

Project Title: BattleShips Game Using AI

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Course: AI

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1. Project Overview

- **Project Topic:**

This project aims to implement an AI-powered version of the classic board game Battleships. The AI opponent will have multiple difficulty levels, ranging from a simple random shooter to an advanced probability-based decision-maker.

- **Objective:**

The goal is to develop a strategic AI for Battleships that provides an engaging and challenging gameplay experience. The AI will incorporate probability estimation, heuristic decision-making, and hunt-and-target strategies to improve its gameplay.

2. Game Description

- **Original Game Background:**

Battleships is a two-player strategy game played on a **10x10 grid**. Each player places a fleet of ships of different sizes on their grid. The objective is to **sink all enemy ships** by guessing their positions and firing shots. Players take turns calling out grid coordinates, and the opponent announces whether it's a hit or a miss.

- **Innovations Introduced:**

AI Difficulty Levels.

AI Strategy Optimization:

- Uses **heuristics** for better target selection.
- Adapts its strategy dynamically based on game progress.
- Potential **GUI**: A user-friendly **Pygame/Tkinter** interface for visuals.

3. AI Approach and Methodology

- **AI Techniques to be Used:**

Random Shooting (Easy Mode) – AI selects random coordinates.

Hunt & Target Strategy (Medium Mode) – AI shifts between hunting (random shots) and targeting (focusing on a hit area).

Probability-Based Targeting (Hard Mode) – AI assigns probabilities to each cell based on remaining ship placements and dynamically updates its predictions.

- **Heuristic Design:**

Assigns **higher probability** to central and larger empty areas.

Focuses on completing ship destruction before moving on.

Uses previous shots to **avoid redundant moves** and improve efficiency.

- **Complexity Analysis:**

Easy Mode: $O(1)$ per turn (random choice).

Medium Mode: $O(n)$ for checking adjacent hits (where n is the number of previous hits).

Hard Mode: $O(n^2)$ for updating probability maps dynamically.

4. Game Rules and Mechanics

- **Modified Rules:**

The player gets a Power-up when they hit a ship in 3 consecutive shots.

- **Winning Conditions:**

The first player to sink all enemy ships wins.

- **Turn Sequence:**

- The player selects a coordinate and fires.

- The AI (depending on its difficulty level) selects and fires at a coordinate.

- Hits and misses are displayed.

- The game continues until one player loses all ships.

5. Implementation Plan

- **Programming Language:** Python

- **Libraries and Tools:**

Pygame\Tkinter (*for Potential GUI*)

NumPy (*AI Probability Calculations*)

- **Milestones and Timeline:**

Week 1-2: Game board logic implementation.

Week 3-4: Difficulty Levels

Week 5-6: Coding and testing the game mechanics

Week 7: DeBugging

Week 8: Final testing and Documentation

6. References

- Battleships game rules: [Wikipedia](#)