POMDPs

POMDPs

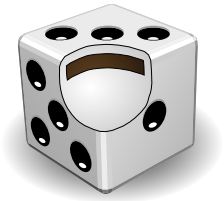
- We've been living a lie:

```
s = observe(env)
```

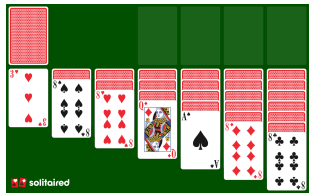
Types of Uncertainty

Alleatory

Epistemic (Static)

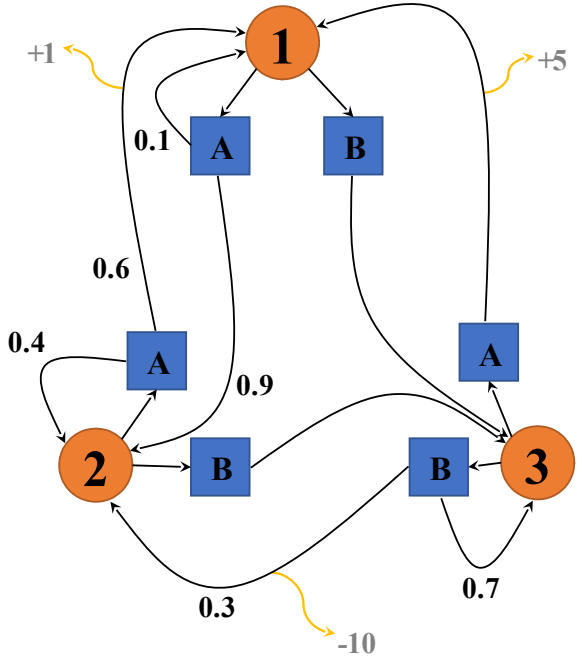


Epistemic (Dynamic)



Interaction

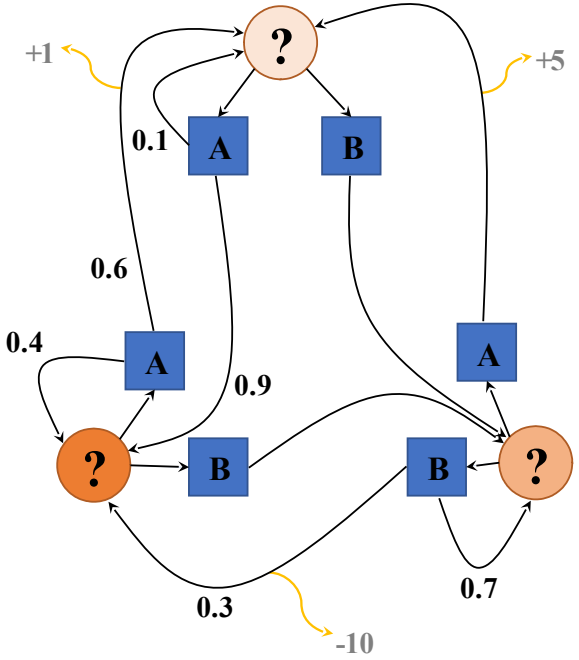
Markov Decision Process (MDP)



- $\mathcal{S}$ - State space
- $T : \mathcal{S} \times \mathcal{A} \times \mathcal{S} \to \mathbb{R}$ - Transition probability distribution
- $\mathcal{A}$ - Action space
- $R : \mathcal{S} \times \mathcal{A} \to \mathbb{R}$ - Reward

Alleatory

Partially Observable Markov Decision Process (POMDP)



- $\mathcal{S}$ - State space
- $T : \mathcal{S} \times \mathcal{A} \times \mathcal{S} \to \mathbb{R}$ - Transition probability distribution
- $\mathcal{A}$ - Action space
- $R : \mathcal{S} \times \mathcal{A} \to \mathbb{R}$ - Reward
- $\mathcal{O}$ - Observation space
- $Z : \mathcal{S} \times \mathcal{A} \times \mathcal{S} \times \mathcal{O} \to \mathbb{R}$ - Observation probability distribution

Alleatory

Epistemic (Static)

Epistemic (Dynamic)

Tiger POMDP Definition

Hidden Markov Models and Beliefs

Bayesian Belief Updates

Filtering Loop

Tiger Example

Recap