

# Hidden Markov Models

Two steps

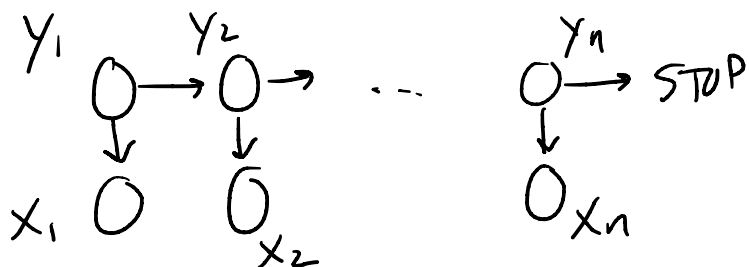
Generative sequence model

Tags  $y_i \in \mathcal{T}$   
words  $x_i \in \mathcal{V}$   
tags vocabulary

① Param estimation

② Inference

$$P(\bar{y}, \bar{x}) = P(y_1) P(x_1 | y_1) P(y_2 | y_1) P(x_2 | y_2) \dots P(\text{STOP} | y_n)$$



$y_i$ 's form a Markov process

$y_i$  is conditionally independent of  $y_1, \dots, y_{i-2}$  given  $y_{i-1}$

Parameters

$P(y_i | y_{i-1})$   
transitions

$P(x_i | y_i)$   
emissions

$P(y_1)$  initial distribution  
 $|\mathcal{T}|$ -len vector  
 $S$

$y_{\text{curr}}$   $y_{\text{next}}$   
 $T$   $X_{\text{curr}}$   
 $|\mathcal{T}| \times |\mathcal{T}|$  matrix

$NN$   $y_{\text{curr}}$   $E$   
 $|\mathcal{T}| \times |\mathcal{V}|$