A MONTE CARLO TREE SEARCH

Here, we provide the pseudocode for single agent POMCP [Silver and Veness 2010] in Alg [2] as well as an example AND-OR tree in Fig. 5 referenced in Section 4.1.

Algorithm 2 POMCP [Silver and Veness 2010]

1: procedure CREATEPLAN(b)
2: for traj ∈ 1, 2, . . . , τ do
3: s ← SampleParticle (b)
4: UpdateTree (s, 0, ε)
5: return \( \arg\max_{a \in A} Q(\varepsilon, a) \)
6: procedure UPDATETREE(s, t, h)
7: if \( t \geq H \) then
8: return 0
9: if h is a leaf then
10: Expand(h)
11: return Rollout(s, t)
12: \( a^* \) ← ChooseAction(h)
13: \( s', r, o \) ← SimulateComm(s, a)
14: \( R \leftarrow r + \gamma \ast \) UpdateTree\((s', t + 1, hao)\)
15: StoreResults(h, s, a, R)
16: return R
17: procedure EXPAND(h)
18: \( B(h) \leftarrow \emptyset, \ n(h) \leftarrow 0 \)
19: \( n(0) \leftarrow 0, \ Q(h, a) \leftarrow 0 \ \forall a \in A \)
20: procedure CHOOSEACTION(h)
21: return \( \arg\max_{a \in A} Q(h, a) + \sqrt{\frac{\log n(h)}{n(ha)}} \)
22: procedure STORERESULTS(h, s, a, R)
23: \( B(h) \leftarrow B(h) \cup \{s\} \)
24: \( n(h) \leftarrow n(h) + 1, \ n(ha) \leftarrow n(ha) + 1 \)
25: \( Q(h, a) \leftarrow Q(h, a) + \frac{R - Q(h, a)}{n(ha)} \)

Figure 5: The first two levels of an example AND-OR tree created by MCTS for a POMDP with 2 actions, 2 observations, and 4 states

B AGENT ACTIONS PERFORMED IN EXPERIMENTS

In Figs. 6-14 we document the actions chosen by each agent in all three setups for both the I-POMCP-PF\( _O \) and CI-POMCP-PF\( _O \) algorithms (using communication costs of 0 and 1 to show both ends of the spectrum). Note: for all setups, action 0 = the left most fire, action 1 = the middle fire, action 2 = the right fire, and action 3 = NOOP.

C MESSAGES SENT IN EXPERIMENTS

In Figs. 15-22 we document the messages sent by each agent in all three setups for CI-POMCP-PF\( _O \) algorithms (using communication costs of 0 and 1 to show both ends of the spectrum).
Figure 6: Agent actions using I-POMCP-PF in Setup 1

References


Figure 7: Agent actions using CI-POMCP-PF (cost = 0) in Setup 1
Figure 8: Agent actions using CI-POMCP-PF (cost = 1) in Setup 1

Figure 9: Agent actions using I-POMCP-PF in Setup 2
Figure 10: Agent actions using CI-POMCP-PF (cost = 0) in Setup 2

Figure 11: Agent actions using CI-POMCP-PF (cost = 1) in Setup 2
Figure 12: Agent actions using I-POMCP-PF in Setup 3

Figure 13: Agent actions using CI-POMCP-PF (cost = 0) in Setup 3
Figure 14: Agent actions using CI-POMCP-PF (cost = 1) in Setup 3

Figure 15: Messages sent using CI-POMCP-PF (cost = 0) in Setups 1-3
Figure 16: Messages sent using CI-POMCP-PF (cost = 1) in Setups 1-3

Figure 17: Messages sent using CI-POMCP-PF (cost = 0) in Setup 1
Figure 18: Messages sent using CI-POMCP-PF (cost = 1) in Setup 1

Figure 19: Messages sent using CI-POMCP-PF (cost = 0) in Setup 2
Figure 20: Messages sent using CI-POMCP-PF (cost = 1) in Setup 2

Figure 21: Messages sent using CI-POMCP-PF (cost = 0) in Setup 3
Figure 22: Messages sent using CI-POMCP-PF (cost = 1) in Setup 3