

Markov Process

1. [David Silver, Lecture 2. Markov Decision Process](#)
2. [YouTube 팜요랩, 강화학습 2강](#)

Markov Property

"The future is independent of the past given the present"

미래는 현재가 주어지면 과거로부터 독립이다.

Markov Property

Definition

A state S_t is Markov if and only if

$$\mathbb{P}[S_{t+1}|S_t] = \mathbb{P}[S_{t+1}|S_1, \dots, S_t].$$

The state captures all relevant information from the history.

state는 history에서 모든 관련 정보를 수집한다.

Once the state is known, the history may be thrown away.

state가 알려지면, history는 버려질 수 있다. (?)

The state is a sufficient statistic of the future.

state는 미래에 대한 충분 통계량이다.

State Transition Matrix

For a Markov state s and successor state s' , the state transition probability is defined by

$$\mathcal{P}_{ss'} = \mathbb{P}[S_{t+1} = s' | S_t = s].$$

State transition matrix \mathcal{P} defines transition probabilities from all states s to all successor states s' ,

$$\mathcal{P} = from \begin{bmatrix} \mathcal{P}_{11} & \cdots & \mathcal{P}_{1n} \\ \vdots & \ddots & \vdots \\ \mathcal{P}_{n1} & \cdots & \mathcal{P}_{nn} \end{bmatrix},$$

where each row for the matrix sums to 1.

행렬의 행의 합이 1이어야 한다.

Markov Process

A Markov Process is a memoryless random process, i.e. a sequence of random states S_1, S_2, \dots with the Markov property.

Definition

A Markov Process (or Markov Chain) is a tuple $\langle \mathcal{S}, \mathcal{P} \rangle$

- \mathcal{S} is a (finite) set of states
 - \mathcal{P} is a state transition probability matrix,
$$\mathcal{P}_{ss'} = \mathbb{P}[S_{t+1} = s' | S_t = s]$$
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in Graph Neural Networks,
adjacency matrix가 state transition matrix와 개념이 동일하므로,
adaptive adjacency matrix에 활용할 수 있을 것으로 예상