10_ses_rl.py

1. For all bots which are currently at a node & idle

Update:

- true idleness of all nodes in graph (true) = +Δt
- Store all the true idleness values at this time stamp
- Expected idleness of nodes at which bots are currently present is calculated by performing simple exponential smoothing (ses) of true idleness for a particular edge (now, expected idleness is function of edge not node)
- We have chosen last 5 values at any instant and $\alpha = 0.4$ for SES.

Calculate: here, learning rate (α)= 0.1, discount factor (γ)= 0.95

- Value function all edges where bots are present (Q) =

$$Q^{new}(s_t, a_t) \leftarrow \underbrace{Q(s_t, a_t)}_{\text{old value}} + \underbrace{\alpha}_{\text{learning rate}} \cdot \overbrace{\Bigg(\underbrace{\underbrace{r_t}_{\text{reward}} + \underbrace{\gamma}_{\text{discount factor}} \cdot \underbrace{\max_a Q(s_{t+1}, a)}_{\text{estimate of optimal future value}}}_{\text{new value (temporal difference target)}} - \underbrace{Q(s_t, a_t)}_{\text{old value}} \Bigg)}^{\text{temporal difference}}$$

- Reward (r_t)= $log(\ |expect\ -\ true|\ )$and

  $r_t = 0$ if [expect = true]

- Softmax of Value function = value_exp = $\frac{e^{Q_i}}{\sum_{j=i}^{k} e^{Q_j}}$ (summation over all edges)

Set:

- True idleness of nodes where bots are present = 0

OBSERVATION model: bot will calculate the expected idleness as an average of all the past true idleness it has seen when it last visited the node while travelling **along that particular edge**.

The name 10_ses_rl indicates => ses = SES to estimate expected idleness
(OBSERVATION model)
rl = using reinforcement learning (Q-learning algorithm
to calculate the value function

2. For a bot deciding the next node to visit

Set:

- True idleness of the node where the bot is present = 0

Decision Making: here, we chose ε=0.1

- With $(1 - \varepsilon)$probability, check all neighbours and visit the one with highest value of = $[expected\ idleness]\ x\ [value\_exp]$

- With ε probability, go to a random node

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DRAWBACK:

- Even when |expect-true| = 1, reward = 0.