

## Curriculum-Based Multi-Agent Reinforcement Learning for Robotic Navigation

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**Abstract :** Deep reinforcement learning has been applied to address various problems in robotics, such as autonomous driving and unmanned aerial vehicle. However, because of the sparse reward penalty for a collision with obstacles during the navigation mission, the agent fails to learn the optimal policy or requires a long time for convergence. Therefore, using obstacles and enemy agents, in this paper, we present a curriculum-based boost learning method to effectively train compound skills during multi-agent reinforcement learning. First, to enable the agents to solve challenging tasks, we gradually increased learning difficulties by adjusting reward shaping instead of constructing different learning environments. Then, in a benchmark environment with static obstacles and moving enemy agents, the experimental results showed that the proposed curriculum learning strategy enhanced cooperative navigation and compound collision avoidance skills in uncertain environments while improving learning efficiency.

**Keywords :** curriculum learning, hard exploration, multi-agent reinforcement learning, robotic navigation, sparse reward

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