2048 Game

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Version 1- MinMax with Score Heuristic

Development Summary:

In this version I ran basic MinMax agent for the 2048 game using a score-based heuristic.

Testing Results:

- Final Score: 6040
- Time-limit:0.1
- Search depth: 10

Analysis:

- The current MinMax agent avoids invalid moves and plays okay.
- It mostly moves right or down
- It has bad score mostly because of bad tile placement
- Big tiles dont end up in the corners
- Score is not consistent, sometimes it stops around 2000-4000

Next improvement:

- Try to fit the highest tile stays in corner.
- Make it work good by adding penalty if sudden jump.
- Make score consistent.

Version 2- MinMax with an improved corner based heuristic

Development Summary:

In this version the goal is to keep the maximum tile in a corner and reward empty spaces. Soo the Highest tile won't fluctuate and gives higher score

Testing Results:

- Maximum Score: 15044
- Average Score: 8000
- Time-limit:0.1
- Max search depth: 108

Analysis:

- My Agent avoids bad moves.
- Max tile most of the time stays in a corner.
- Board has more empty tiles.
- Score is more consistent compared to version 1.

Next improvement:

- I will try to add snake pattern and make the tiles evaluated with descending order.
- And will try to keep the highest tile in right corner without moving

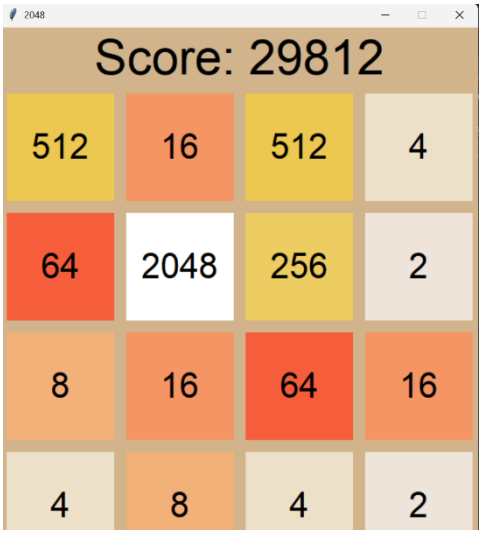
Version 3- Expectimax with monotonic and smoothing heuristic

Development Summary:

In this version I used Expectimax instead of Minimax, I implemented:

- Highest tile in the corner
- I used snake pattern
- I implemented merge and smoothness

Test Results:



- Maximum Score: 70000
- Average Score: 35000
- Time-limit:0.1

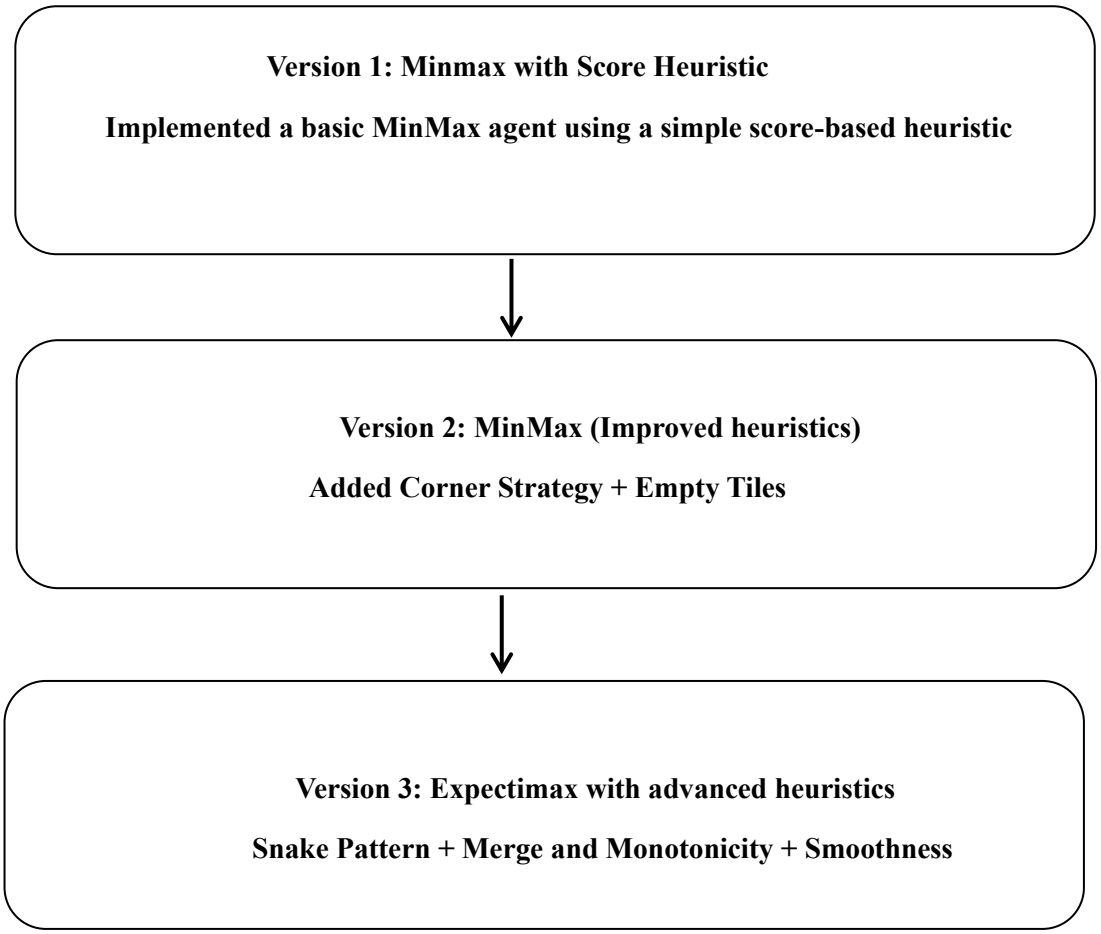
Analysis:

- Expectimax made better decisions compared to minmax.
- For this version the max tile will always stays in corner which is one of the main heuristics in 2048
- Used weighted snake pattern which made the agent think even smarter
- The agent reached 2048+4096+ tiles
- This version was more stable with median score 35k

Next Improvement:

- I will try to tune the weights to get more scores
- Try to merge both Minmax and Expectimax to implement more pruning.

Flowchart:



Conclusion:

In all three versions my agent got better over time.

- Version 1 was a simple I used scores to make moves, but it did not think where the tiles were placed so it didn't do that well.
- Version 2 it got little smarter it tried to keep the highest tile in a corner. This helped the agent make better moves.
- Version 3 was even better I used Expectimax and added advanced heuristics where it kept the board smooth, highest tile cornered and using a snake pattern I was able to score more. This made version scored the highest and it was more stable too.