ETH
Eidgenössische Technische Hochschule Zürich
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Distributed Computing

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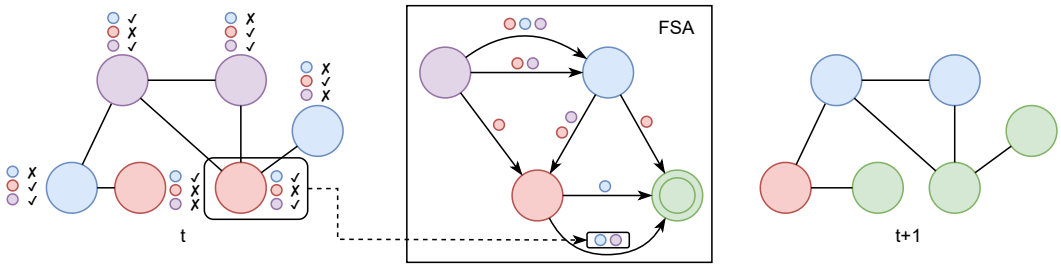
Learning Finite State Automatons on Graphs with Reinforcement Learning

In this project, our chosen model of computation revolves around a graph-based framework. Specifically, we deploy an identical Finite State Automaton (FSA) on each node within the graph, and the computation proceeds in synchronous rounds. During each round, nodes gather states from their neighboring nodes, aggregating this variable-sized input into a fixed-size output. Subsequently, this aggregated output serves as the input for the FSA, determining of the next state. A straightforward aggregation method involves checking for the presence of neighbors in a particular state, as depicted in the visualization below.



The primary objective of this computation model is to tackle graph-related tasks, such as algorithms where nodes are assigned an initial state, and through learned transitions, they compute output values determined by the final states of the automatons. As an example, consider a scenario where one node is initially in a different state from the rest. After the all nodes reach a final state, they can then be used to decide whether a node has an odd or even distance from the starting node.
To achieve this, we aim to leverage (multi-agent) reinforcement learning (RL), wherein each node acts as an agent responsible for taking actions. The scope of the project encompasses the development of the RL agent and the generation of appropriate training and testing datasets.

Requirements: Strong motivation, knowledge in neural networks and machine learning, as well as good coding skills. Prior practical experience with neural networks is a big advantage. We will have weekly meetings to discuss open questions and determine the next steps.

Contact

In a few short sentences, please tell us why you are interested in the project and about your coding and machine learning background (i.e., your own projects or courses).

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