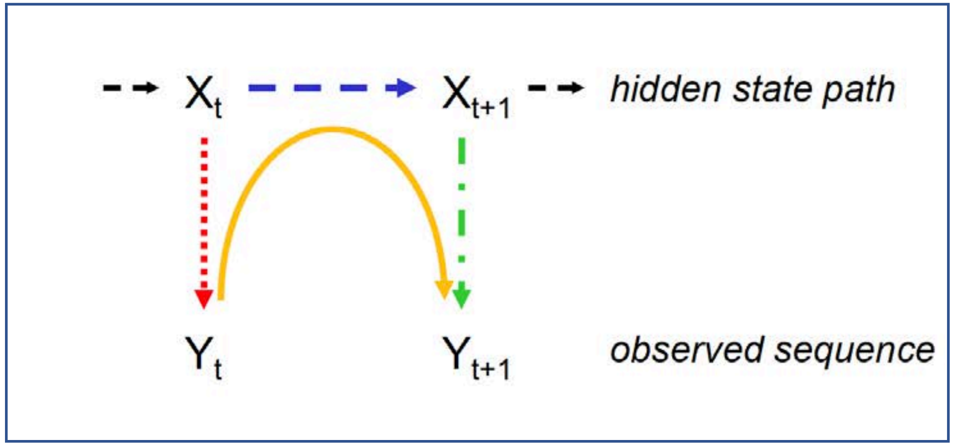
The computation of conditional probabilities of an observed symbol given a previous observed symbol for an HMM

The Markov chain specifies the transition probabilities $P(Y_{t+1} \mid Y_t)$ for the observed sequence.

Using the HMM we need to calculate (see next slide):

$$P(Y_{t+1}|Y_t) = \sum_{X_t, X_{t+1}} P(Y_{t+1} \mid X_{t+1})\, P(X_{t+1} \mid X_t)\, P(X_t \mid Y_t)$$

conditional independence



Transition probability:

$$P(Y_{t+1}|Y_t) = \sum_{X_t, X_{t+1}} \underbrace{P(Y_{t+1} \mid X_{t+1})}_{\text{emission matrix of HMM}}\, \underbrace{P(X_{t+1} \mid X_t)}_{\text{transition matrix of HMM}}\, \underbrace{P(X_t \mid Y_t)}_{\text{obtained using Bayes' rule}}$$

emission matrix of HMM

transition matrix of HMM

obtained using Bayes' rule:

$$P(X_t|Y_t) = \frac{P(Y_t \mid X_t)\, P(X_t)}{\sum_{X_t \in \{\mathtt{I,\ E}\}} P(Y_t \mid X_t)\, P(X_t)}$$

All possible hidden states