

Summary (Multiple Agents)

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Introduction

The Pacman question is about to get the biggest reward and win this game. Pacman problem is an NP-hard problem, thus we cannot get the best solution in polynomial time complex. But we can break this big question into several small questions. For this game, there are two main sub-problems of the Pacman game, get the biggest reward and dodging the ghosts. Then there is an administrator to balance these parts. We assign all the sub-problems to individual agents. Each Agent has its own idea about the best next movement based on the sub-problem it solving. Finally, The Manager Agent will make a decision on which idea to use.

Gain Reward Agent

There are two stages in this game. The first stage is when pellets number higher than a threshold. The second stage is when the pellets number lower than a threshold. In prospect, we want to use the Hill Climber algorithm in the first stage because it can always return the best result in a local area. Then, we use BFS for the final stage to eat all the remaining pellets because BFS can always return the nearest pellets. After testing the Pacman competition, we found that the hill climber agent is too slow to take a movement which means it is nearly impossible to get a high score in 30 seconds. So we drop the idea which using Hill Climber Agent at the beginning and BFS Agent at the end as Gain Reward Agent.

Functionalities for Gain Reward Sub Agents:

- 1) Hill Climber Agent: find the best result in the local area (idea dropped)
- 2) BFS Agent: find the closest pellet. We call the distance between the closest pellet and Pacman BFS distance.

DodgingGhostAgent

The agent uses current states to find all legal next states. Then it loops these states to find the positions of Pacman and ghosts. It calculates the Euclidean distance between Pacman and each ghost and finds the ghost closer to Pacman. Then the final action that agent returns will lead to the state which keeps Pacman away from the closer ghost. In this case, Pacman is almost impossible to be caught by a ghost.

Functionalities for Dodging Ghost Agent:

- 1) To keep Pacman away from the closer(Euclidean Distance) ghost.

Manager Agent

This agent is used to balance the Dodging Ghost agent and the Gain reward agent. At first, Manager Agent uses the Euclidean Distance to judge if it close enough. When it is, then Manager Agent judges the accurate BFS distance. It is not necessary to get an accurate distance for each time because this will waste us a lot of time. If BFS distance is close enough, Manager Agent takes the action of DodgingGhost Agent to avoid being eaten. But in the normal situation, Manager Agent takes the idea of Gain Reward Agent to gain the biggest reward. **Our best record is 10 consecutive wins.**