

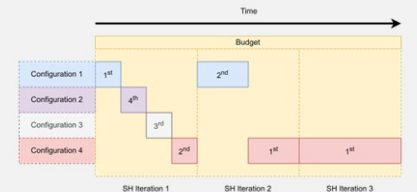
Continual Hyperband

Jasmin Brandt¹, Marcel Wever², Dimitrios Iliadis³, Viktor Bengs², Eyke Hüllermeier²
¹ Paderborn University, Paderborn, Germany ² Munich Center for Machine Learning, LMU Munich, Munich, Germany ³ Ghent University, Ghent, Belgium



Basis: Hyperband (HB)

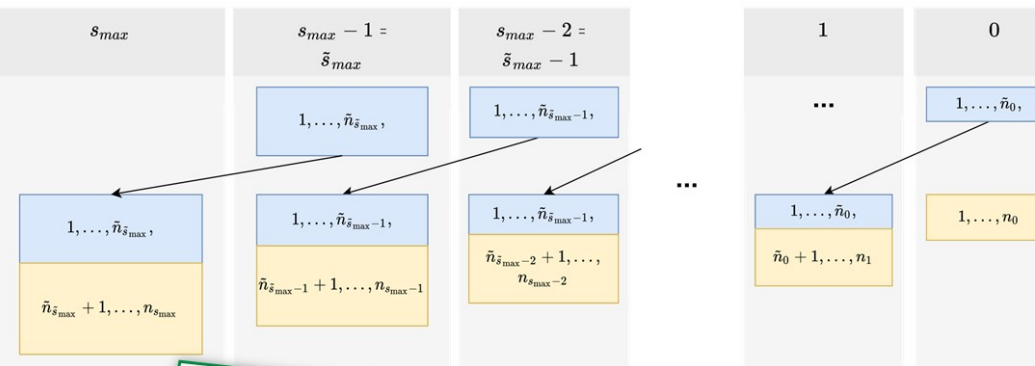
Run Successive Halving (SH) for varying initial budgets and number of initial candidates



Increase the maximum assignable budget R ?
→ Re-run HB with new parameterization

Infinite-Horizon HB: Re-run Hyperband from scratch for increasing budgets

Continuation of Hyperband Runs for Increased Maximum Budget



Iterations: s_{max} , $s_{max} - 1 = \tilde{s}_{max}$, $s_{max} - 2 = \tilde{s}_{max} - 1$, ..., 1, 0

Configurations: $1, \dots, \tilde{n}_{\tilde{s}_{max}}$, $1, \dots, \tilde{n}_{\tilde{s}_{max}-1}$, ..., $1, \dots, \tilde{n}_0$

Pruned configurations: $\tilde{n}_{\tilde{s}_{max}} + 1, \dots, n_{s_{max}}$, $\tilde{n}_{\tilde{s}_{max}-1} + 1, \dots, n_{s_{max}-1}$, ..., $\tilde{n}_{\tilde{s}_{max}-2} + 1, \dots, n_{s_{max}-2}$

Theoretical Results

Convergence of xC-SH
Given sufficient amount of budget, C-SH finds a near-optimal configuration

Efficiency of xC-SH over SH
Bounds for the efficiency ratio as compared to standard SH regarding the allocated budget

Soundness of C-HB
C-HB finds a near-optimal configuration with probability at least $1 - \delta$

Continual Hyperband

Fill initial pools for increased R

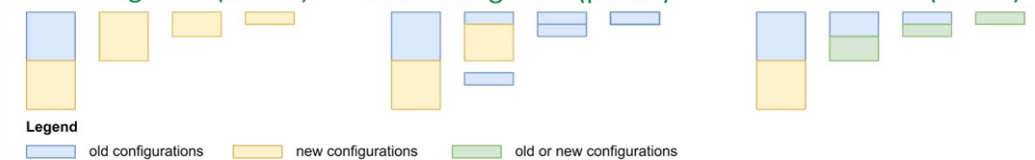
Discarding (dC-HB)
- Proceed as usual
- Cache for evaluations of previous configurations

Preserving (pC-HB)
- Allow to revoke previous decisions
- Still consider evaluated configurations

Efficient (eC-HB)
- Just fill up subsequent iterations of SH
- Once promoted stays promoted

Efficiency ↑
Consistency (Run from Scratch) ↓

Discarding C-SH (dC-SH) Preserving C-SH (pC-SH) Efficient C-SH (eC-SH)



Legend: ■ old configurations ■ new configurations ■ old or new configurations

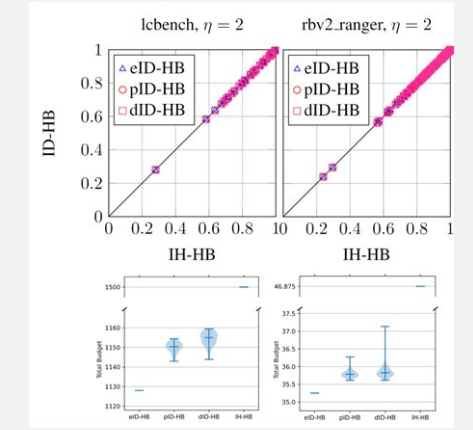
Conclusion

- Competitive Quality (Scales icon)
- Reuse of Information (Recycling icon)
- More Eco-friendly HPO (Leaf icon)

Future Work

- C-AC-Band (Gear icon)
- C-BOHB / C-DEHB (Puzzle icon)

Empirical Results



lcbench, $\eta = 2$ rbv2_ranger, $\eta = 2$

Legend: △ eID-HB ○ pID-HB □ dID-HB

Box plots show evaluation counts for IH-HB and ID-HB variants.