Overview of Multi-agent Reinforcement Learning in Game Playing

Buciu Ștefan

**What is MARL?**

Multi-agent RL (MARL) defines a setting where multiple agents are trying to maximize their own long-term result by taking sequential decisions that interact with the environment and each other.

**MARL Settings**

* Cooperative: agents share the reward function
* Competitive: Zero-sum Markov Games
* Mixture: general-sum game setting

**MARL Challenges**

* Nonstationarity

In MARL environments, there are multiple agents that interact with the environment. Thus, it becomes nonstationary and loses the MDP properties.

* Scalability

Due to the fact that we need to consider a joint-action space, algorithms may have exponential complexity

* Partial observability

Agents do not have full information about the environment

**MARL Algorithms**

* Counterfactual multi-agent policy gradient (COMA)

The COMA algorithm uses the actor-critic and centralized training of decentralized policies paradigms.

* Hysteretic Q-learning (HQ-learning)

The HQ-learning algorithm is an improvement over optimistic learners where the Q-values are increased or decreased by using two different learning rates.

* Lenient Multi-Agent Deep Reinforcement Learning (LDQN)

LDQN deals with relative generalization by ignoring sub-optimal actions in the beginning.