

Invited Talk Abstract

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Deep Reinforcement Learning Strategies in Cooperative and Competitive Multi-Agent Games

André A. Keller*Invited Speaker*

Date	July 29, 2026
Time	14:00–14:30
Session	Session 7
Venue	S102, Lecture Hall, Gong-Guan Campus, NTNU

Abstract

This presentation investigates deep reinforcement learning (DRL) strategies for cooperative and competitive multi-agent games, using neural networks as high-capacity function approximators for policies, value functions, and opponent models. Multi-agent environments introduce non-stationarity, partial observability, and strategic coupling between agents, making classical RL insufficient. We analyze how neural-network-based architectures—such as centralized critics, value-decomposition networks, multi-agent policy gradients, and differentiable communication modules—enable agents to learn robust strategies in cooperative, competitive, and mixed-motive settings. The study compares learning dynamics, convergence properties, and emergent behaviors across game types, emphasizing how deep architectures shape coordination, competition, and equilibrium selection. Applications to benchmark environments (e.g., SMAC, PettingZoo, Hanabi) illustrate the strengths and limitations of DRL in multi-agent strategic decision-making.

References

- [1] A. A. Keller, An introduction to reinforcement learning methods for strategic decisions in competitive and cooperative multi-agent games, in Jingyang Xu (Ed.), *Proceedings of the 2025 4th International Conference on Automation, Robotics and Computer Engineering (ICARCE)*, December 18–19, 2025, Wuhan, China.
- [2] S. V. Albrecht, F. Christianos, and L. Schäfer, *Multi-Agent Reinforcement Learning: Foundations and Modern Approaches*, The MIT Press, Cambridge, MA, 2024.
- [3] R. S. Sutton and A. G. Barto, *Reinforcement Learning: An Introduction*, The MIT Press, Cambridge, MA, 2018.