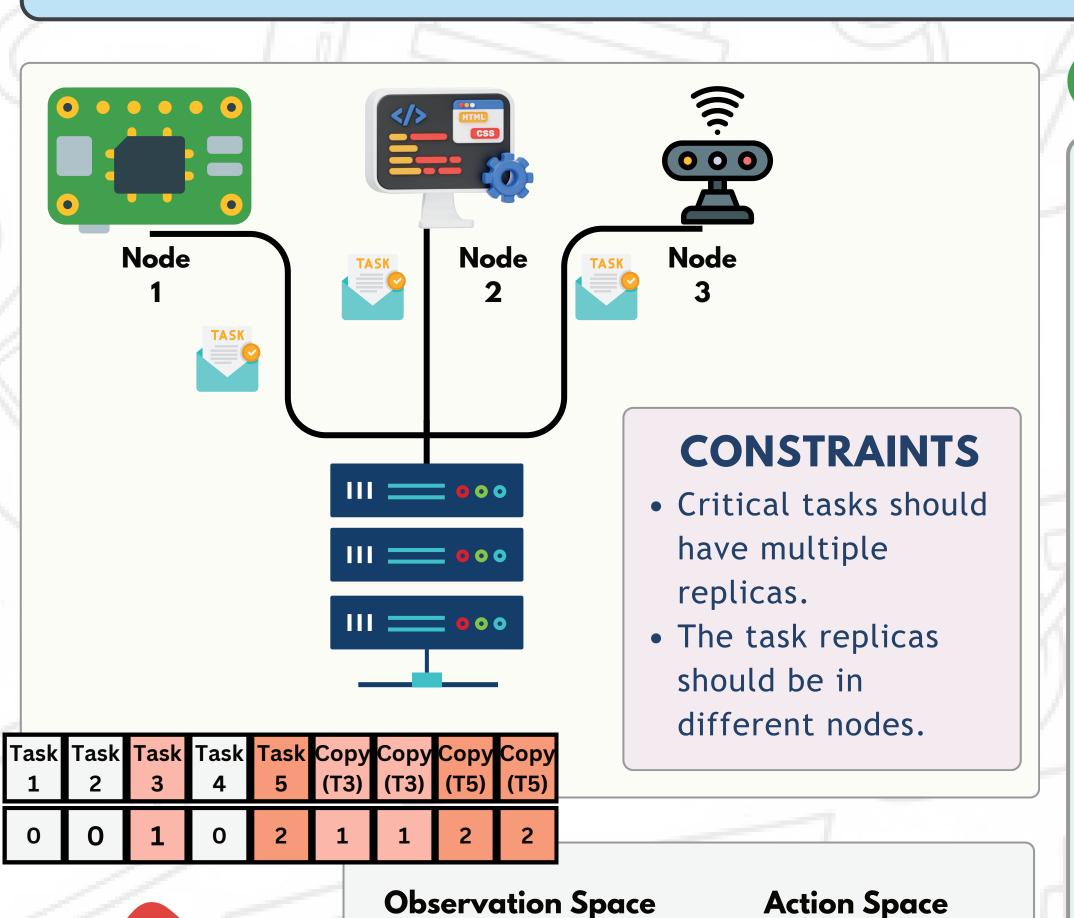
NEW CONFIGURATIONS IN CRITICAL ADAPTIVE DISTRIBUTED EMBEDDED SYSTEMS

Arrange Tasks

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WHAT IS IT?

A Distributed Embedded System (DES) is a network of nodes performing cooperative tasks. They may need high adaptability and should be able to handle dynamic and uncertain conditions. **Our goal** is to create a system that can find suitable configurations for tasks execution, support the allocation of critical tasks, and enable the replication of critical tasks so that the system can continue functioning in case of node failures.



Tasks

Nodes

• Deep Reinforcement Learning Model - LSTM PPO with Actor-Critic • Critical Masking for Critical Tasks and Its Duplicates Action Masking on Duplicate Chosen Tasks • Curriculum Learning for Learning Complex Environments Action **Proximal Policy Optimization (PPO)** Duplicate **Actor (LSTM Policy)** Selected? Critic Generate a (Value Function) Unmasked **Valid Action** Action Masked **Negative reward** Action for invalid choice **`--→** ENVIRONMENT ◀ **Unmasked Action**

EDISS

Flow

Curriculum Learning

of

Training:

- Fixed Task Weights
- Small Range of variability
- On a higher range of variability

Comparison:

 Train Directly on the higher range

Tasks	Tasks	weight
12	2	3
12	2	3-4
12	2	1-5

Critical

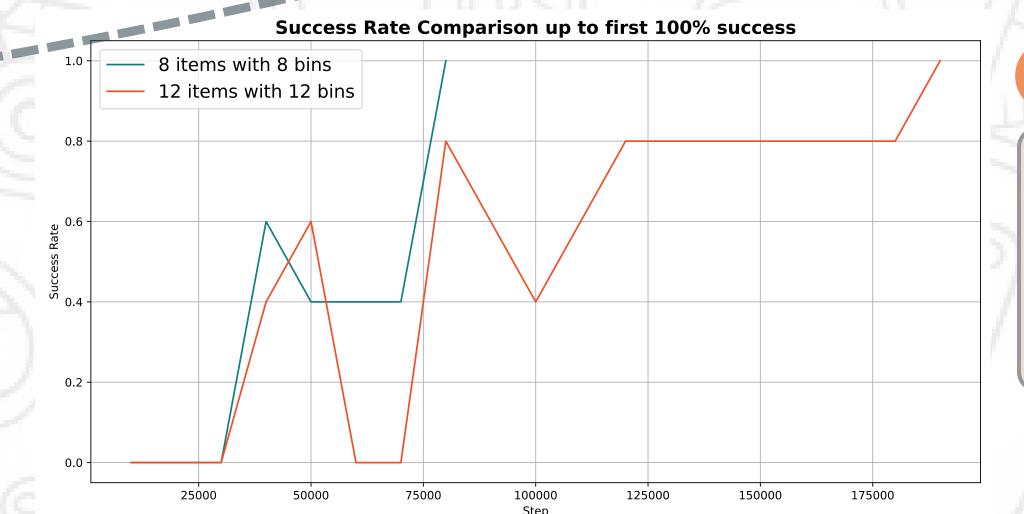
Success Rate Comparison up to first 100% success 1.0 Curriculum Learning Normal Approach 0.8 0.0.0 0.0.

WHY ACTION MASKING?

- O(N^N)
 complexity
 without
 Duplicate
 Masking
- O(N!)
 Complexity
 with
 Duplicate
 Masking
- Critical Mask

 Start | New | New Action |
 Description | No | N

Environment



Reward

Applications

- Real-world applications and some of them have real-time (RT) and dependability requirements.
- In Distributed Clouds where zone-wise availability is crucial.
- From IOT, Sensor Fusion to Critical Industrial Systems