partA-report

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Team Number: 5

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Belief Update

After reaching s', the agent observes $o \in \Omega$ with probability $O(o \mid s', a)$. Let b be a probability distribution over the state space S. $b(s)$ denotes the probability that the environment is in state s. Given $b(s)$, then after taking action a and observing o,

$$b'(s') = \eta O(o \mid s', a) \sum_{s \in S} T(s' \mid s, a) b(s)$$

where $\eta = 1/\Pr(o \mid b, a)$ is a normalizing constant

Calculations:

Initial beliefs: [1 / 3, 0, 1 / 3, 0, 0, 1 / 3]

Move is Right, Observation is Green

Calculating b_prime[0]

- T(0→0,Right) = 0.01
    - On multiplying by b[0]=0.3333333 gives 0.0033333

- T(1→0,Right) = 0.01
    - On multiplying by b[1]=0 gives 0.0
- T(2→0,Right) = 0
- T(3→0,Right) = 0
- T(4→0,Right) = 0
- T(5→0,Right) = 0

sum of transitions= 0.0033333
P(o=Green|a=Right,s'=0) = 0.15
b_prime[0]= 0.0033333 * 0.15 = 0.0005

Calculating b_prime[1]

- T(0→1,Right) = 0.99
    - On multiplying by b[0]=0.3333333 gives 0.33
- T(1→1,Right) = 0
- T(2→1,Right) = 0.01
    - On multiplying by b[2]=0.3333333 gives 0.0033333
- T(3→1,Right) = 0
- T(4→1,Right) = 0
- T(5→1,Right) = 0

sum of transitions= 0.3333333
P(o=Green|a=Right,s'=1) = 0.9
b_prime[1]= 0.3333333 * 0.9 = 0.3

Calculating b_prime[2]

- T(0→2,Right) = 0
- T(1→2,Right) = 0.99
    - On multiplying by b[1]=0 gives 0.0
- T(2→2,Right) = 0
- T(3→2,Right) = 0.01

    - On multiplying by b[3]=0 gives 0.0
- T(4→2,Right) = 0
- T(5→2,Right) = 0

sum of transitions= 0.0
P(o=Green|a=Right,s'=2) = 0.15
b_prime[2]= 0.0 * 0.15 = 0.0

Calculating b_prime[3]

- T(0→3,Right) = 0
- T(1→3,Right) = 0
- T(2→3,Right) = 0.99
    - On multiplying by b[2]=0.3333333 gives 0.33
- T(3→3,Right) = 0
- T(4→3,Right) = 0.01
    - On multiplying by b[4]=0 gives 0.0
- T(5→3,Right) = 0

sum of transitions= 0.33
P(o=Green|a=Right,s'=3) = 0.9
b_prime[3]= 0.33 * 0.9 = 0.297

Calculating b_prime[4]

- T(0→4,Right) = 0
- T(1→4,Right) = 0
- T(2→4,Right) = 0
- T(3→4,Right) = 0.99
    - On multiplying by b[3]=0 gives 0.0
- T(4→4,Right) = 0
- T(5→4,Right) = 0.01
    - On multiplying by b[5]=0.3333333 gives 0.0033333

sum of transitions= 0.0033333
P(o=Green|a=Right,s'=4) = 0.9
b_prime[4]= 0.0033333 * 0.9 = 0.003

Calculating b_prime[5]

- T(0→5,Right) = 0
- T(1→5,Right) = 0
- T(2→5,Right) = 0
- T(3→5,Right) = 0
- T(4→5,Right) = 0.99
    - On multiplying by b[4]=0 gives 0.0
- T(5→5,Right) = 0.99
    - On multiplying by b[5]=0.3333333 gives 0.33

sum of transitions= 0.33
P(o=Green|a=Right,s'=5) = 0.15
b_prime[5]= 0.33 * 0.15 = 0.0495

Not normalized numerator
0.0005 0.3000 0.0000 0.2970 0.0030 0.0495

Denominator 0.65
Updated Beliefs
0.0008 0.4615 0.0000 0.4569 0.0046 0.0762

Move is Left, Observation is Right

Calculating b_prime[0]

- T(0→0,Left) = 0.99
    - On multiplying by b[0]=0.0007692 gives 0.0007615
- T(1→0,Left) = 0.99
    - On multiplying by b[1]=0.4615385 gives 0.4569231
- T(2→0,Left) = 0

- T(3→0,Left) = 0
- T(4→0,Left) = 0
- T(5→0,Left) = 0

sum of transitions= 0.4576846
P(o=Right|a=Left,s'=0) = 0.85
b_prime[0]= 0.4576846 * 0.85 = 0.3890319

Calculating b_prime[1]

- T(0→1,Left) = 0.01
    - On multiplying by b[0]=0.0007692 gives 7.7e-06
- T(1→1,Left) = 0
- T(2→1,Left) = 0.99
    - On multiplying by b[2]=0.0 gives 0.0
- T(3→1,Left) = 0
- T(4→1,Left) = 0
- T(5→1,Left) = 0

sum of transitions= 7.7e-06
P(o=Right|a=Left,s'=1) = 0.1
b_prime[1]= 7.7e-06 * 0.1 = 8e-07

Calculating b_prime[2]

- T(0→2,Left) = 0
- T(1→2,Left) = 0.01
    - On multiplying by b[1]=0.4615385 gives 0.0046154
- T(2→2,Left) = 0
- T(3→2,Left) = 0.99
    - On multiplying by b[3]=0.4569231 gives 0.4523538
- T(4→2,Left) = 0
- T(5→2,Left) = 0

sum of transitions= 0.4569692
P(o=Right|a=Left,s'=2) = 0.85
b_prime[2]= 0.4569692 * 0.85 = 0.3884238

Calculating b_prime[3]

- T(0→3,Left) = 0
- T(1→3,Left) = 0
- T(2→3,Left) = 0.01
    - On multiplying by b[2]=0.0 gives 0.0
- T(3→3,Left) = 0
- T(4→3,Left) = 0.99
    - On multiplying by b[4]=0.0046154 gives 0.0045692
- T(5→3,Left) = 0

sum of transitions= 0.0045692
P(o=Right|a=Left,s'=3) = 0.1
b_prime[3]= 0.0045692 * 0.1 = 0.0004569

Calculating b_prime[4]

- T(0→4,Left) = 0
- T(1→4,Left) = 0
- T(2→4,Left) = 0
- T(3→4,Left) = 0.01
    - On multiplying by b[3]=0.4569231 gives 0.0045692
- T(4→4,Left) = 0
- T(5→4,Left) = 0.99
    - On multiplying by b[5]=0.0761538 gives 0.0753923

sum of transitions= 0.0799615
P(o=Right|a=Left,s'=4) = 0.1
b_prime[4]= 0.0799615 * 0.1 = 0.0079962

Calculating b_prime[5]

- T(0→5,Left) = 0
- T(1→5,Left) = 0
- T(2→5,Left) = 0
- T(3→5,Left) = 0
- T(4→5,Left) = 0.01
    - On multiplying by b[4]=0.0046154 gives 4.62e-05
- T(5→5,Left) = 0.01
    - On multiplying by b[5]=0.0761538 gives 0.0007615

sum of transitions= 0.0008077
P(o=Right|a=Left,s'=5) = 0.85
b_prime[5]= 0.0008077 * 0.85 = 0.0006865

Not normalized numerator
0.3890 0.0000 0.3884 0.0005 0.0080 0.0007

Denominator 0.7865962
Updated Beliefs
0.4946 0.0000 0.4938 0.0006 0.0102 0.0009

Move is Left, Observation is Green

Calculating b_prime[0]

- T(0→0,Left) = 0.99
    - On multiplying by b[0]=0.4945764 gives 0.4896307
- T(1→0,Left) = 0.99
    - On multiplying by b[1]=1e-06 gives 1e-06
- T(2→0,Left) = 0
- T(3→0,Left) = 0
- T(4→0,Left) = 0
- T(5→0,Left) = 0

sum of transitions= 0.4896316
P(o=Green|a=Left,s'=0) = 0.15
b_prime[0]= 0.4896316 * 0.15 = 0.0734447

Calculating b_prime[1]

- T(0→1,Left) = 0.01
  - On multiplying by b[0]=0.4945764 gives 0.0049458
- T(1→1,Left) = 0
- T(2→1,Left) = 0.99
  - On multiplying by b[2]=0.4938034 gives 0.4888654
- T(3→1,Left) = 0
- T(4→1,Left) = 0
- T(5→1,Left) = 0

sum of transitions= 0.4938111
P(o=Green|a=Left,s'=1) = 0.9
b_prime[1]= 0.4938111 * 0.9 = 0.44443

Calculating b_prime[2]

- T(0→2,Left) = 0
- T(1→2,Left) = 0.01
  - On multiplying by b[1]=1e-06 gives 0.0
- T(2→2,Left) = 0
- T(3→2,Left) = 0.99
  - On multiplying by b[3]=0.0005809 gives 0.0005751
- T(4→2,Left) = 0
- T(5→2,Left) = 0

sum of transitions= 0.0005751
P(o=Green|a=Left,s'=2) = 0.15
b_prime[2]= 0.0005751 * 0.15 = 8.63e-05

Calculating b_prime[3]

- T(0→3,Left) = 0
- T(1→3,Left) = 0
- T(2→3,Left) = 0.01
  - On multiplying by b[2]=0.4938034 gives 0.004938
- T(3→3,Left) = 0
- T(4→3,Left) = 0.99
  - On multiplying by b[4]=0.0101655 gives 0.0100639
- T(5→3,Left) = 0

sum of transitions= 0.0150019
P(o=Green|a=Left,s'=3) = 0.9
b_prime[3]= 0.0150019 * 0.9 = 0.0135017

Calculating b_prime[4]

- T(0→4,Left) = 0
- T(1→4,Left) = 0
- T(2→4,Left) = 0
- T(3→4,Left) = 0.01
  - On multiplying by b[3]=0.0005809 gives 5.8e-06
- T(4→4,Left) = 0
- T(5→4,Left) = 0.99
  - On multiplying by b[5]=0.0008728 gives 0.0008641

sum of transitions= 0.0008699
P(o=Green|a=Left,s'=4) = 0.9
b_prime[4]= 0.0008699 * 0.9 = 0.0007829

Calculating b_prime[5]

- T(0→5,Left) = 0
- T(1→5,Left) = 0

- T(2→5,Left) = 0
- T(3→5,Left) = 0
- T(4→5,Left) = 0.01
    - On multiplying by b[4]=0.0101655 gives 0.0001017
- T(5→5,Left) = 0.01
    - On multiplying by b[5]=0.0008728 gives 8.7e-06

sum of transitions= 0.0001104
P(o=Green|a=Left,s'=5) = 0.15
b_prime[5]= 0.0001104 * 0.15 = 1.66e-05

Not normalized numerator
0.0734 0.4444 0.0001 0.0135 0.0008 0.0000

Denominator 0.5322622
Updated Beliefs
0.1380 0.8350 0.0002 0.0254 0.0015 0.0000