Markov Modeling

$t=1$ $t=2$ $t=3$ ...

Discrete time Markov chain

$$P(X_n = i_n \mid X_{n-1} = i_{n-1}, X_{n-2} = i_{n-2}, \dots, X_0 = i_0)$$

$$= P(X_n = i_n \mid X_{n-1} = i_{n-1})$$ First order Markov property

$$P(X_n = i_n \mid X_{n-1} = i_{n-1}, X_{n-2} = i_{n-2}, \dots \to X_0 = i_0)$$

$$= P(X_n = i_n \mid X_{n-1} = i_{n-1}, X_{n-2} = i_{n-2})$$ 2nd order Markov property

3 states

Transition matrix

$$\begin{array}{c} \\ S_0 \\ S_1 \\ S_2 \end{array} \begin{array}{c} \begin{array}{ccc} S_0 & S_1 & S_2 \end{array} \\ \begin{bmatrix} p_{00} & p_{01} & p_{02} \\ p_{10} & p_{11} & p_{12} \\ p_{20} & p_{21} & p_{22} \end{bmatrix} \end{array} \begin{array}{l} \Sigma = 1 \\ \Sigma = 1 \\ \Sigma = 1 \end{array}$$