

MDP: Student Housing

Overview

This Markov Decision Process (MDP) models designs a scenario revolving around the management of food and interactions with a neighbor in Student Housing. This model captures the constraints and possible actions of decision-making in everyday scenarios.

States

The MDP contains three distinct states reflecting different scenarios a person might face in the context of food management:

1. **You Have Food:** This state represents the scenario where the individual has food to consume.
2. **You Don't Have Food:** This state represents case where the individual has run out of food.
3. **Neighbor Suspects You:** This state represents case where neighbour suspect you stealing his food.

Actions

Actions are defined for each state, determining the transitions and influencing the outcomes based on the choice made:

- *Eat Own Food:* Consume available food.
- *Buy Food:* Buying food.
- *Take Neighbor Food:* Attempting to take food from the neighbor.

Transitions

Transitions between states are determined by the actions taken. Some action in a particular state has an uncertainty of outcome:

- From **You Have Food**:
 - *Eat Own Food* always result in "You Don't Have Food".
 - *Take Neighbor Food* has a 20% chance of resulting in "Neighbor Suspects You" and an 80% chance of resulting in "You Have Food".
- From **You Don't Have Food**:
 - *Buy Food* always results in "You Have Food".
 - *Take Neighbor Food* has a 50% chance of resulting in "Neighbor Suspects You" and a 50% chance of remaining in "You Have Food".
- From **Neighbor Suspects You**:
 - *Buy Food* transitions the individual back to "You Have Food".
 - *Take Neighbor Food* has a 90% chance of resulting in "Neighbor Suspects You" state and a 10% chance of resulting in "You Have Food".

Rewards

Rewards are associated with transitions between states, based on the actions taken:

- **You Have Food**:
 - *Eat Own Food* leads to a reward of +1.
 - *Take Neighbor Food* could result in a reward of +1 if goes to "You Have Food" or a penalty of -1 if "Neighbor Suspects You"
 - *Buy Food* results in a reward of -2.
 - *Take Neighbor Food* could lead to no change (0) or a penalty of -1 if goes to "Neighbor Suspects You"
- **Neighbor Suspects You**:
 - *Buy Food* has no reward of -2.
 - *Take Neighbor Food* can lead to a severe penalty of -5 if goes to "Neighbor Suspects You" or a reward of +1 if goes to "You have Food"

Conclusion

This MDP for Student Housing provides a clear model for predicting the best strategy in managing food resources and interactions with neighbors. The model defines possible states and actions, making it possible to evaluate the outcomes of various decisions under uncertainty and to strategize effectively for optimal results in a shared living environment.