Assignment 3: Ms. Pacman

The purpose of the assignment is to give a deeper understanding of decision trees and the ID3 learning algorithm and how they can be implemented. This assignment is also intended to be a practical experience in data mining and machine learning on real gameplay data.

Preparation:

Read chapters 8.1 and 8.2 in the book Data Mining: Concepts and Techniques. Make sure to understand the algorithm in Figure 8.3 as well as the Information Gain attribute selection method.

Download the Ms. Pacman framework and set it up in your IDE. Follow the initial steps and make sure that you understand its architecture as well as how to code your own AI.

Assignment:

Implement an AI controller for Ms. Pacman that is capable of learning from data extracted from previous (human) gameplays. This controller must be a decision tree trained by means of the ID3 algorithm. Also write an assignment report.

Do not use data from the recorded gameplay as raw input for the ID3 algorithm. Combine the attributes gathered during the gameplay so that you can build your trees from pre-processed data. Remember that you don't have to use all the attributes. Filter out those that do not seem interesting for building your Pacman controller. Describe the attributes that you have chosen, as well as how you combine them in the report.

The decision tree has to be implemented as a fully functional Ms. Pacman controller. A valid controller for Ms. Pacman:

- Inputs the current state of the game at time t, and (after processing it) outputs one of the following commands: UP, LEFT, RIGHT, DOWN, or NEUTRAL. Whatever this command is, Ms. Pacman will do it before the game jumps onto the next state t+1.
- Implements the interface Controller<MOVE> and therefore, implements the method getMove.

Project requirements:

- Gameplay data must be gathered by playing Ms. Pacman in manual (human vs AI, data recording mode) mode against any Ghosts AI (free choice but don't use Random).
- The decision tree agent must be implemented from scratch as a working Ms. Pacman controller. And any decision tree should be able to be displayed on the screen in a human readable fashion (free choice).

- The ID3 algorithm must be correctly implemented on the data extracted from the human gameplay. The training accuracy must be provided when the learning has finished.
- The game must work in the automatic mode (AI vs AI, visual mode) using the last trained decision tree as Ms. Pacman's controller.
- The code shall be well designed and structured, as well as clearly commented.
- You are allowed to work individually or in pairs.

Report requirements:

- The report is expected to be 5 pages long.
- The report shall answer the following questions:
    - What input parameters have you used as the input of the decision tree, how have you combined them and why?
    - Why have you discouraged the others?
    - Did you have to discretize any parameters? Why? How have you accomplished this?
    - How did you code the learning algorithm and the attribute selection function?
    - What experiences have you acquired?
- The report must include a reference list if it refers to external sources.
- Naturally, the report shall be written in your own words (i.e. slightly modified or simply translated texts written by someone else, will be rejected).
- The report shall be well-structured with relevant headings and correct paragraph groupings.
- The report shall be well-written and proofread several times. It must be written with correct spelling and sentence construction.

Submission:

This assignment has three submission deadlines, which are specified on the assignment submission page on Itslearning. If you, after your submission, need to make minor changes to your assignment, you are allowed to make one resubmission. However, if you need to make major changes, if your assignment is not approved after one resubmission, or if you miss the submission deadline, you will have to (re)submit using one of the submission deadlines later in the course.

If your assignment is not approved after the final opportunity to submit, you need to come back the next time the course is taught.

After the submission has been approved, you should meet the teacher responsible for the assignment for a short discussion about your assignment (the teacher will

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announce the time for the discussion). In order to pass this assignment, you need to pass both the report part and the discussion part of the examination.

The source code will include the whole Ms. Pacman project, with the developed AI controller inside. One submission per group is sufficient (i.e. one report and one application).