CSCI-485

Quiz-2

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HMM-MDP

1. Complete the HMM Forward/Backtracking table (reference in the previous slide) using these transition and emission probabilities.

From -> To	Sunny	Cloudy	Rainy
Sunny	0.33	0.67	0.00
Cloudy	0.33	0.00	0.67
Rainy	0.33	0.33	0.33

Weather -> Behaviour	Walk	Umbrella
Sunny	1.0	0.0
Cloudy	0.67	0.33
Rainy	0.33	0.67

Iteration	Observation	Transition Probability	Sunny	Cloudy	Rainy
0		$V_0(\_)$	0.33	0.33	0.33
1	Walk	$P(W\|\_)$	1.0	0.67	0.33
		$V_1(\_) = V_0(\_)*P(W\|\_)$	0.33	0.221	0.11
2	Umbrella	$V_1(S)*P(\_\|S)$	0.00	0.22	0.00
		$V_1(C)*P(\_\|C)$	0.00	0.00	0.14
		$V_1(R)*P(\_\|R)$	0.00	0.03	0.03
		$P(U\|\_)$	0.00	0.33	0.67
		$V_2(\_) = \max(\_)*P(U\|\_)$	0.00	0.073	0.099
3		$V_2(S)*P(\_\|S)$	0.00	0.00	0.00
		$V_2(C)*P(\_\|C)$	0.002	0.00	0.006
		$V_2(R)*P(\_\|R)$	0.029	0.029	0.029
		$P(W\|\_)$	1	0.67	0.33
		$V_3(\_) = \max(\_)*P(W\|\_)$	0.029	0.019	0.009

2. Complete the MDP process from Canvas → Modules → Jupyter Notebooks → MDP.todo.ipynb- Construct a table (similar to but not the same as the reference HMM table in the previous slide) that shows the progress of the MDP process.

Step 1: Defining the MDP Components

States (S):

- Low Wealth (L)
- Medium Wealth (M)
- High Wealth (H)

Actions (A):

- Conservative (C)
- Aggressive (A)

Transition Probabilities:

Current State	Action	Next State Probabilities
Low (L)	C	80% Stay in L, 20% Move to M
Low (L)	A	60% Stay in L, 40% Move to M
Medium (M)	C	70% Stay in M, 30% Move to H
Medium (M)	A	50% Stay in M, 50% Move to H
High (H)	C	90% Stay in H, 10% Drop to M
High (H)	A	70% Stay in H, 30% Drop to M

Rewards:

- Low Wealth (L): -1
- Medium Wealth (M): 3
- High Wealth (H): 5

Discount Factor (γ): 0.9

V(S) after each iteration:

Iteration	State	V(S)
0	Low	0
	Medium	0
	High	0
1	Low	-1
	Medium	3
	High	5
2	Low	-046
	Medium	6.6
	High	9.32
3	Low	1.1276
	Medium	10.164
	High	13.1432

Policy evaluation after each iteration:

Iteration	State	Q(S,A)	Q(S,C)	Policy
1	Low	-0.46	-1.18	Aggressive(A)
	Medium	6.6	6.24	Aggressive(A)
	High	8.96	9.32	Conservative(C)
2	Low	1.127	-1.856	Aggressive(A)
	Medium	10.164	9.674	Aggressive(A)
	High	12.654	13.143	Conservative(C)
3	Low	3.27	1.64	Aggressive(A)
	Medium	13.49	12.95	Aggressive(A)
	High	16.02	16.56	Conservative(C)