Open-Book Neural Algorithmic Reasoning

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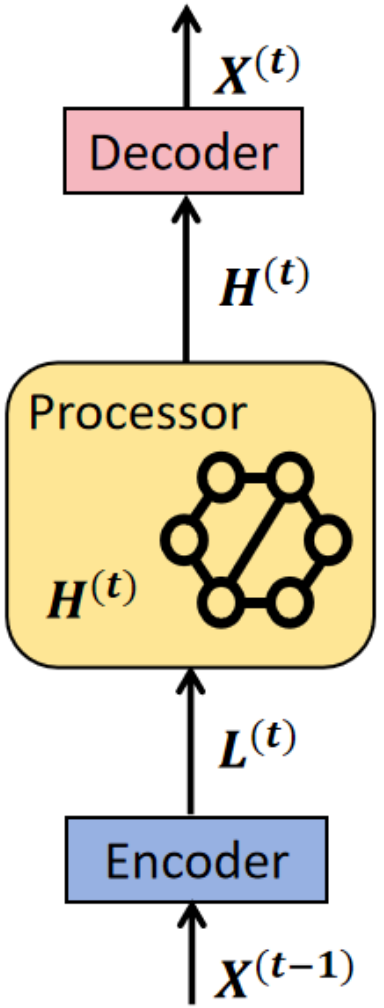
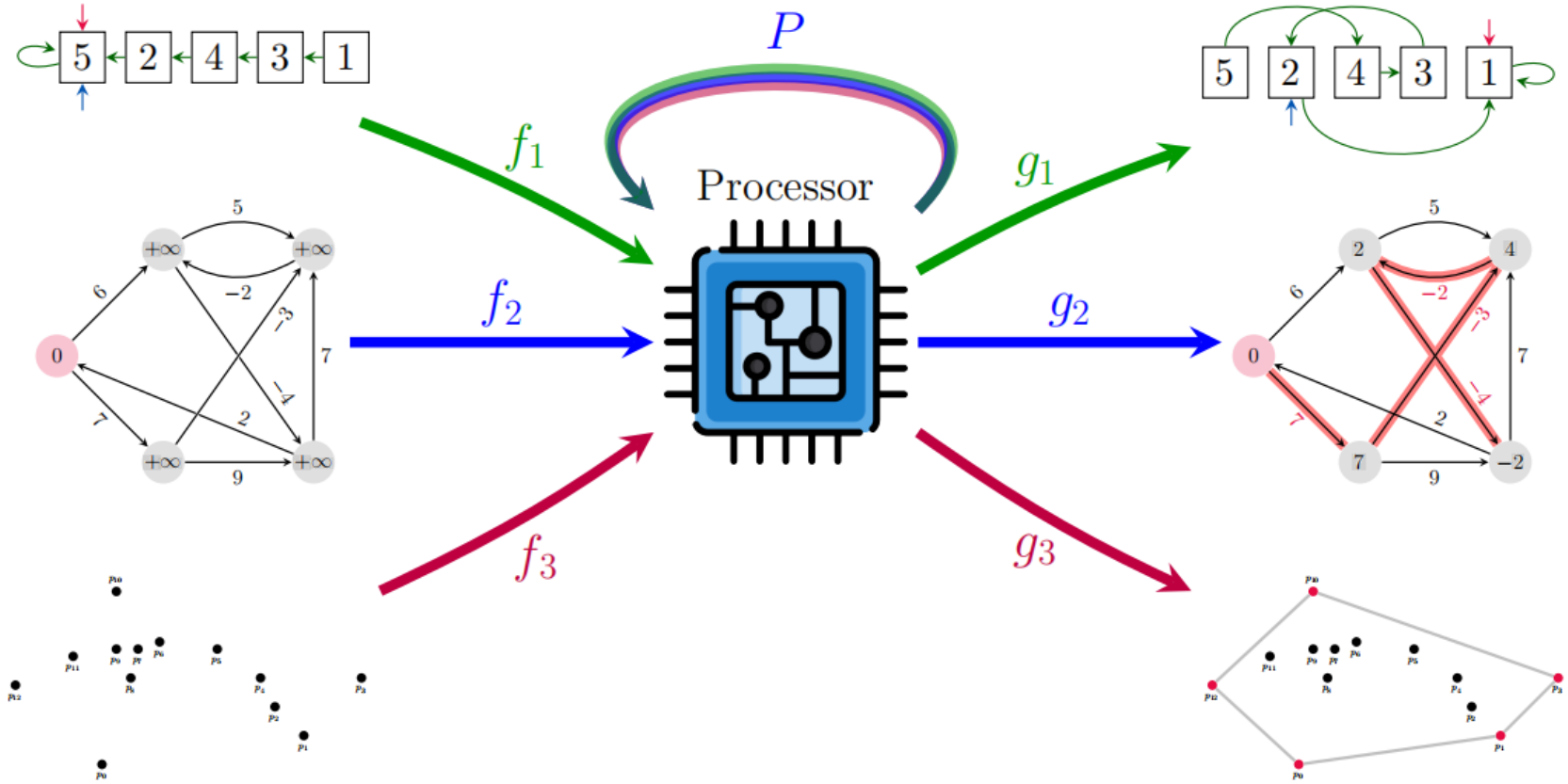
Problem Statement

- Neural algorithm reasoning



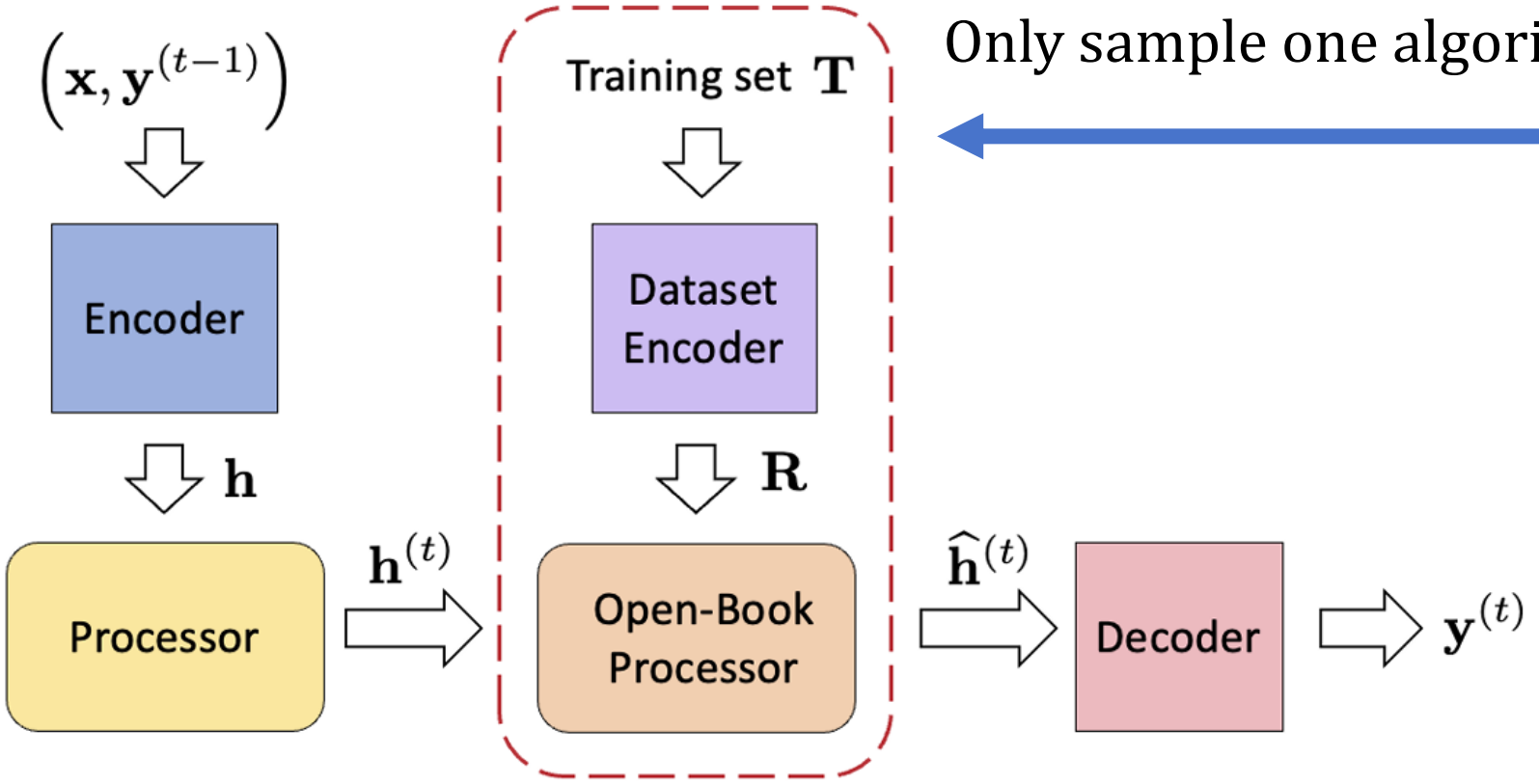
Problem Statement



B. Ibarz et al., A Generalist Neural Algorithmic Learner.(2022)

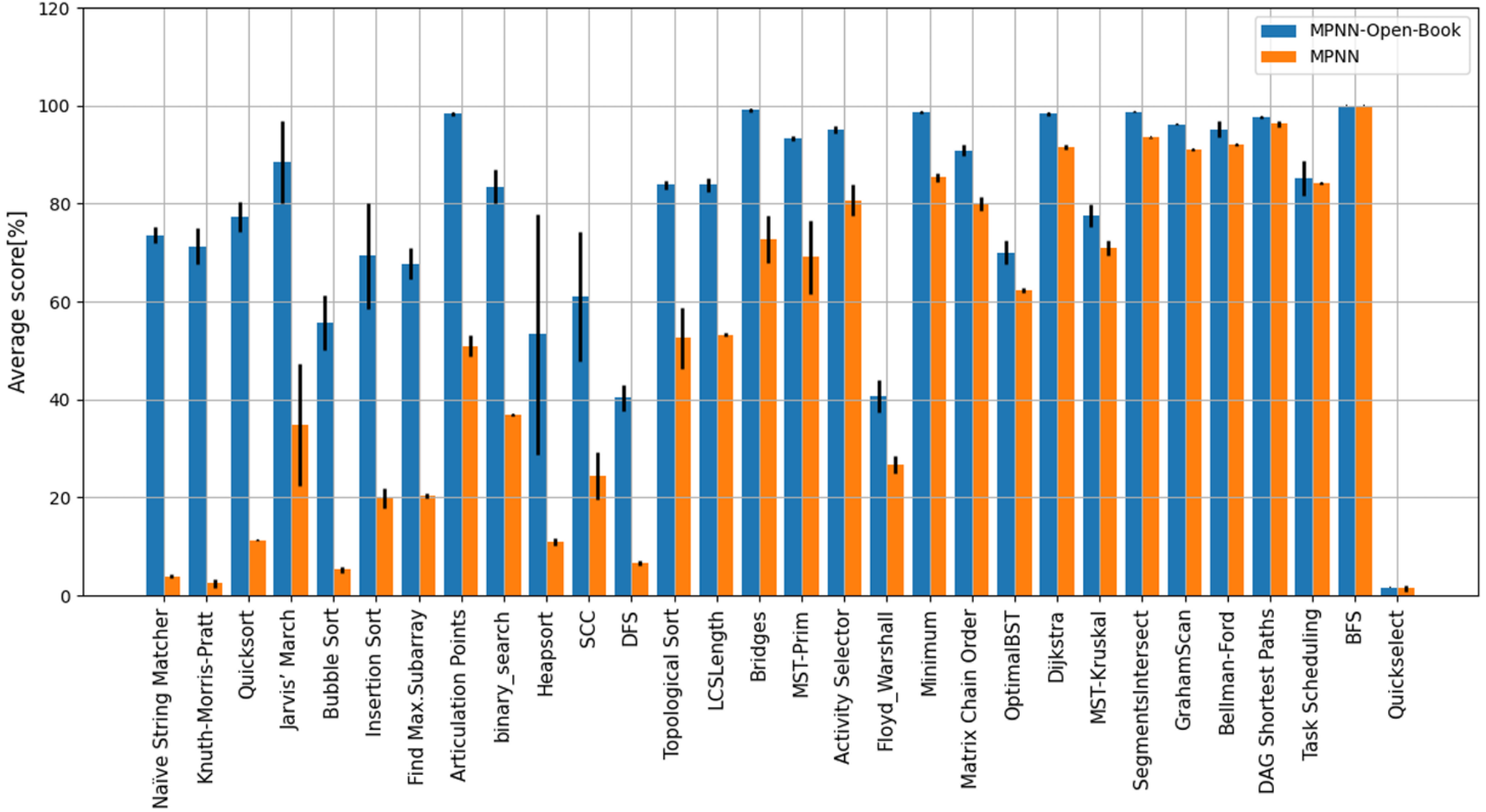
Open-book Reasoning Framework

Single-Task Augmenting



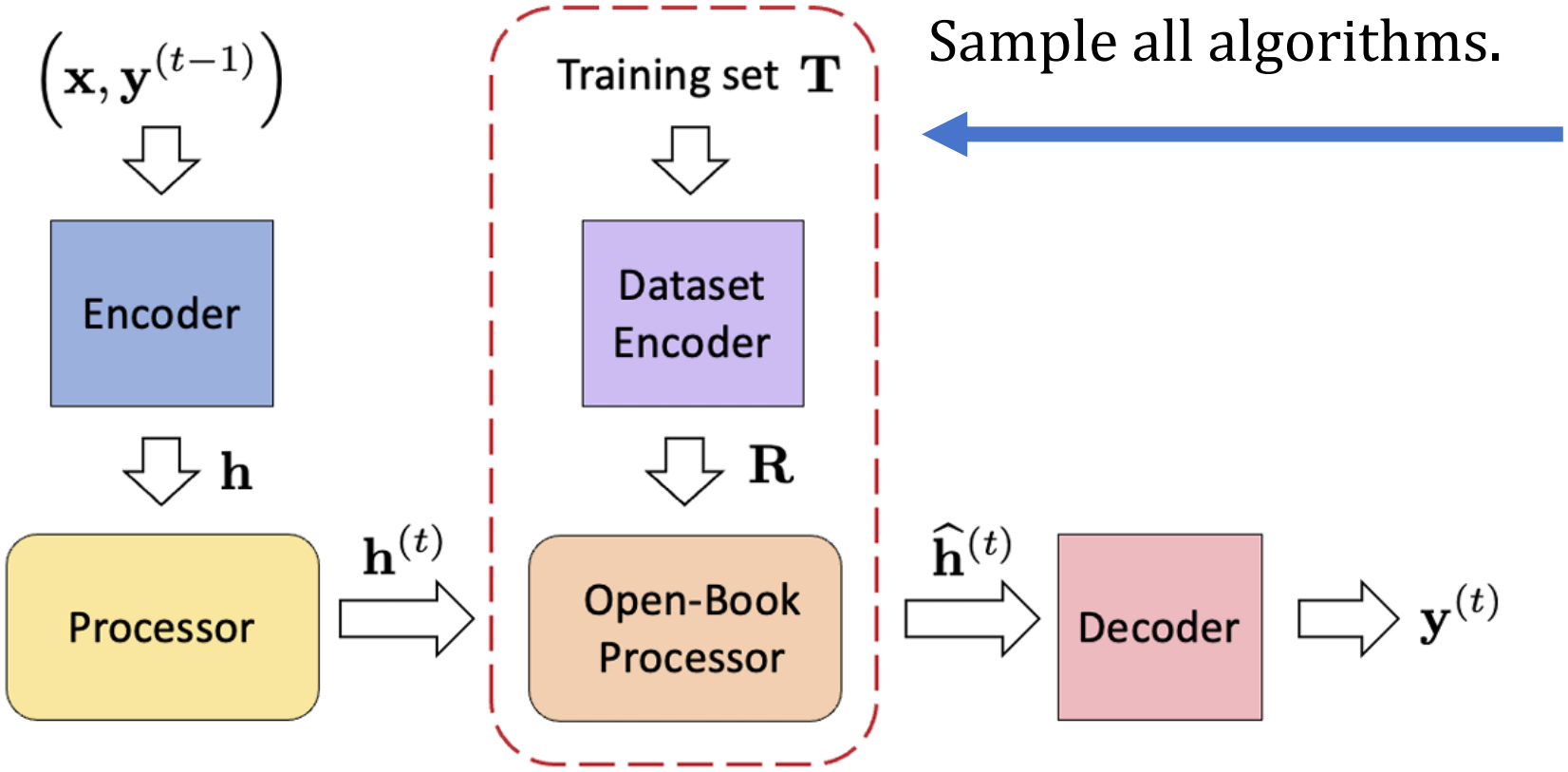
Only sample one algorithm.

Experimental results

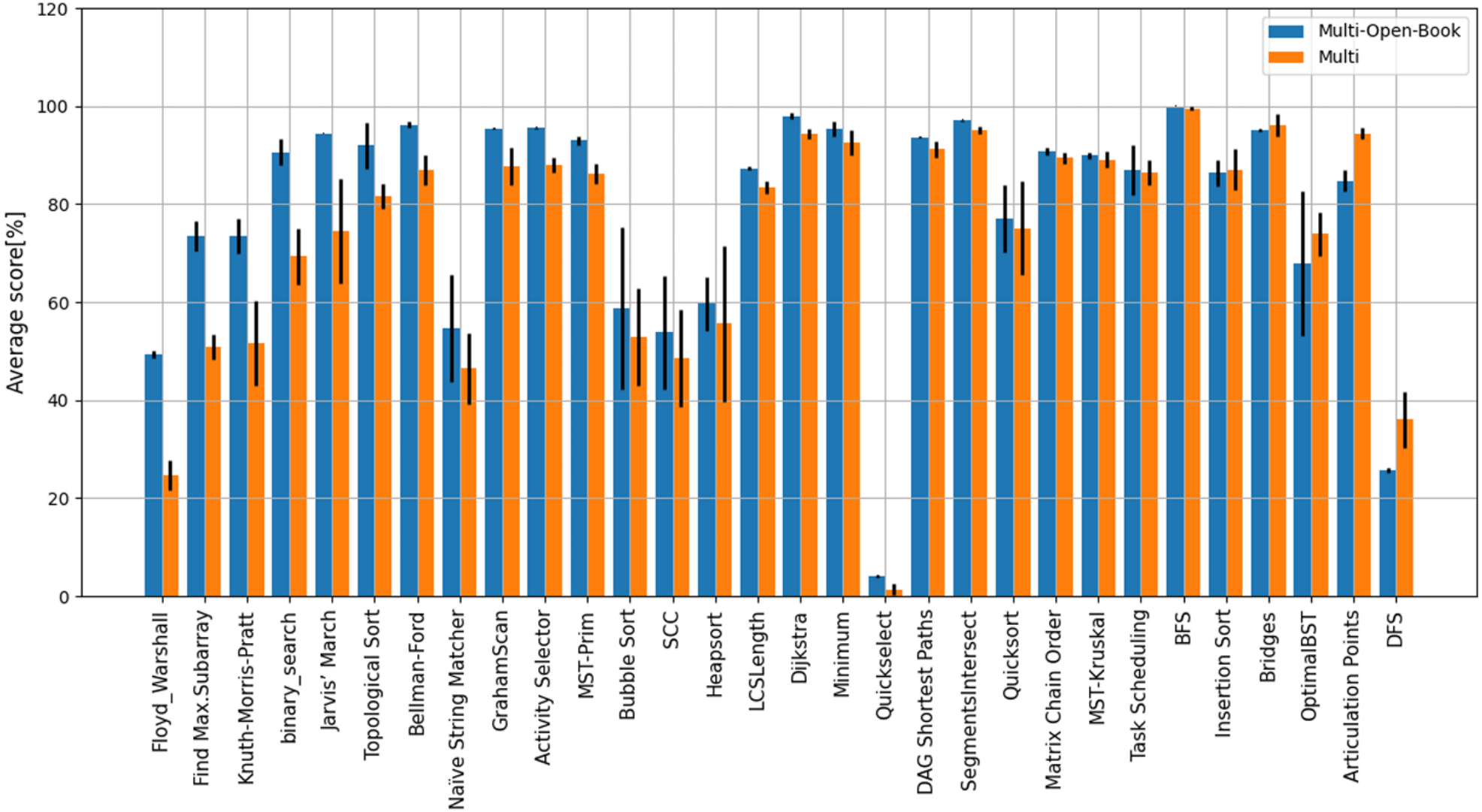


Open-book Reasoning Framework

Multi-Task Augmenting



Experimental results



Experimental results

Table 2: For each target (task), we show the task with the highest attention weight among other tasks in column "Auxiliary". We use bold text to indicate when the paired tasks belong to the same algorithmic category.

Target	Auxiliary	Target	Auxiliary
Activity Selector	Topological Sort	Jarvis' March	MST-Kruskal
Articulation Points	Knuth-Morris-Pratt	Knuth-Morris-Pratt	Quicksort
Bellman-Ford	Bridges	LCS Length	Dijkstra
BFS	Task Scheduling	Matrix Chain Order	Jarvis' March
Binary Search	**Quickselect**	Minimum	Quicksort
Bridges	Optimal BST	MST-Kruskal	Heapsort
Bubble Sort	Task Scheduling	**MST-Prim**	**Bridges**
DAG Shortest Paths	Naïve String Matcher	Naïve String Matcher	LCS Length
DFS	Binary Search	Optimal BST	Find Max. Subarray
Dijkstra	**Bellman-Ford**	Quickselect	Dijkstra
Find Max. Subarray	Jarvis' March	Quicksort	BFS
Floyd-Warshall	Heapsort	Segments Intersect	Topological Sort
Graham Scan	Quicksort	SCC	Task Scheduling
Heapsort	Activity Selector	Task Scheduling	Heapsort
Insertion Sort	Minimum	**Topological Sort**	**DAG Shortest Paths**

Experimental results

Table 3: Comparisons among three training manners under Triplet-GMPNN.

Task	Single-Task	Multi-Task	Paired-Task
Heapsort	31.04%±5.82	**55.62%**±15.91	46.63%±10.43
Knuth-Morris-Pratt	19.51%±4.57	51.61%±8.63	**65.67%±12.36**
Insertion Sort	78.14%±4.64	87.00%±4.16	**95.78%±0.80**
LCS Length	80.51%±1.84	83.43%±1.19	**85.86%±1.47**
Quicksort	64.64%±5.12	75.10%±9.52	**88.43%±6.25**
SCC	43.43%±3.15	48.48%±9.96	**73.39%±3.00**
Jarvis'March	91.01%±1.30	74.51%±10.71	**94.44%±0.63**
MST-Kruskal	89.80%±0.77	89.08%±1.64	**90.55%±1.12**
MST-Prim	86.39%±1.33	86.26%±2.08	**92.56%±0.99**
Topological Sort	87.27%±2.67	81.65%±2.53	**87.30%±4.62**
Dijkstra	96.05%±0.60	94.29%±1.04	**97.44%±0.50**
Binary Search	77.58%±2.35	69.30%±5.65	**79.17%±2.79**
Bubble Sort	67.68%±5.50	52.94%±9.96	**70.30%±6.77**
Graham Scan	93.62%±0.91	87.74%±3.87	**94.58%±0.87**
Minimum	97.78%±0.55	92.50%±2.53	**98.32%±0.14**

Conclusions

- Our contributions includes:

1. Proposing the **open-book framework** and demonstrated its ability to enhance the inference performance of the model.
2. Open-book framework can be used as an effective tool for Interpretable learning.

- Our future works includes:

1. Continuing to improve our framework.
2. More effective implementations within the framework.

Thanks for your attention.

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