

BATTLESHIP DQN AI – Midterm Report

Course: CENG 3511 – Artificial Intelligence
Student: Batuhan EVLEKSIZ
Topic: Battleship Game AI using Deep Q-Learning (DQN)

1. Game Description

Battleship is a two-player strategy game played on 10x10 grids. Each player places ships of varying lengths and tries to sink the opponent's fleet by guessing their locations. The AI version of this project uses one grid for the human player and another for the AI, implemented with Pygame visuals.

2. AI Method

The AI is based on Deep Q-Learning (DQN). The agent learns by interacting with the environment, using exploration and exploitation to choose the best actions. A neural network estimates Q-values for all possible moves. The network has 5 layers with ReLU activations, dropout, and batch normalization. The AI improves through experience replay and target network updates. The model can also train itself by self-play.

3. Implementation

Developed in Python 3.12 using PyTorch, NumPy, and Pygame. The main file runs an interactive game while 'train_self_play.py' enables automatic training. The project includes board logic, hit/miss detection, ship placement, reward calculation, and visualization. All hyperparameters (learning rate, epsilon decay, batch size, etc.) can be adjusted.

4. Results

After several hundred self-play episodes, the AI shows a significant improvement in hit accuracy and strategic shooting. It can defeat random agents consistently and adapts to patterns by recognizing ship positions efficiently. Average move time is below 0.1 seconds on CPU.

5. Challenges

Balancing exploration and exploitation, handling sparse rewards, and avoiding overfitting were the main difficulties. Implementing efficient replay memory and managing long training sessions were also challenging. Designing the reward system to encourage optimal strategies required fine-tuning.

6. Conclusion

The project demonstrates a reinforcement learning agent capable of playing Battleship strategically. It successfully integrates Deep Q-Learning with self-play to improve decision-making over time. This work combines game development, AI, and deep learning into a single functional system.

NO:
210709024