Artificial Intelligence Lab 2 : Environments

The setup of rational agents is given in Figure 1

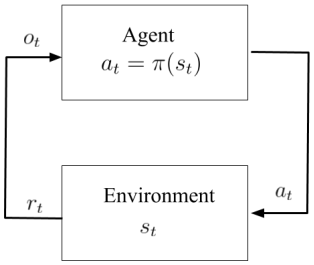

Figure 1: Rational Agent

For the next two lab sessions, we will create the following kinds of tasks

1. Static Prediction Task
2. Dynamic Prediction Task
3. Dynamic Control Task

1 Static Prediction Task: A Village called "Binary"pur

Environment: The environment is a village called "Binary"pur, with two categories of people: category 0 is *Kid* and category 1 is *Adult*.

State: At time t, the $s_t \in \{0, 1\}$, i.e., the state is $s_t = 0$ or $s_t = 1$. Note that the state can assume only one of the values. Here 0 means *Kid* and 1 means *Adult*. State is generated with $P(s_t = 0) = p_{kid}$, $P(s_t = 0) = p_{adult} = 1 - p_{kid}$.

Observation: $o_t = (h_t, w_t)$, where h_t denotes height and w_t denotes weight of a given person. The height a *Kid* is distributed between (**not necessarily uniform**) 4.5 to 5.25 feet as shown $p_{h|Kid}$ plot of Figure 2. The height of an *Adult* is distributed between (**not necessarily uniform**) 5 to 5.75 feet as shown $p_{h|Adult}$ plot of Figure 2. The weight of *Kid* and *Adult* are distributed uniform in the intervals $[30, 50]$ Kgs and $[45, 60]$ Kgs respectively.

Agent: Agent observes o_t and needs to decide whether the person is *Kid* or an *Adult*.

Action: The action set $a_t = \{0, 1\}$, where 0 means *Kid* and 1 means *Adult*.

Reward: The reward $r_t = R(s_t, a_t)$, $R(0, 0) = 1$, $R(1, 1) = 1$, $R(0, 1) = 0$, $R(1, 0) = 0$, i.e., if the prediction is correct then reward is 1, else it is 0.

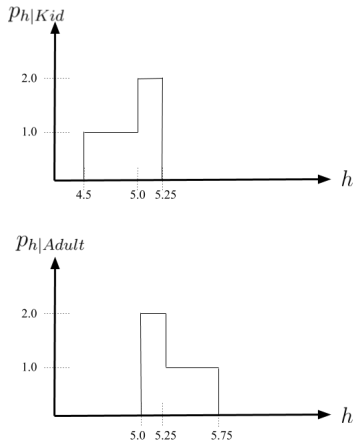

Figure 2: Conditional Density

1. Implement environment which takes inputs the value p_{Kid}, and conditional densities $p_{h|Kid}$ and $p_{h|Adult}$. When called at time t, it gives out o_t.
2. Implement agent which takes inputs $o = (h, w)$ and produces an action $a \in \{0, 1\}$. For now implement a random agent i.e., the agents action is not dependent on o_t but picks uniform actions in the set $\{0, 1\}$.
3. Produce a dataset file which contains t, s_t, h_t, w_t, $t = 1, \ldots, 1000$. Use a new line for each t. [25 Marks]
4. Plot histograms of the height of the *Kid* and *Adult*. [10 Marks]
5. Plot histograms of the weight of the *Kid* and *Adult*. [5 Marks]
6. Measure the performance of the agent, i.e., the average reward obtained. [10 Marks]

Note: Pay attention to the distributions which are not uniform!!!

2 Dynamic Control Task: Room Cleaner Robot

Consider a robot which cleans the room which contains dirt.

Environment: The room is a grid with dimensions $x_{size} \times y_{size}$. It has walls on all sides and the robot if it tries to move out it will hit the wall and stay in the same place.

State: At time t, the agent is in location (x_t, y_t). d_t is an array of size $x_{size} \times y_{size}$, and it contains the information on dirt. At any time a unit dirt is added at a random location (picked uniformly). Say the random location was x', y' then we update $d_t(x', y') = d_t(x', y') + 1$.

Observation: $o_t = (x_t, y_t)$, i.e., the agent gets to observe its position.

Agent: Agent need to decide whether it has to move right, left, up, down or pick up the dirt.

Action: The action set $a_t = \{$up,down,right,left, pick-dirt$\}$.

Reward: The reward $r_t = R(s_t, a_t)$, reward is -1 if the agent tries to pick-dirty in a clean grid, -10 on hitting the wall and is equal to the amount of dirt when it picks the dirt.

1. Implement environment which takes inputs the value x_{size} and y_{size}.
2. Implement agent which takes inputs $o = (x, y)$ and produces an action $a \in \{$up, down, left, right, pick-dirt$\}$. For now implement a random agent i.e., the agents action is not dependent on o_t but picks uniform actions.
3. Print out the activity at each time $t = 1, \ldots, 100$, location of the agent, location of dirt, action of the agent and the reward obtained. [25 Marks]
4. Display at each time $t = 1, \ldots, 100$, the room, agent, and values of dirt at every location. [15 Marks]

5. Measure the performance of the agent, i.e., the average reward obtained. [10 Marks]