**AI LAB PROJECT PROPOSAL**

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1. Project Overview

Project Topic:

This project focuses on implementing Dice Wars, a strategic board game where players compete to conquer territories using dice-based battles. The game will feature two AI opponents:

* Heuristic AI: Uses predefined rules to make decisions.
* MCTS AI: Uses Monte Carlo Tree Search to explore possible moves and optimize strategy.

Objective:

The main goal of this project is to compare heuristic-based AI and MCTS-based AI in a competitive setting to analyze which approach performs better in Dice Wars.

2. Game Description

Original Game Background:

Dice Wars is a turn-based strategy game where players control territories, each containing a stack of dice. Players can attack neighboring territories by rolling their dice against the opponent’s stack. The attacker wins if their total dice roll is higher than the defender’s. The objective is to conquer the entire map.

Innovations Introduced:

* AI vs. AI Battle: Instead of human players, two AI models will compete.
* Heuristic AI vs. MCTS AI: One AI will rely on predefined rules, while the other will use probabilistic simulations.
* Performance Evaluation: The effectiveness of each AI strategy will be analyzed based on the number of wins, decision-making speed, and board control.

3. AI Approach and Methodology

AI Techniques to be Used:

1. Heuristic AI:

* Uses simple rules to determine the best move.
* Example heuristics:
  + Prioritize attacking weaker opponents.
  + Expand into territories with fewer enemy dice.
  + Avoid risky attacks with low probability of success.

2. Monte Carlo Tree Search (MCTS) AI:

* Simulates thousands of random gameplays to estimate the best move.
* Uses Upper Confidence Bound (UCB1) to balance exploration vs. exploitation.
* Backpropagates results to refine decision-making.

Heuristic Design:

* The Heuristic AI will evaluate moves based on risk vs. reward.
* The MCTS AI will simulate multiple game states before making a move.

Complexity Analysis:

* Heuristic AI is fast (O(1) decision-making) but may not always find the optimal move.
* MCTS AI is slower (O(n log n) per decision) but explores better strategies.

4. Game Rules and Mechanics

Modified Rules:

* The game is AI vs AI—no human input.
* No diagonal attacks (only adjacent territories).
* Dice limits may be adjusted for balance.

Winning Conditions:

* A player wins by capturing all territories.

Turn Sequence:

1. The AI evaluates all possible moves.
2. It selects the best move based on its strategy (Heuristic/MCTS).
3. The opponent responds using their strategy.
4. The process repeats until one player wins.

5. Implementation Plan

Programming Language:

* Python

Libraries and Tools:

* NumPy (random number generation)

Milestones and Timeline:

| Week | Task |
| --- | --- |
| 1-2 | Design game rules and map layout |
| 3-4 | Implement Heuristic AI |
| 5-6 | Implement MCTS AI |
| 7 | AI vs. AI testing and evaluation |
| 8 | Final testing and report preparation |

6. References

* Just some google searching and exploration with help of gpt