

RL: Basics

The Markov Assumption

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Markov Assumption

- ▶ Information state: sufficient statistic of history
- ▶ State s_t is Markov if and only if:

$$p(s_{t+1} \mid s_t, a_t) = p(s_{t+1} \mid h_t, a_t)$$

- ▶ with history $h_t = (a_1, s_1, r_1, \dots, a_t, s_t, r_t)$

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- ▶ **Question:** Hypertension control: let state be current blood pressure, and action be whether to take medication or not. Is this system Markov?
- ▶ **Question:** Website shopping: state is current product viewed by customer, and action is what other product to recommend. Is this system Markov?

Why is Markov Assumption Popular?

- ▶ Can always be satisfied
 - ▶ Setting state as history always Markov: $s_t = h_t$
- ▶ In practice often assume most recent observation is sufficient statistic of history: $s_t = o_t$
- ▶ State representation has big implications for:
 - ▶ Computational complexity
 - ▶ Data required
 - ▶ Resulting performance

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 - ▶ In practice, often infeasible
 - ▶ special subfield of RL that deals with such POMDP problems
- ▶ We will see later in the course that even if the Markov assumption is violated and some information is hidden, we can nevertheless train well-performing agents