

Meta-Learning - Using Prior Data to Warmstart Optimization

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1 TL;DR

This AutoML project focuses on the use of prior configuration data to improve optimisation efficiency. Approaches include pre-configuration optimisers and multi-fidelity techniques. The main objective is to find a multi-class neural network classification system with sufficient performance to solve the DeepWeeds dataset.

2 Motivation & Problem Setting

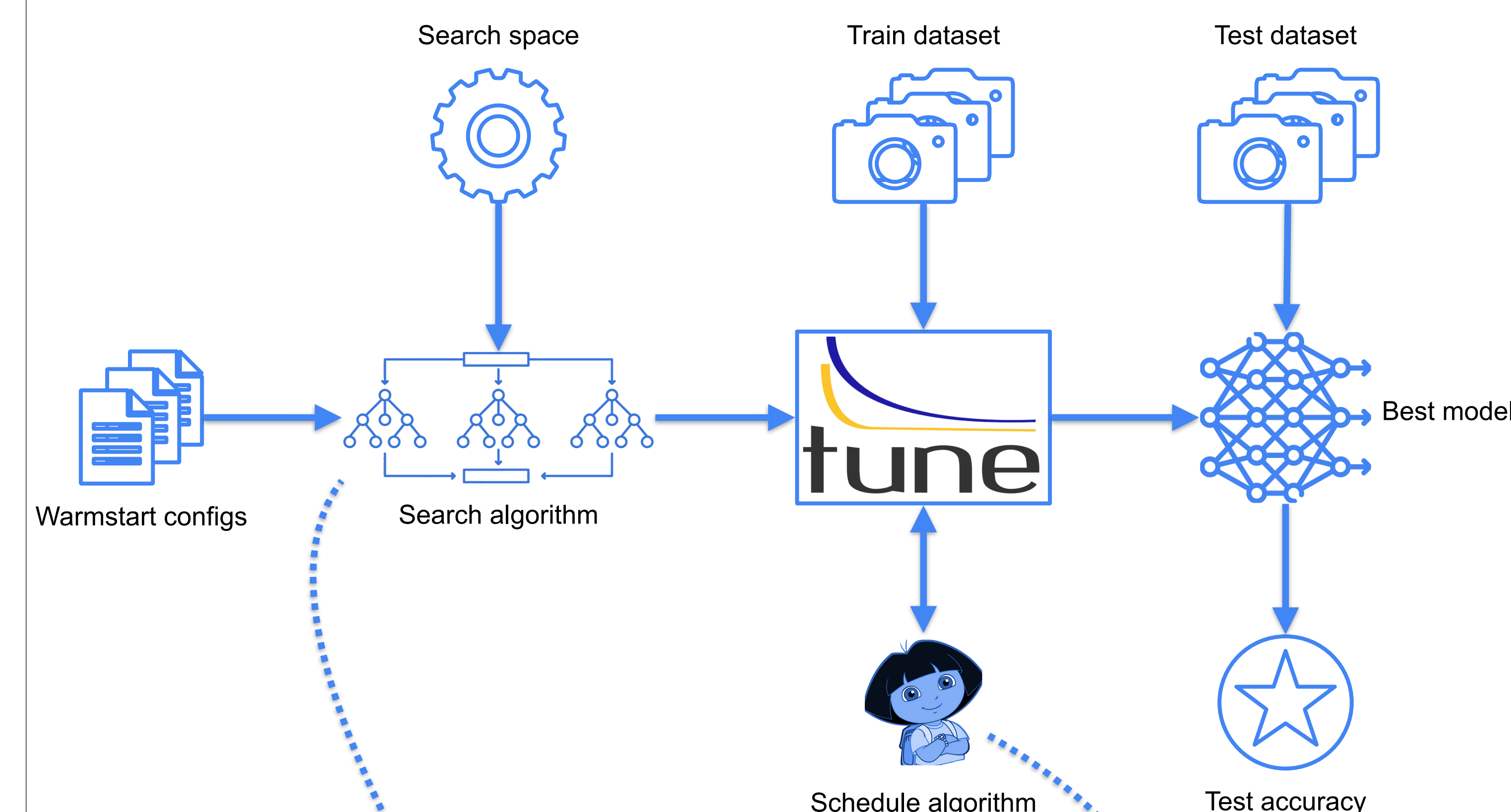
Motivation

- Better Model Performance, Resource Savings & Multi-Fidelity Optimization

Problem Setting

- *Objective*: Find neural network for multi-class classification with test accuracy $> 65\%$
- *Resource Constraints*: Maximum 6h runtime with max 20 epochs per model
- *Prior Configuration Data*
- *Diverse Conditional Configuration Search Space*
- *Dataset*: DeepWeeds (32x32)

3 Approach



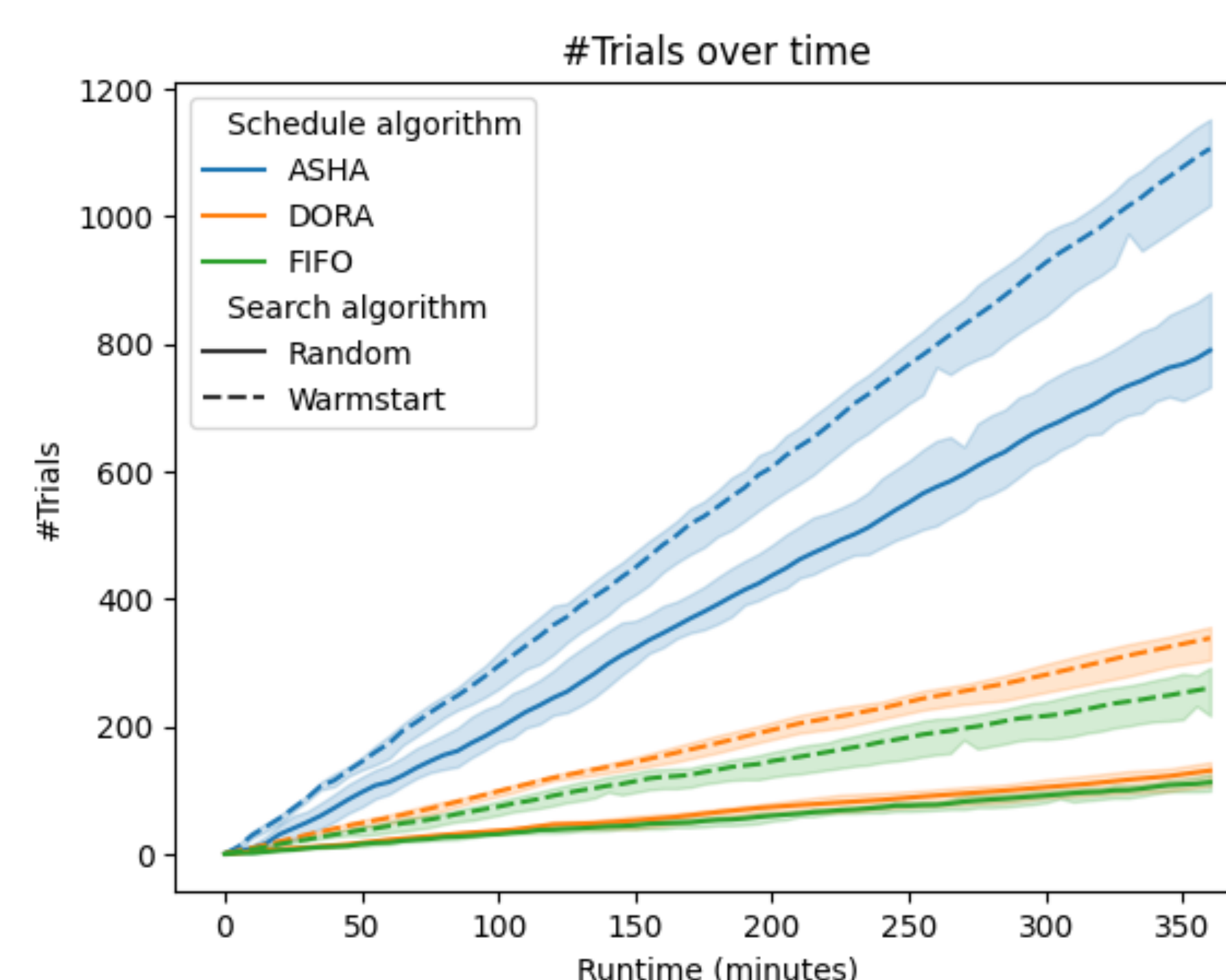
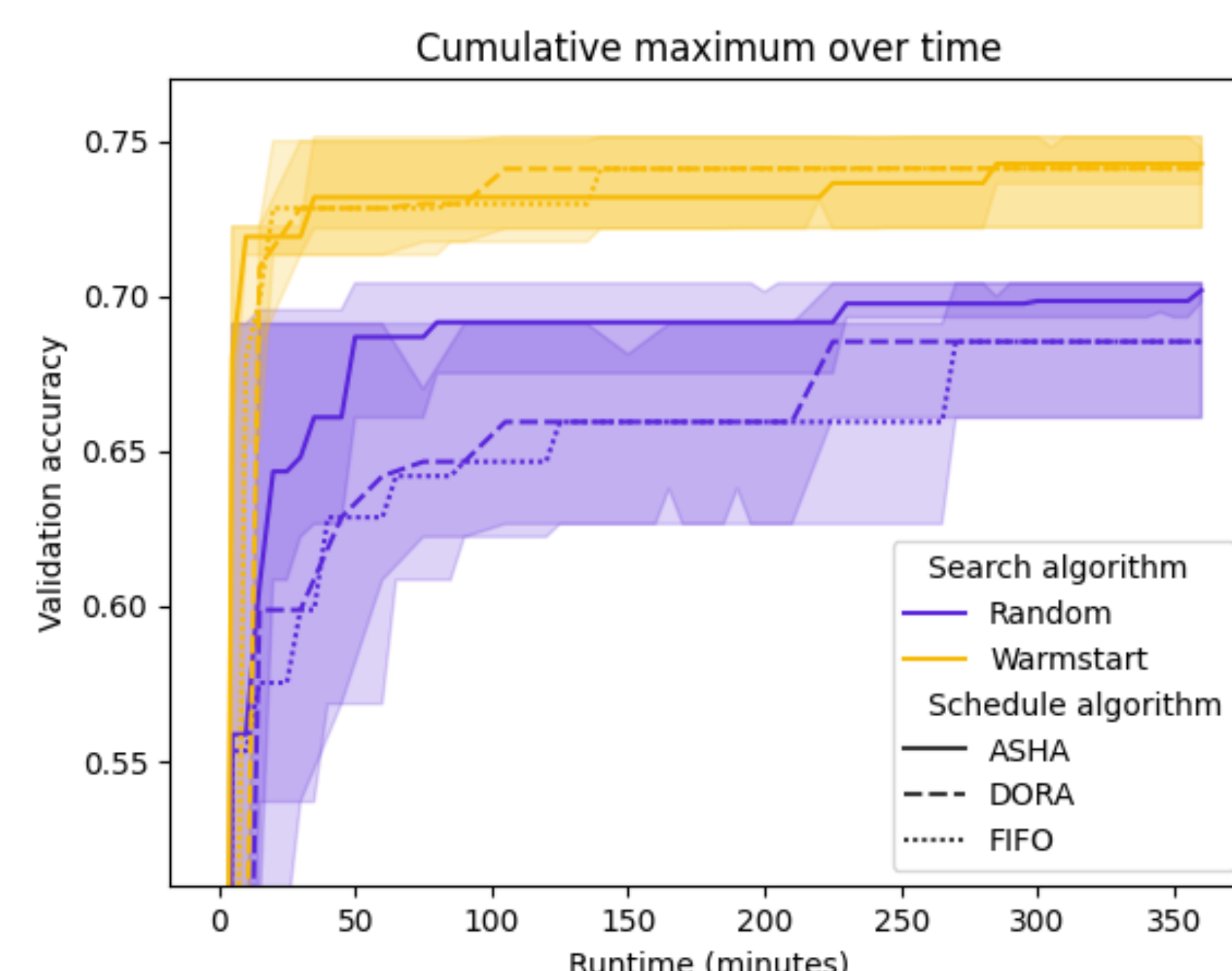
Bayesian Optimiser

Surrogate model	Random Forest
Acquisition function	Expected Improvement
Warmstarting	Pre-train BO before tuning

DORA (Dynamic Optimization using Result Anticipation):
The algorithm employs an adaptive mechanism to modulate fidelity by leveraging predictive techniques to anticipate performance outcomes in future training epochs.

4 Key Insights

- All experiments were conducted on a NVIDIA A100-SXM4-40GB employing 3 randomised seeds.
- The accuracy on the test dataset exhibited a notable enhancement of the warm started bayesian search algorithm compared to random search.
- The cumulative maximum also underscored the proficiency of the warm-started search.
- The proposed scheduling algorithm (DORA) showed a slightly improvement against FIFO scheduling but not as substantial as the asynchronous HyperBand (ASHA).



5 Future Works

- Warmup the search algorithm by initialising it with configuration data sourced from various datasets without specific constraints.
- Further develop the concept of adjusting fidelity adaptively by forecast future performance of running trials.

