Specification and Design

Title: Visualization and AI for 3D tic-tac-toe

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Introduction of tic-tac-toe

- winResult property: all ways to win
- playerResult property: all the ways player win
- compResult property: all the ways computer win
- Initialize the board according to player choice
- choose pieces: X OR O
- choose role: player OR computer
- Click on the board: only player need to click

Tictactoe1.gif

3Dtictactoe.gif

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Specification of 3D tic-tac-toe

- the chessboard extends 4x4x4 instead of 3x3x3, and both sides hold two kinds of pieces and use them in sequence.
- Two modes that are man-machine and two-player are designed
- Each mode (player or AI) holds two kinds of cheeses and uses them in sequence.

  If the cheeses of the same type are connected in a line, the victory is won.
- Player A has ◯ and ◎ pieces, player B holds X and ※ pieces of chess, and the order of the next piece of chess is player A (◯ or ◎), player B(X or ※), player A (◯ or ◎), player B(X or ※).
- player of A needs to make a line of ◯ ◯◯ ◯ or ◎◎◎◎ to win, player B needs to make a line of X X X X or ※※※※ to win.

Design of 3D tic-tac-toe

1. Game rule of 3D tic-tac-toe

- Firstly, initialization of the game.
- Secondly, the player puts the pieces and finds the corresponding array element changes, and pays attention to judging the end of the game and changing the round.
- Thirdly, AI chess placement strategy, AI should do local optimal operations, for each square, if AI can win, AI will win first, then if the opponent can win, AI will block first, otherwise, playing randomly.
- Finally, judging the game over.

Design of 3D tic-tac-toe

2. Introduction of Algorithm

- The Minimax algorithm

It is used when the initial empty board is used to ensure that all states are traversed, and the best results of all the games are cached.

- The evaluation function

The evaluation function is to fill all the empty squares with the current player's pawns and calculate how many of all the rows, columns, and diagonals are connected into four pawns, and use the total number of these pawns as the evaluation value.

Design of 3D tic-tac-toe

3. The Alpha-Beta pruning

It greatly reduces the state space of the game tree, allows the program to detect more states and obtain better decision-making solutions

4. The Visualization

Using Mayavi and TraitsUI completes the visualization of 3D tic-tac-toe. Building Mayavi windows and building steps of TraitsUI visualization has definition class from the inheritance of HasTraits and showing windows.

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