Introduction to AI Assignment 2:
Search Agent (Teamwork)

2021/03/23

Problem solving can be regarded as a searching process. In the lecture, we have shown the typical way to solve a problem through search agent, which includes goal formulation, problem formulation, search, and execution. We have also described several methods for searching. Please design a search agent for playing the simple 2D ball game given below.

Simple 2D Ball Game

In the simple 2D ball game (2DBG), you have to control a ball, and compete the other nine balls (opponents) by collecting resources from resource centers or other opponents in a 1600x900 2D plane.

[Property] In 2DBG, each ball has the following properties:

`xCoordinate` and `yCoordinate`: the coordinates of the balls and resource centers in 2D plane,

`xVelocity` and `yVelocity`: the velocity of the balls in x and y direction,

`circleRadius`: the radius of the balls.

The initial coordinates are set at random for each ball. The initial velocity and radius are set to 0, and 20, respectively. Note that the maximum velocity is inverse proportional to the radius. The own resources reflect on the radius. The more the balls collect the resources, the larger the balls are, and vice versa. The resource centers will appear at random for a short period of time.

[Action] In each game state, you have to determine an action according to the above properties. The action set consists of no-operation, *up*, *down*, *left*, *right*, *up left*, *up right*, *down left* and *down right*. Each action gives an acceleration towards the corresponding direction.

[Resource Collection] Your ball can collect resources by either passing through the resource centers, or passing through an opponent having smaller radius than your ball. On the contrary, you resources may be robbed by other opponents if they have larger radius than you.

[Computational Budget] Each decision should be returned no more than 50ms; otherwise, the action becomes no-operation.

Implementation

Try to implement a search agent of any kinds to control a ball in the 2DBG for maximizing the collected resources. To control the agent in the 2DBG, you have to implement the dynamic linking library for the agent. This can be easily done by the following instructions:

1. Install the **Code::Blocks** IDE with 32bit MinGW (cf. attached file.).
2. Open the project file **agent_dll.cbp** in the **agent_dll** folder.
3. Design your search strategy in the `controller` function in the **agent_dll.cpp** file. **Any modification on the function header or any illegal memory access should lead to zero score.**
4. Build the project.
5. **Find the agent_dll.dll** file in the subfolder **bin/Debug** or **bin/Release.**
6. Put and replace the file in the game folder **2D_simple_ball_game**.

Writing

1. [30%] Describe the goal formulation and problem formulation **your team used**.
2. [30%] Describe the search strategy **your team used**, and explain the design concept.
3. [20%] Describe the challenges encountered when designing the agent.
4. [20%] Give two scores from 1 to 10 to evaluate the performance of your teammates in this assignment in terms of Design and Implementation.

Scoring

The score of this assignment includes:
1. Implementation [40%]: Each implementation will be tested in 100 random games. The total collected resources will be recorded for evaluation.
2. Writing [60%]: Turn in the report in a **PDF** file to answer the questions listed in the section **Writing**.

Requirement

1. This is a teamwork assignment; a group should contain at most **three** students.
2. **Each group** should turn in one agent, i.e., one version of `controller` function.
3. Each student should turn in the source code designed by your group and a report for the assignment written by yourself.
4. The due day is 2021/04/06 23:59. Every delay takes a penalty of 20 scores per day.
5. Upload your files in a **.zip** file in the format: **2DBG_*StudentID*.zip**, where *StudentID* is your student ID. Your .zip file should only include the following two files:
   a) agent_dll.cpp (designed by **your group**)
   b) report.pdf (written by **yourself**)
   A penalty of 20 scores will be added for wrong format.
6. **Plagiarism is prohibited with no exception!!**