

Searching new Configurations in Critical Adaptive Distributed Embedded Systems with DRL

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A system that constitutes of a number of functional tasks which are executed on the computational nodes that are interconnected with multiple links on a coordinate by exchanging messages and cooperating to achieve some common goal.

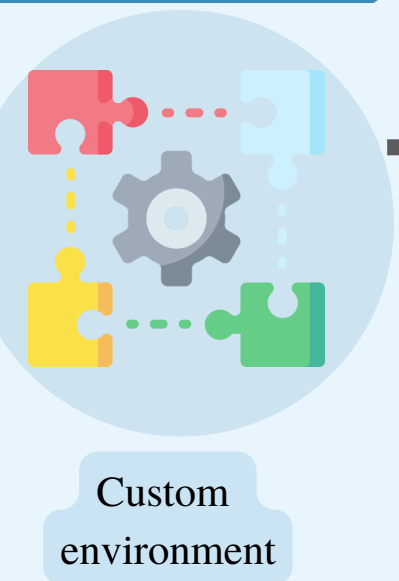
- OPERATIONAL CONTEXTS
- FAULT TOLERANCE
- REAL-TIME
- ADAPTIVITY
- SELF-RECONFIGURATION

This project aims to use Deep Reinforcement Learning to solve the combinatorial optimization problem of assigning task to nodes with varying capacities in a distributed embeded environment.

Allocation criteria must obey following restrictions:

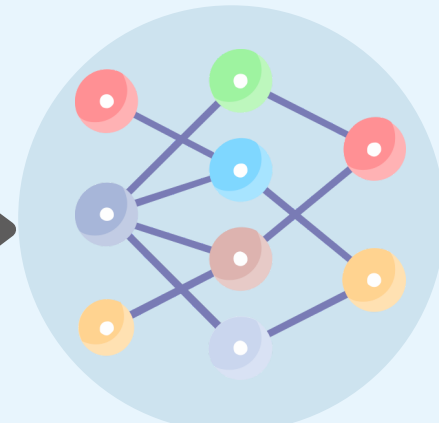
- Critical task should not be allocated in same node.
- Task sharing message should be in same node.
- Configuration should have maximum occupancy ratio.

Methodology



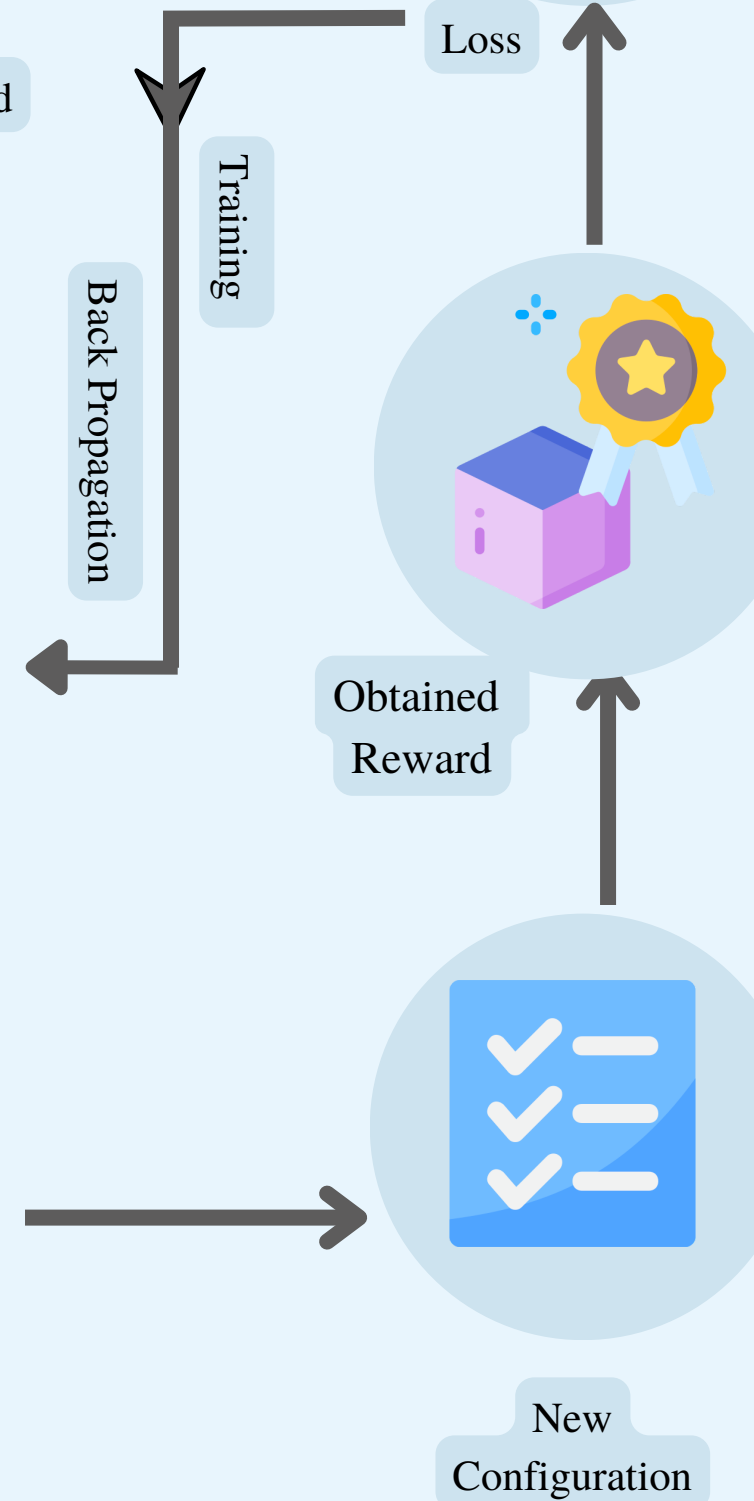
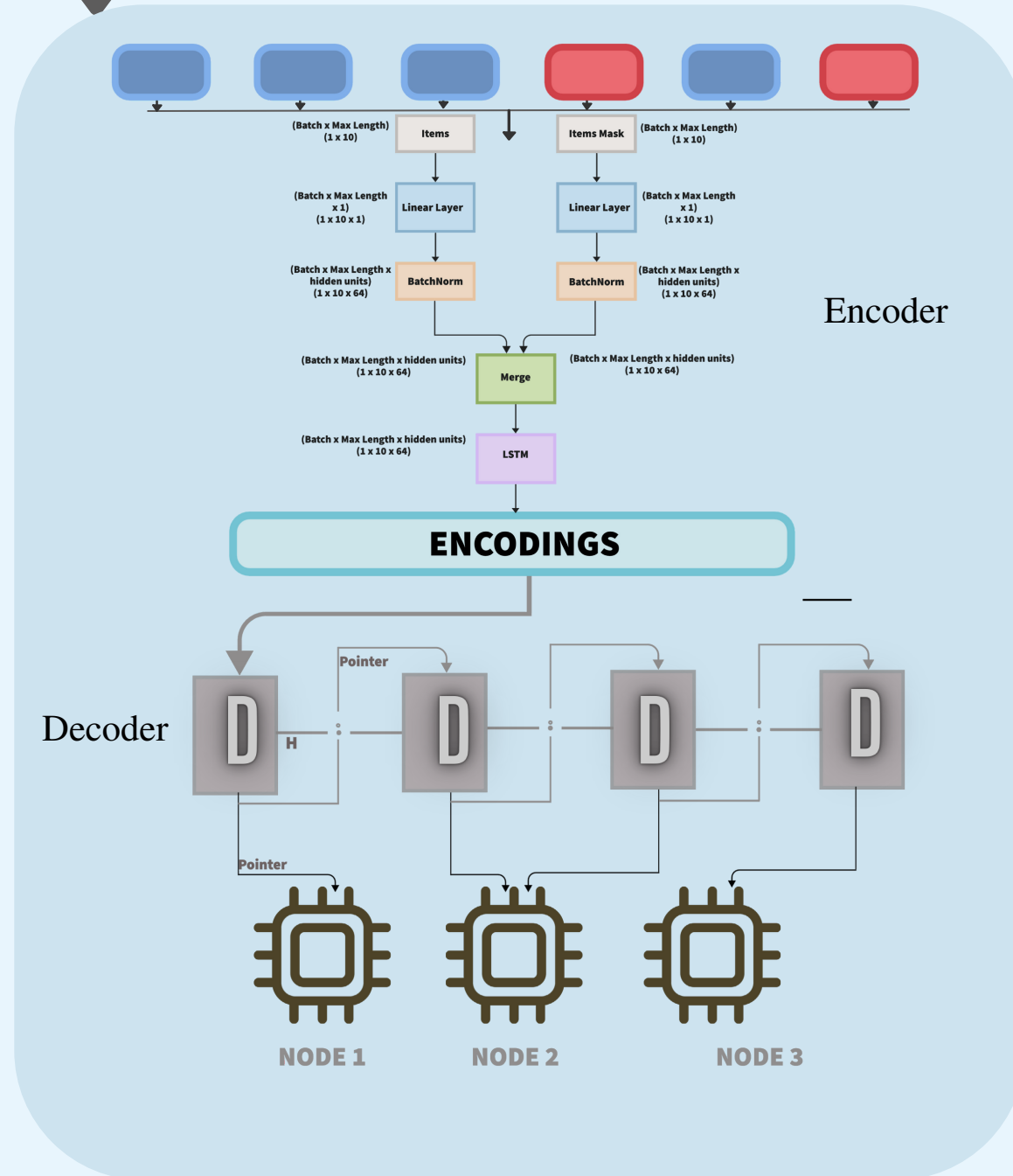
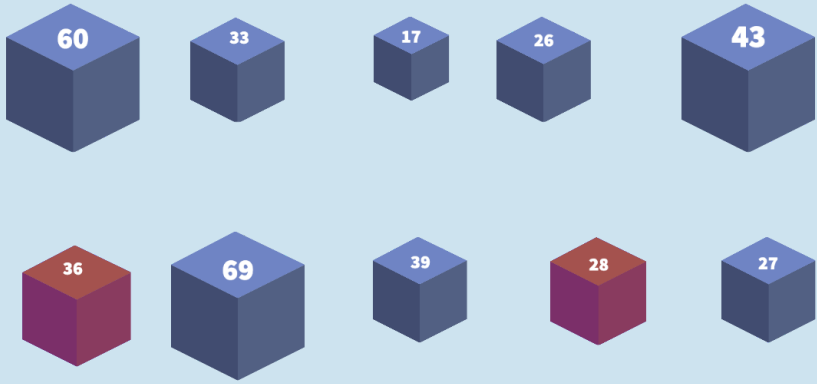
- Task weights
- Node Capacity
- Task Types

- Normal Task
- Critical Task

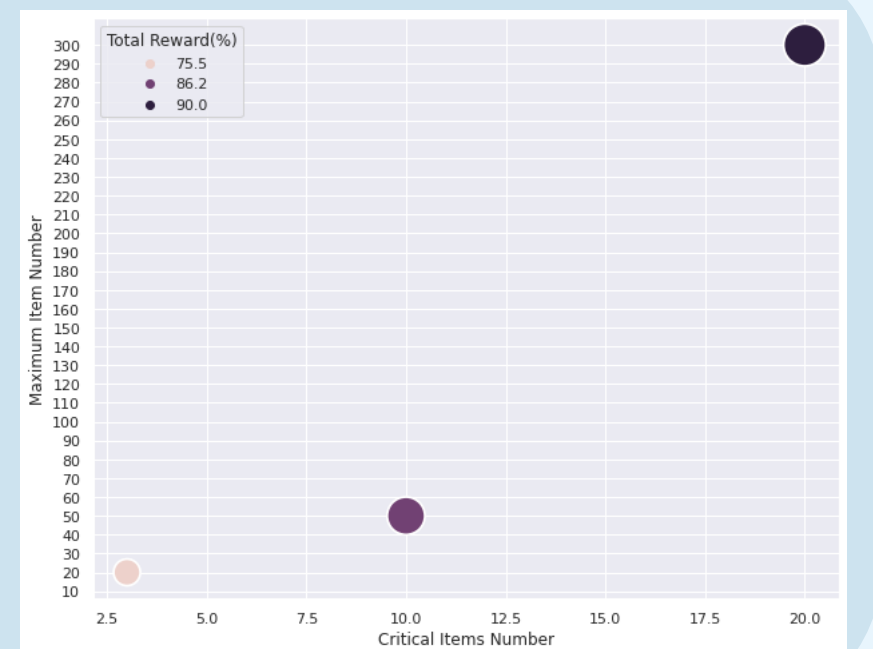
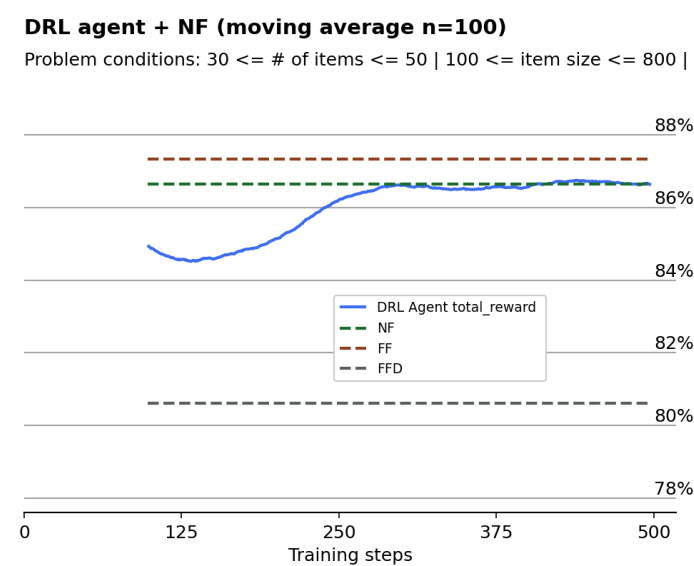
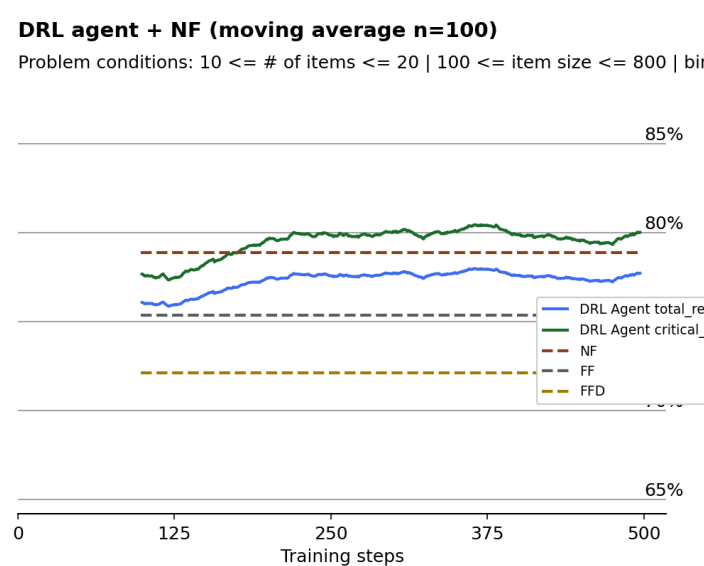
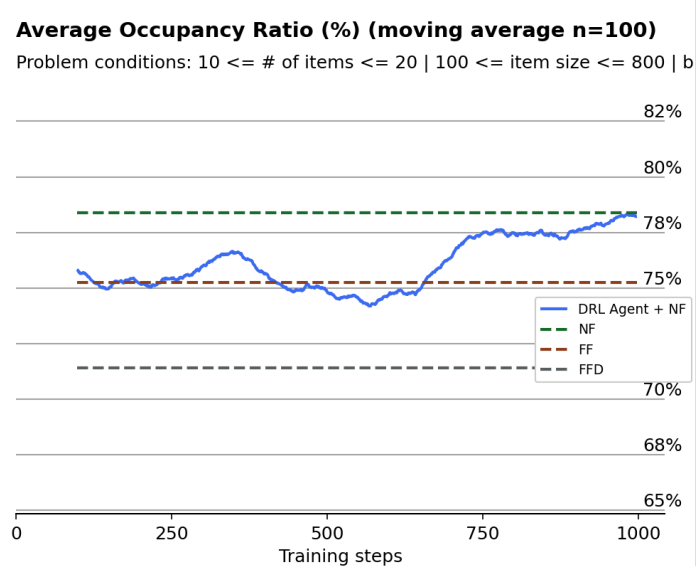


Can you solve?

- Put all the items in bags
- Use minimum number of bags
- Red items should be in same bag
- Solve within 60 seconds



Result



Tools



Use Cases

- Solve task allocation and scheduling problem on various Critical Adaptive Distributed Embedded Systems
- Provide optimal solutions quickly for combinatorial optimization problems in a constraint environment
- Distribution and Inventory section of supply chain industry can be beneficiary in truck and container loading, design of packing and others



Challenges

- Lack of underlying research
- No other approach to compare our results
- Uncertainty of critical scenerios
- No ground truth for more than 14 tasks
- Formulizing reward function

Future plan

- Convert to a light model to run on MCUs
- Emitting Heuristics
- Train different for specific scenerios