University of El Oued
Department of Computer science

Duration: 1 hour
Level: Master 1

AI principles and approaches

Exam - Correction

Exercise 1: *10 pts*

1) Define in your own word the terms: **agent** and **rationality**.
Agent- A system with at least some form of intelligence. ***1pts***
A Rational agent must perform the action that maximizes its measure of performance according to its perception of the world and its knowledge. ***1pts***

2) iRobot Roomba is the vacuum cleaner shown in the photo :
   - Give a PEAS description for it.
     _ **Performance:** cleanness, efficiency: distance travelled to clean, battery life, security. ***1pts***
     _ **Environment:** room, table, wood floor, carpet, different obstacles. ***1pts***
     _ **Actuators:** wheels, different brushes, vacuum extractor. ***1pts***
     _ **Sensors:** camera, dirt detection sensor, cliff sensor, bump sensors, infrared wall sensors. ***1pts***
   - Characterize it in terms of the following properties: Observable, Deterministic, Static, Discrete, Agents.
     Partially Obs. Stochastic, Dynamic, Continuous, Single Agent. 2.5pts
   - Is this vacuuming cleaning agent rational?
     Yes, considering the defined performance measures, its perceptions and its actuators, the agent is indeed rational. ***1.5pts***

Exercise 2: *10 pts*

Mushrooms of various types grow widely all over area x. Some of the mushrooms have been determined as poisonous and others as not. You have the following data to consider:

Example	NotHeavy	Smelly	Spotted	Smooth	Edible
A	1	0	0	0	1
B	1	0	1	0	1
C	0	1	0	1	1
D	0	0	0	1	0
E	1	1	1	0	0
F	1	0	1	1	0
G	1	0	0	1	0
H	0	1	0	0	0
U	0	1	1	1	?
V	1	1	0	1	?
W	1	1	0	0	?

a) Which attribute should you choose as the root of a decision tree between **NotHeavy** and **Smooth**? ***3pts***

$$Remainder_{NotHeavy} = \frac{5}{8}\left(-\frac{2}{5}\log_2\frac{2}{5} - \frac{3}{5}\log_2\frac{3}{5}\right) + \frac{3}{8}\left(-\frac{1}{3}\log_2\frac{1}{3} - \frac{2}{3}\log_2\frac{2}{3}\right)$$
$$\cong 0.9512$$
$$Remainder_{Smooth} = \frac{4}{8}\left(-\frac{1}{4}\log_2\frac{1}{4} - \frac{3}{4}\log_2\frac{3}{4}\right) + \frac{4}{8}\left(-\frac{2}{4}\log_2\frac{2}{4} - \frac{2}{4}\log_2\frac{2}{4}\right) \cong 0.9056$$

Choose ***Smooth*** for first split since it minimizes the remaining information needed to classify all examples.

b) Build a decision tree to classify mushrooms as poisonous or not, figure this out by looking at the data without explicitly computing the information gain of the rest of the attributes **(explain).** ***3.5 pts***

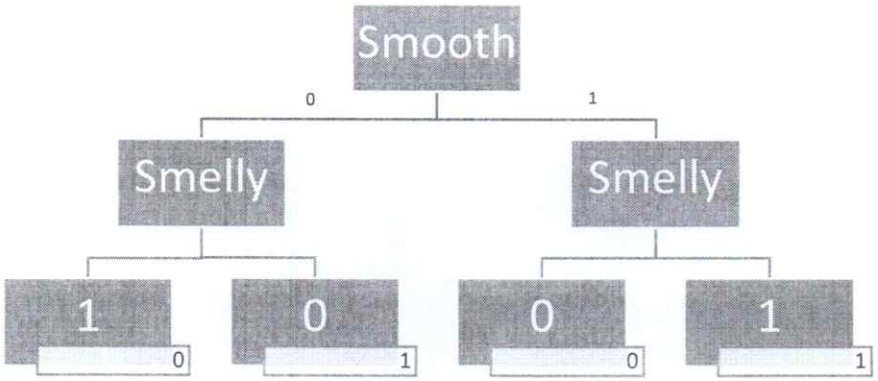
*You can notice that the **attribute smelly** is accurately decisive:*

When **smooth** equal to **1:** **1 smelly = 1 => edible = 1**
3 smelly = 0 => edible = 0

When **smooth** equal to **0:** **2 smelly = 1 => edible = 0**
2 smelly = 0 => edible = 1

Then: *we can use **smelly** as the **leaf node** to create a **decision tree**.*

2pts



c) Classify mushrooms U, V and W using the decision tree as poisonous or not poisonous. ***1.5pts***

U: Smooth = 1, Smelly = 1 ⇒ ***Edible = 1***
V: Smooth = 1, Smelly = 1 ⇒ ***Edible = 1***
W: Smooth = 0, Smelly = 1 ⇒ ***Edible = 0***