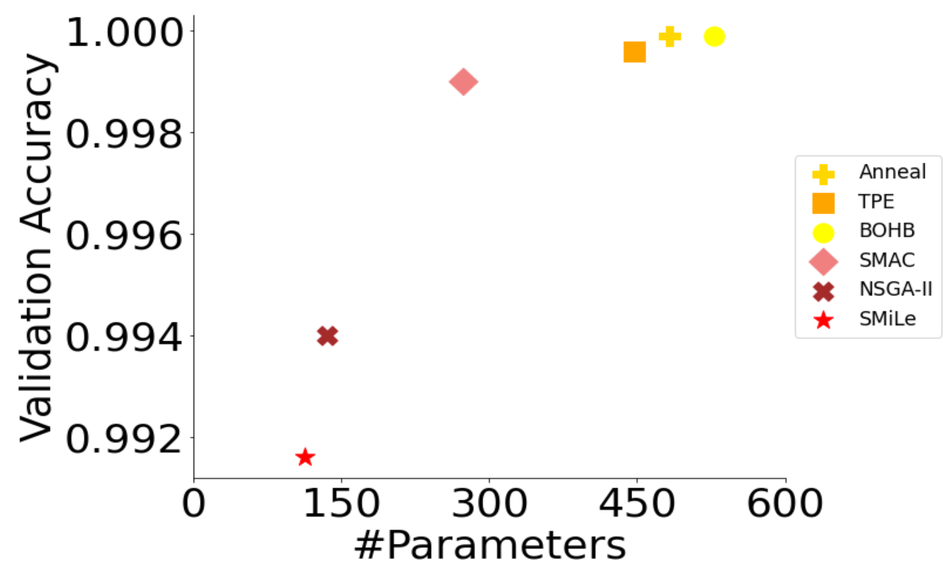


Design Space for Exploration



Algo	Val Acc	#Params	Frequency	Window
Anneal	1	573	104	700
TPE	0.999	671	1660	200
BOHB	0.9999	1878	1660	300
SMAC	0.999	391	1660	700
NSGA-II	0.9999	432	1660	200
SMiLe	1	339	1660	100

Results with only *SMiLe* having hardware-in-the-loop (HIL); *SMiLe* finds configuration with minimum Energy requirements using HIL



Results without hardware-in-the-loop; There is a trade-off between Validation Accuracy and #Parameters among optimization results of different AutoML algorithms

Outlook

- **Hardware-in-the-loop** is essential for direct **optimization** of energy for edge analytics in Industrial use cases.
- Existing algorithms support **multi-objective optimization** in a **minimal** way. It is important to use extensions of these algorithms for better analysis of **complex trade-offs.**