Advanced AI Techniques

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Exercise Sheet 9

Due: Tuesday, 16. January 2007

Exercise 9.1

(a) Proof the conditionalized version of the general product rule:

$$P(A, B \mid E) = P(A \mid B, E) \cdot P(B \mid E)$$

(b) Proof the conditionalized version of Bayes' rule:

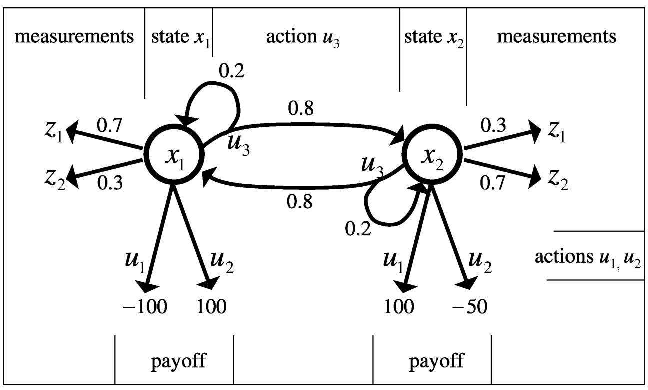
$$P(A \mid B, C) = \frac{P(B \mid A, C) \cdot P(A \mid C)}{P(B \mid C)}$$

Exercise 9.2

Suppose you are a witness to a nighttime hit-and-run accident involving a taxi in Athens. All taxis in Athens are blue or green. You swear, under oath, that the taxi was blue. Extensive testing shows, that under the dim lighting conditions, discrimination between blue and green is 75% reliable. Is it possible to calculate the most likely color for the taxi? (Hint: distinguish carefully between the proposition that the taxi is blue and the proposition that the taxi appears blue.) What is your resulting estimate, given that 9 out of 10 Athenian taxis are green?

Exercise 9.3

Consider the following Hidden Markov Model:



Determine the resulting belief after the following sequences of observations and actions. For each sequence the initial belief is $p(x_1) = p(x_2) = 0.5$.

(a) z_1, z_2, z_1

(b) z_1, u_3, z_1