

Homework 01

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Task 01

You are tasked with creating an AI for the game of chess. To solve the problem using Reinforcement Learning, you have to frame the game of chess as a Markov Decision Process (MDP). Describe both the game of chess formally as a MDP, also formalize the respective policy.

Solution

- Set of states $S^{\text{Num rows} \times \text{Num columns} \times \text{Chess pieces}}$.
- Set of actions A : Let be $d = \{\text{up, down, right, left} \dots\}$. $A = \bigcup_{i=1}^{\text{Chess pieces}} \hat{A}_i$ with $\hat{A}_i = \{x : x \in d \wedge \text{isAvaibleAction}(x, i)\}$.
- State dynamics/state transition function $p(s'|s, a) = \text{makeMove}(s, a)$. $\text{makeMove}(s, a)$ returns a next state given action a and current state s .
- Reward dynamics $p(R_{t+1}|s, a) = \text{killEnemyPiece}(s, a)$.
$$\text{killEnemyPiece}(s, a) = \begin{cases} 1 & \text{if action } a \text{ does capture a enemy piece in current state } s \\ 0 & \text{otherwise} \end{cases}$$
- Initial state $\mu = \text{start state} \in S$.
- Policy: $\pi(s) = \arg \max_{a \in A} V_\pi(s)$ with $V_\pi(s) = \text{Number of captured chess pieces from the enemy}$.

Task 02

Task 03