6-1 Discussion: Exploring AlphaGo

Joel De Alba posted Aug 14, 2023 4:44 PM Subscribed

Hello fellow classmates,

AlphaGo Zero marked a significant leap forward in the field of artificial intelligence and reinforcement learning, demonstrating remarkable improvements over its predecessors. The key differences that set AlphaGo Zero apart are its novel training methodology and its self-play approach without relying on human expert data. Unlike the original AlphaGo, which learned from a large dataset of human games, AlphaGo Zero starts from scratch and learns solely through self-play using Monte Carlo Tree Search (MCTS) simulations.

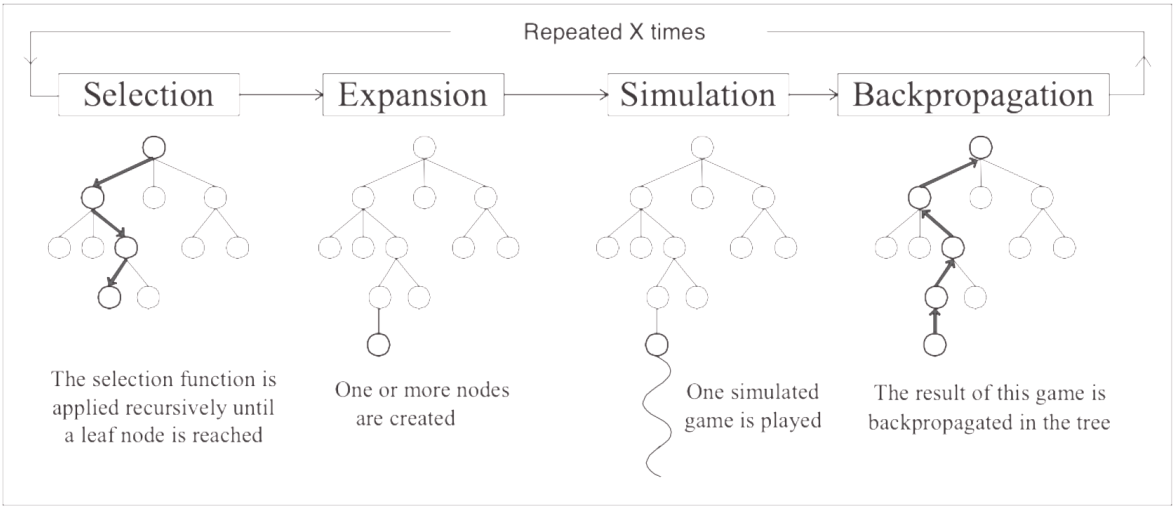

Figure 1: Outline of a Monte-Carlo Tree Search.

Image from GeeksforGeeks - Link in sources

Monte Carlo Tree Search (MCTS) is a popular algorithm used in decision-making processes, it begins by traversing a tree-like structure representing different possible moves or actions. It starts at the root node (initial game state) and selects child nodes iteratively based on a

selection strategy, this initiation step is called Selection. Once a leaf node is reached (a node with unexplored children), the algorithm expands the tree by adding new child nodes corresponding to possible actions from that state, this second part is called Expansion. For each new child node, the MCTS algorithm performs simulations, also known as rollouts. From here MCTS randomly selects actions from the current node to a terminal state (end of the game) and evaluates the outcome, this third section is Simulation. After a rollout is complete, the algorithm backpropagates the results of the rollout back up the tree to update the statistics of the nodes traversed. This information includes the number of times a node has been visited and the cumulative rewards obtained, this last part is part of the backpropagation after this a decision is made based on the amount of iterations and computational resources, this is usually the action with the highest average reward in the root node's children.

To provide simpler understanding,

MCTS is like a smart strategy used in situations where you have lots of choices and things are a bit uncertain. Imagine you're playing a game with many possible moves. MCTS helps you pick the best moves by doing a few important steps.

First, it starts with the first move you can make and checks what might happen next. It's like looking ahead in the game tree. Then, it selects a move to explore based on what seems good. It does this over and over, like taking steps in a tree. When it gets to a point where it hasn't looked before (like a new place in the tree), it tries new moves from there. It's like trying out different paths to see how they turn out. This is called "expanding" the tree. For each new move it tries, it pretends to play the game from there to the end. This is called a "simulation" or a "rollout." It does this many times, and each time it sees how the game ends up.

After trying lots of paths, MCTS looks back and sees which moves seem to be good based on the results of the simulations. It counts how often each move leads to a good result. In the end, MCTS helps you decide which move is the best by picking the one that usually leads to the best results. It's like finding the path that's most likely to win the game.

This helps AI systems, like in AlphaGo and AlphaGo Zero, make smart choices in games with many possibilities. It's like having a strategy guide that tells you the best moves to make.

Sources

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