Foundations of Artificial Intelligence

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Exercise Sheet 8

Due: Friday, June 22, 2007

Exercise 8.1 (Decision Tree Learning)

Consider the following examples of weekends when you decided to go into a movie theater.

weekend	weather	parents	money	cinema
W1	sunny	yes	rich	yes
W2	sunny	no	rich	no
W3	windy	yes	rich	yes
W4	rainy	yes	poor	yes
W5	rainy	no	rich	no
W6	rainy	yes	poor	yes
W7	windy	no	poor	yes
W8	windy	no	rich	no
W9	windy	yes	rich	yes
W10	sunny	no	rich	no

(a) Apply the algorithm presented in the lecture to generate a decision tree based on these examples given that the attributes in this table are chosen from left to right.

(b) Define a logical formula on the basis of your decision tree that exactly specifies, in which cases you go to the movie theater and in which cases you do not go.

Exercise 8.2 (Choosing Attribute Tests)

Find out whether the chosen order of attribute tests in the previous excercise 1 was reasonable. Do this by computing and then comparing the gain values of the individual attribute tests using the formula from the lecture.

Exercise 8.3 (Entropy and Information gain)

Suppose, an attribute splits the set of examples E into subsets E_i and that each subset has p_i positive and n_i negative examples. Show that the attribute has no information gain, if the ratio $p_i/(p_i + n_i)$ is the same for all i.
What is the sign of the information gain in all other cases? What can be concluded from this fact?

The exercise sheets may and should be worked on in groups of three (3) students. Please write all your names and the number of your exercise group on your solution.