Reinforcement learning for board games

Laboratory:
Swiss Data Science Center

Type:
Semester project

Description:
Reinforcement Learning (RL) has emerged as a powerful technique for training agents to master complex tasks through trial and error. Board games provide an ideal domain for exploring RL algorithms, as they offer well-defined rules and clear objectives. Recent advancements have demonstrated the effectiveness of RL techniques, particularly the AlphaZero algorithm [1], in achieving superhuman performance in classic games like chess, shogi, and go.

RL is a branch of machine learning that focuses on training agents to make sequential decisions in an environment to maximize cumulative rewards. Self-play is a training paradigm where an agent learns by playing against itself, allowing it to improve over time through continuous self-generated experience. AlphaZero combines Monte Carlo Tree Search (MCTS) with deep neural networks to learn optimal policies without relying on any human expertise or prior knowledge. Due to its success, AlphaZero has been applied in various scenarios [2, 3].

This project goal is to define a simulator for a selection of board games and employ self-play techniques to train RL models, with the objective of discovering optimal strategies. Such exploration could also be applied to evaluate game balance, a critical feature that needs fine-tuning during the design of a board game.

Goals/benefits:
- Working with machine learning, deep learning, and reinforcement learning libraries in Python
- Hands-on experience, from data collection to visualization

Prerequisites:
- Machine learning (advanced or intermediate skills)
- Python (advanced skills)
- Interest in board games and game design are a plus

Deliverables:
- Well-documented code
- Written report and oral presentation

References:

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