CS 6613 Artificial Intelligence Project Checker Game Design

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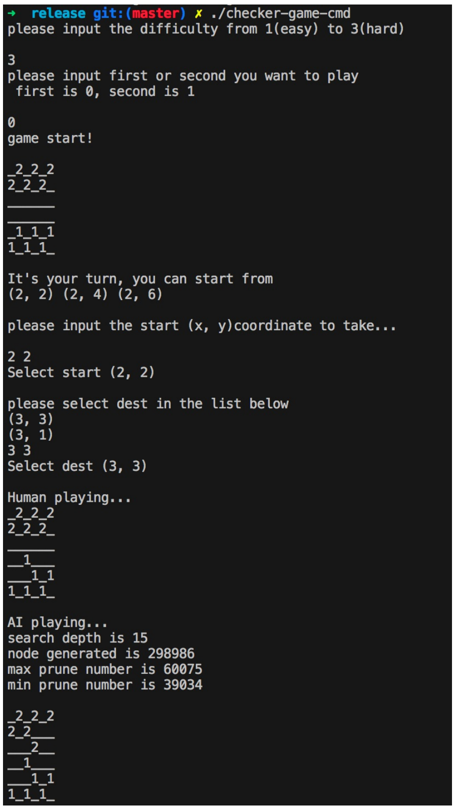
How to compile and run

- Command line version (cmake is required to compile)

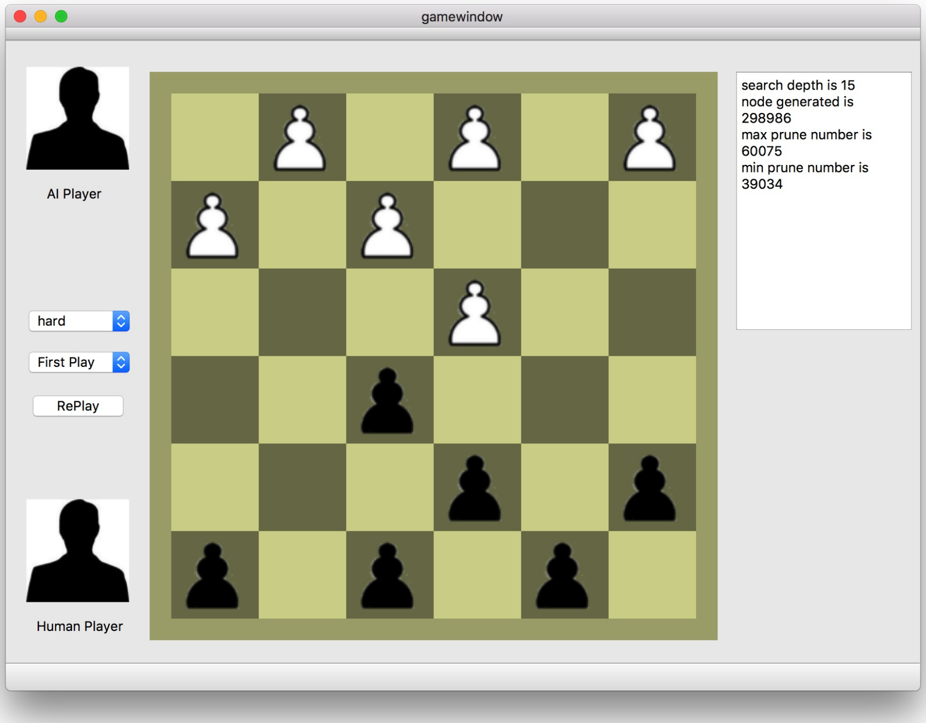
```
cd checker-game-commandline

mkdir release

cd release

cmake ..

make

./checker-game-cmd
```



```
➜  release git:(master) ✗ ./checker-game-cmd
please input the difficulty from 1(easy) to 3(hard)

3
please input first or second you want to play
 first is 0, second is 1

0
game start!

_2_2_2
2_2_2_

______
______
_1_1_1
1_1_1_

It's your turn, you can start from
(2, 2) (2, 4) (2, 6)

please input the start (x, y)coordinate to take...

2 2
Select start (2, 2)

please select dest in the list below
(3, 3)
(3, 1)
3 3
Select dest (3, 3)

Human playing...
_2_2_2
2_2_2_

______
__1___
___1_1
1_1_1_

AI playing...
search depth is 15
node generated is 298986
max prune number is 60075
min prune number is 39034

_2_2_2
2_2___
___2__
__1___
___1_1
1_1_1_
```

- GUI version (Using QT, C++ GUI Library, qmake is required to compile)

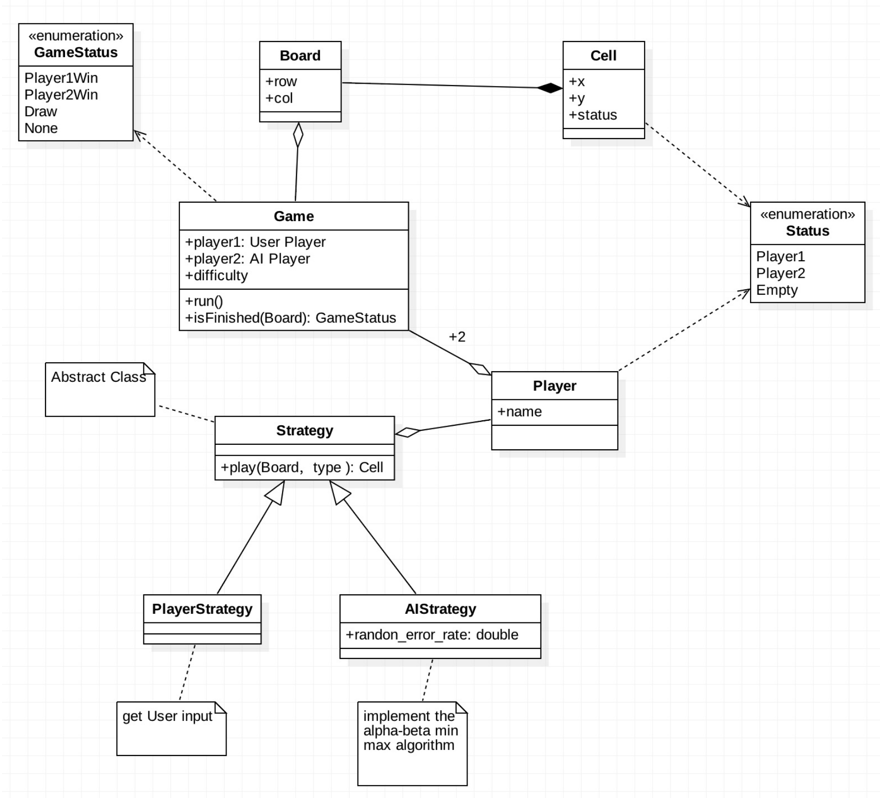
```
cd checker-game-ui

mkdir release

cd release

qmake ..

make

# For Mac, use this command, if you use windows or linux,
# please go to corresponding folder to run app.
# since QT is a cross platform library, different OS
# will generate different code

./checker-game-ui.app/Contents/MacOs/checker-game-ui
```



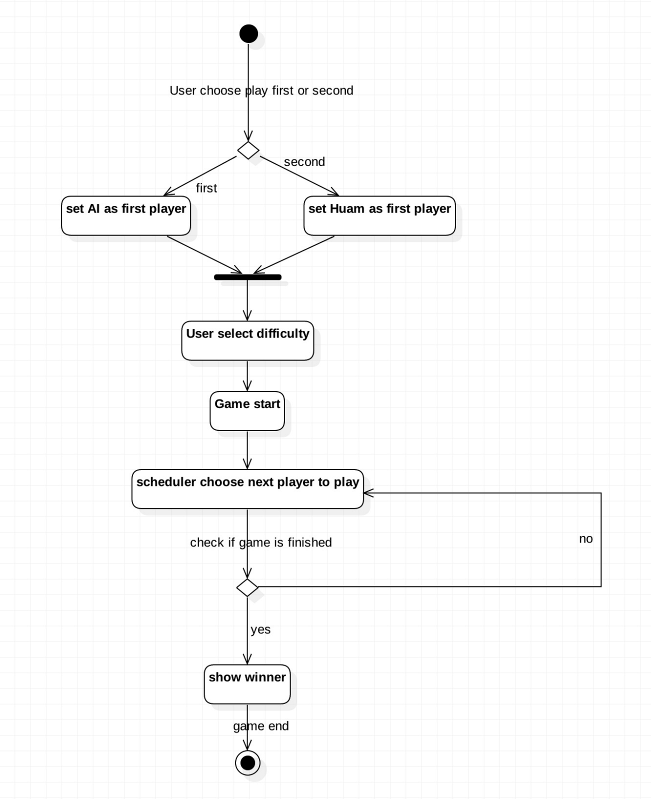
search depth is 15
node generated is
298986
max prune number is
60075
min prune number is
39034

OOAD Desigin

- Class Design



- Game Flow



Terminal state

- WIN: 200
- LOSR: 200
- DRAW: 0
- Evaluation value for cut off: (-200, 200)

Evaluation function

when search depth reaches Max Depth, cut off happens and evaluation function will be returned. Function is as below:

$$f = w_1 * cost_1 + w_2 * cost_2$$

$cost_1$ is the difference between pieces left on the board, that is the number of AI pieces - the number of human pieces. w_1 is the weight of $cost_1$.

$cost_2$ is the difference between safe pieces left on the board. w_2 is the weight of $cost_2$. Here safe means the piece is on the leftmost column or the rightmost column since these positions will never be captured and it's safe to stay.

If the evaluation function f is higher, then means this status is more likely to win for AI.

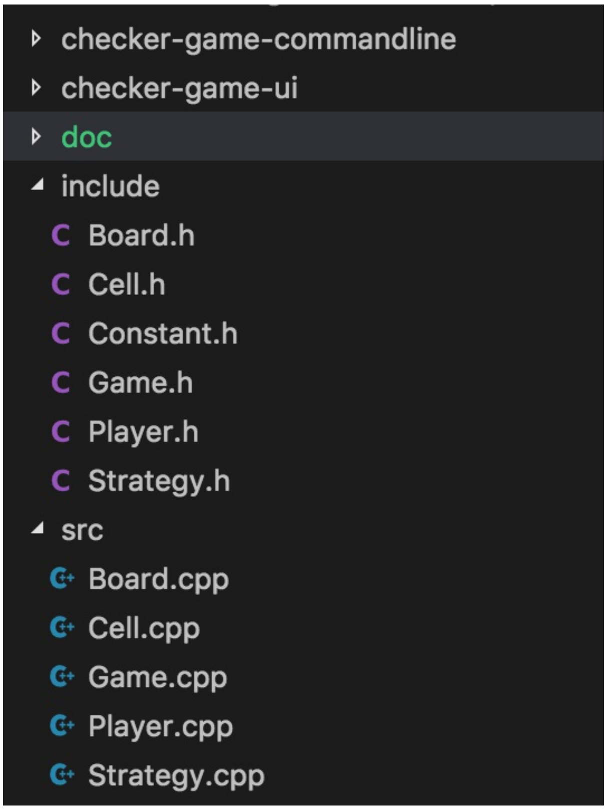
Difficulty set

I implement diffetent difficulty by setting different **Max Search Depth**

- Easy: 3 Max Search Depth
- Medium: 6 Max Search Depth
- Hard: 15 Max Search Depth

Code structure (c++)

- include: header file
- src: source file
- checker-game-ui: QT UI class, main ui program
- checker-game-commandline: main command line program
- doc: documentation



```
▸ checker-game-commandline
▸ checker-game-ui
▸ doc
◢ include
   C Board.h
   C Cell.h
   C Constant.h
   C Game.h
   C Player.h
   C Strategy.h
◢ src
   Board.cpp
   Cell.cpp
   Game.cpp
   Player.cpp
   Strategy.cpp
```

Alpha-Beta Algorithm Implementaion

in the class `AIStrategy`, file location

- include/Strategy.h
- src/Strategy.cpp