Artificial Intelligence (CSE481)

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Project description:

Mancala game is a two-player turn-based board game, where there are 14 pockets filled with stones where 2 of them is for calculating score for each player.

Our project is an implementation for this game to be played with an AI player using Minmax algorithm with alpha-beta pruning, our implementation supports networking mode where a game can instantiated between human vs human on the same machine or on different machines, also we support AI player vs AI player game. Our implementation also supports different difficulty modes (easy/medium/hard) with the option of with/without stealing mode.

Github repo link: MohamedAli25/Mancala-Game-Using-AI (github.com)

Youtube demonstration video:

Implementation details:

We chose Python to be the programming language of our algorithm implementation and pygame module for the user interface.

Project API (simplified):

- GUI
- Controller
  - Logger
- Core
  - class Node
    - methods:
      - get_score – for returning the difference between players' score
      - getScore_playerA – for returning score of playerA at the current gameState
  - Tree Traversal (class SearchTree)
    - methods:
      - make_move – for appyling the move made by the player into the searchTree.
      - make_optimal_move – for calculating the best move the AI could make.
      - is_game_finished – returns the game state whether it is finished or not.
      - get_game_state – returns the current game state.

- get_current_player_number – returns the type of the current player.
- save – for saving a game in a directory.
- load – for loading a previously saved game.

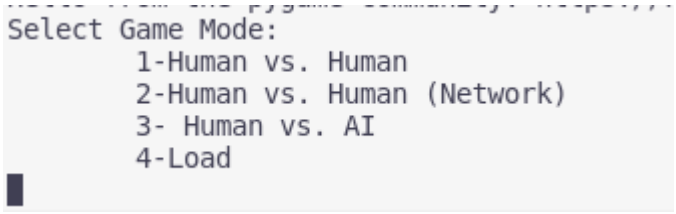
◦ AlphaBeta Prunning (class Pruner)

▪ methods:

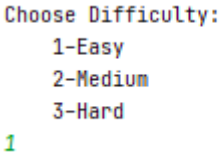
- _run_pruning – returns the best move in the game tree using alpha-beta prunning algorithm with the help of some helper functions: _update_parent_node, _update_node, _update_beta, _update_alpha and _update_bestMoveInd.
- update_bestMoveInd – recursive funciton returns the index of the child correspoding to the best move.
- _updateLeavesScore – applys the heuristic function to calculate the score of each node before calling _run_pruning.

User guide:

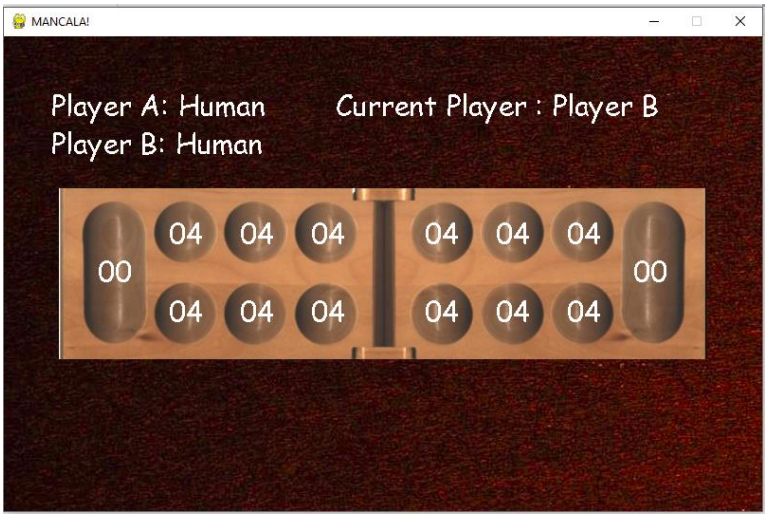
- run the game from the .exe
- choose the mode:

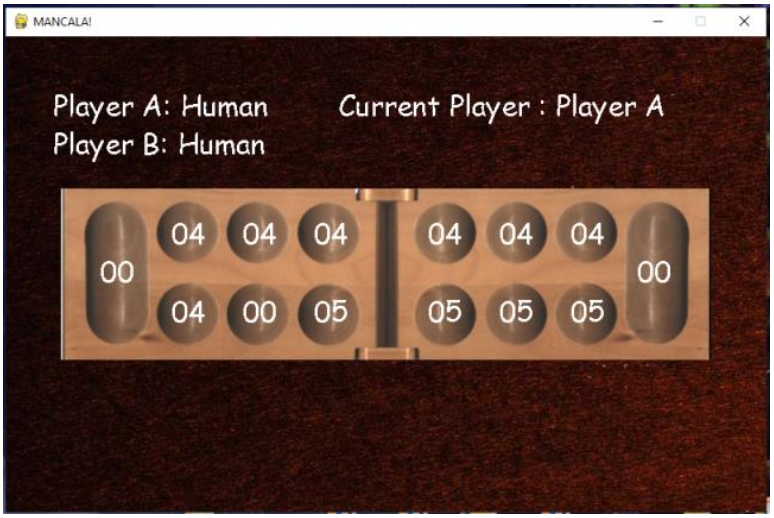


- choose the difficulty and start the game.

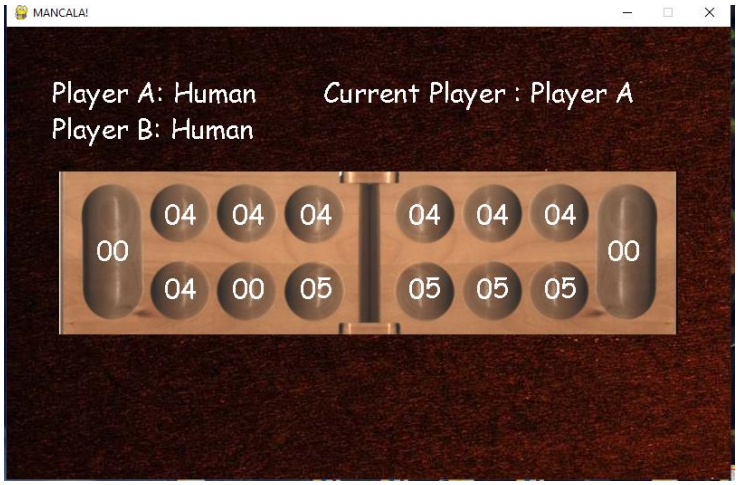


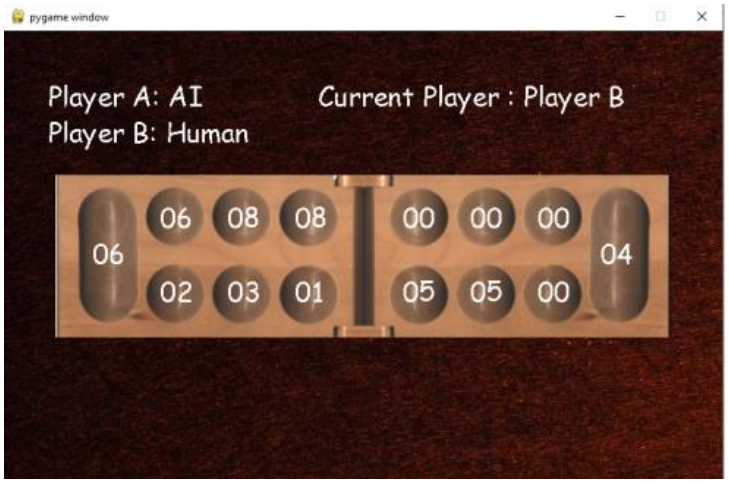
Human vs Human game:

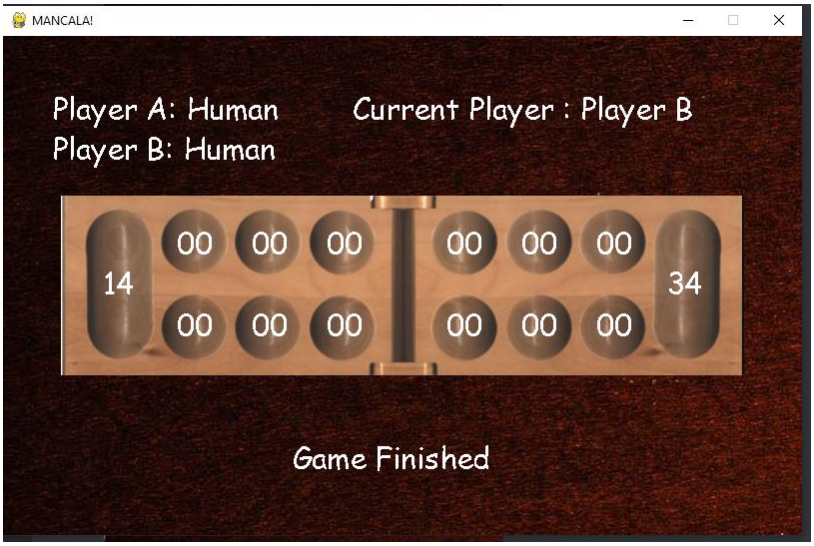




Human vs AI game:







Name	Job
Mohamed Gamal Talaat	Controller – integrating between GUI and backend algorithm
Mohamed Adel Ali	TreeCreator class implementation
Mahmoud Ashraf Mahmoud	Prunner implementation
Mariam Abdelrahman Ali	SearchTree class implementation
Yasmin Alaa Abdelfattah	GUI implementation