Unit 11 - Week 9

Assignment 9

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-11-18, 23:59 IST.

Instructions: In the following questions, one or more choices may be correct. Select all that apply.

1) Consider the operation of a Bayes filter algorithm as described in the class. The world consists of the state of a door – it is either *open* or *shut*. The robot has a single sensor that can sense the state of the door as *open* or *shut*. The robot also has an actuator that can *push-open* the door, if appropriate. The robot can also choose to *do-nothing*, which does not cause any change in state. Given the information below, compute the belief state after the following sequence of actions and observations: ***3 points***

$u_1 =$**do-nothing**, $z_1 =$**shut**.

Initial Belief: $\text{bel}(x_0 = open) = 0.5, bel(x_0 = shut) = 0.5$

Sensor Model:
$p(z_t = open|x_t = open) = 0.8$
$p(z_t = shut|x_t = open) = 0.2$
$p(z_t = open|x_t = shut) = 0.1$
$p(z_t = shut|x_t = shut) = 0.9$
Transition Model:
$p(x_t = open|u_t = push\text{-}open, x_{t-1} = open) = 1.0$
$p(x_t = shut|u_t = push\text{-}open, x_{t-1} = open) = 0.0$
$p(x_t = open|u_t = push\text{-}open, x_{t-1} = shut) = 0.7$
$p(x_t = shut|u_t = push\text{-}open, x_{t-1} = shut) = 0.3$

Which of the following are true?

- $bel(x_1 = open) \approx 0.75,\ bel(x_1 = shut) \approx 0.25$
- $bel(x_1 = open) \approx 0.27,\ bel(x_1 = shut) \approx 0.73$
- $bel(x_1 = open) \approx 0.64,\ bel(x_1 = shut) \approx 0.36$
- $bel(x_1 = open) \approx 0.18,\ bel(x_1 = shut) \approx 0.82$
- $bel(x_1 = shut) \approx 0.75,\ bel(x_1 = open) \approx 0.25$
- $bel(x_1 = shut) \approx 0.27,\ bel(x_1 = open) \approx 0.73$
- $bel(x_1 = shut) \approx 0.64,\ bel(x_1 = open) \approx 0.36$
- $bel(x_1 = shut) \approx 0.18,\ bel(x_1 = open) \approx 0.82$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$bel(x_1 = open) \approx 0.18,\ bel(x_1 = shut) \approx 0.82$

2) In the previous question, suppose that the robot subsequently pushes the door open and observes that it is open (that is, $u_2 = push - open, z_2 = open$), use the belief state that you computed after z_1 to compute the belief state after z_2 is observed. (Assume that the robot sensor model and the dynamics of the environment are unchanged.) ***3 points***

Which of the following are true?

- $bel(x_2 = open) \approx 0.56,\ bel(x_2 = shut) \approx 0.44$
- $bel(x_2 = open) \approx 0.49,\ bel(x_2 = shut) \approx 0.51$
- $bel(x_2 = open) \approx 0.96,\ bel(x_2 = shut) \approx 0.04$
- $bel(x_2 = open) \approx 0.29,\ bel(x_2 = shut) \approx 0.71$
- $bel(x_2 = shut) \approx 0.56,\ bel(x_2 = open) \approx 0.44$
- $bel(x_2 = shut) \approx 0.49,\ bel(x_2 = open) \approx 0.51$
- $bel(x_2 = shut) \approx 0.96, bel(x_2 = open) \approx 0.04$
- $bel(x_2 = shut) \approx 0.29,\ bel(x_2 = open) \approx 0.71$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$bel(x_2 = open) \approx 0.96,\ bel(x_2 = shut) \approx 0.04$

3) Since the Bayes Filter algorithm uses the entire history of observations and actions, it does not assume Markov dynamics for the system. ***1 point***

- True
- False

No, the answer is incorrect.
Score: 0
Accepted Answers:
False

4) Which of the following are valid state variables for a Markov model? ***1 point***

- The total distance travelled since the robot was turned on.
- Is the stoplight red?
- The on-board battery level
- The number of times the robot turned left so far

No, the answer is incorrect.
Score: 0
Accepted Answers:
The total distance travelled since the robot was turned on.
Is the stoplight red?
The on-board battery level
The number of times the robot turned left so far

5) Given a noise-free measurement model, it is possible for the robot to know exactly where it is in the state space at every instant? ***1 point***

- Yes
- No

No, the answer is incorrect.
Score: 0
Accepted Answers:
No