email sign-up by Thursday evening: bit.ly/IFT6269-F22

Probabilistic graphical model:

Model multivariate data

Graphical model \rightarrow \text{mix of graph theory + probability theory}

Prob. and statistics

Data

Applications:

Hidden Markov Model

Hidden Markov Model (HMM)

a) Speech recognition: \( X_t \rightarrow \text{sound waves (observed)} \)
\( Y_t \rightarrow \text{phoneme (latent)} \)

b) Part of speech tagging:
\( DT \rightarrow V \rightarrow DT \rightarrow ADJ \rightarrow N \)
\( Y_t: \text{part of speech} \)
This is a red box \( X_t: \text{words} \)

C) Gene finding:
\( X_t \rightarrow \text{DNA} \)
\( Y_t: \text{coding vs. non-coding} \quad Y_t \in \{0,1\} \)

\[ 
\begin{bmatrix}
0 & 1 & 1 \\
1 & 1 & 0
\end{bmatrix}
\]
(d) Control

\[ y_{t+1} = A y_t + B u_t + \varepsilon_t \]

where \( x_t \) and \( y_t \) are control variables.

\[ x_t = C y_t + \varepsilon_t \]

If \( \varepsilon_t \) is Gaussian

HMM → "Kalman filter"