
Artificial Intelligence

Spring 2022

— HW#2 - Multi-agent Search —

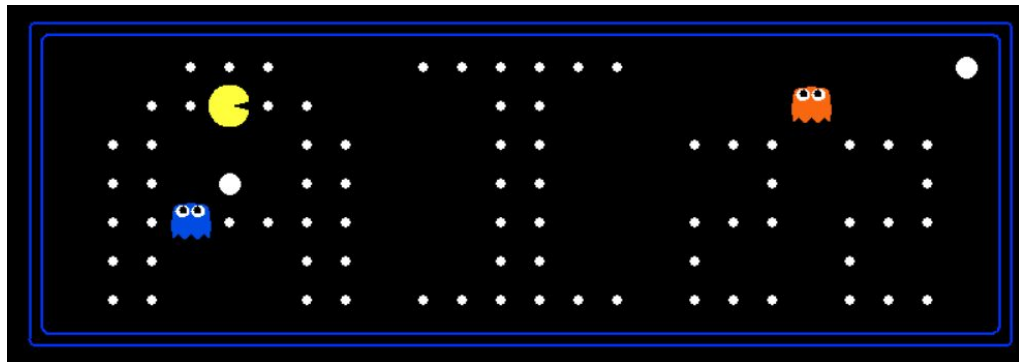
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Overview

HW2 deadline : **Monday, 11 APR 2022 14:20 (UTC+8)**

Total Points - 110pts

1. Reflex Agent - 10pts + 10 bonus pts
2. Minimax - 30pts
3. Alpha-Beta Pruning - 30pts
4. Expectimax - 30pts



File Description

Files you'll edit:

`multiAgents.py` Where all of your multi-agent search agents will reside.

Files you might concern:

`pacman.py` The main file that runs Pacman games. This file also describes a Pacman GameState type, which you will use extensively in this project

`game.py` The logic behind how the Pacman world works. This file describes several supporting types like AgentState, Agent, Direction, and Grid.

`util.py` Useful data structures for implementing search algorithms.

Base Code Tutorial - Problem 1

```
class ReflexAgent(Agent):  
  
    def getAction(self, gameState):  
        ...  
        return action  
  
    def evaluationFunction(self, currentGameState, action):  
        #TODO  
        return score
```

Base Code Tutorial - Problem 1

Several Important Information For Reflex Agent

- **gameState.generatePacmanSuccessor(action)** -> GameState
 - # Successor's gameState Object
- **gameState.getPacmanPosition()** -> coordinate tuple
 - # Current Position of pacman
- **gameState.getFood()** -> Boolean Matrix
 - # Returns a Grid of boolean food indicator variables.
Grids can be accessed via list notation, so if we want to check if there is food at (x,y), just call `state.getFood()[x][y] == True`
 - # 10 points for each food you eat
- **gameState.getCapsules()** -> list of coordinate tuple
 - # Eating capsules can enable the pacman to eat the ghosts. 200 points for each eaten ghost but zero point for eating capsule.

Base Code Tutorial - Problem 1

Several Important Information For GhostGameState

- **gameState.getGhostStates()** -> list of AgentState
 - # GameState of ghosts
- **ghostState.getPosition()** -> coordinate tuple
 - # Current Position of ghost
 - # Position of ghost do not change regardless of your state
because you can't predict the future
- **ghostState.start.getPosition()** -> coordinate tuple
 - # Start Position of ghost
- **ghostState.scaredTimer** - int
 - # Remaining scare time of ghost, counting down from 40 moves

Base Code Tutorial - Problem 2 ~ 4

```
class MinimaxAgent(MultiAgentSearchAgent):
```

```
    def getAction(self, gameState):
```

```
        #TODO
```

```
        return action
```

Base Code Tutorial - Problem 2 ~ 4

Several Important Function For Problem 2 - Problem 4

- **gameState.generateSuccessor(agentIndex, action)** -> GameState
 - # Returns the successor game state after an agent takes an action
- **gameState.getLegalActions(agentIndex)** -> list
 - # Returns a list of legal actions for an agent
 - agentIndex=0 means Pacman, ghosts are >= 1
 - **Ex: ['West', 'Stop', 'East']**
- **gameState.getNumAgents()** -> int
 - # Returns the total number of agents in the game
 - **Ex: 4**



Base Code Tutorial - Problem 2 ~ 4

Several Important Attribute For Problem 2 - Problem 4

- **self.evaluationFunction(gameState)** -> float
 - # Returns the score of gameState
 - **Ex: -1.0**
- **self.depth** - int
 - # Depth you need to search
 - **Ex: 2**



Notice for Mac

If you are using **macOS 10.6 or later**, the **Apple-supplied Tcl/Tk 8.5 has serious bugs** that can cause application crashes. If you wish to use IDLE or Tkinter, **do not use the Apple-supplied Pythons**. Instead, install and use a newer version of Python from python.org or a third-party distributor that supplies or links with a newer version of Tcl/Tk.

Error message example :

```
DEPRECATION WARNING: The system version of Tk is deprecated and may be removed in  
a future release. Please don't rely on it. Set TK_SILENCE_DEPRECATION=1 to suppress this  
warning.
```

Detail information : [IDLE and tkinter with Tcl/Tk on macOS | Python.org](#)

Python2 download link : [Python Release Python 2.7.18 | Python.org](#)

Notice for Mac

Python 2.7.18

1. Download the python package from [Python Release Python 2.7.18 | Python.org](https://www.python.org/downloads/release/python-2718/)
2. Type `which -a python` in the terminal to find the directory of downloaded python
 - a. Default directory for downloaded Python:
 - i. `/usr/local/bin/python`
3. Type `/usr/local/bin/python pacman.py` to run the pacman file.

HW2 - Submission on NTU COOL

Deadline : Monday, 11 APR 2022 14:20 (UTC+8)

Language : Python2.7

Package : Do not import any other package

Delay Policy : One Day -> points * 0.7

Two Days -> points * 0.5

After Two Days -> 0 points

Everyone has a chance for a one-day late submission this semester!

File Format : r123456xx_hw2.zip

- r123456xx_hw2.py (this is your multiAgents.py file)

Do not include other python file except **r123456xx_hw2.py (search.py)*

All file name should be in **lower case and **only zip file** (No rar and 7zip)*

****Incompatible format will not be graded.***

Notice : Zero point for plagiarism!!! (either from internet or copy from classmate)