Generative Modeling and the Naïve Assumption

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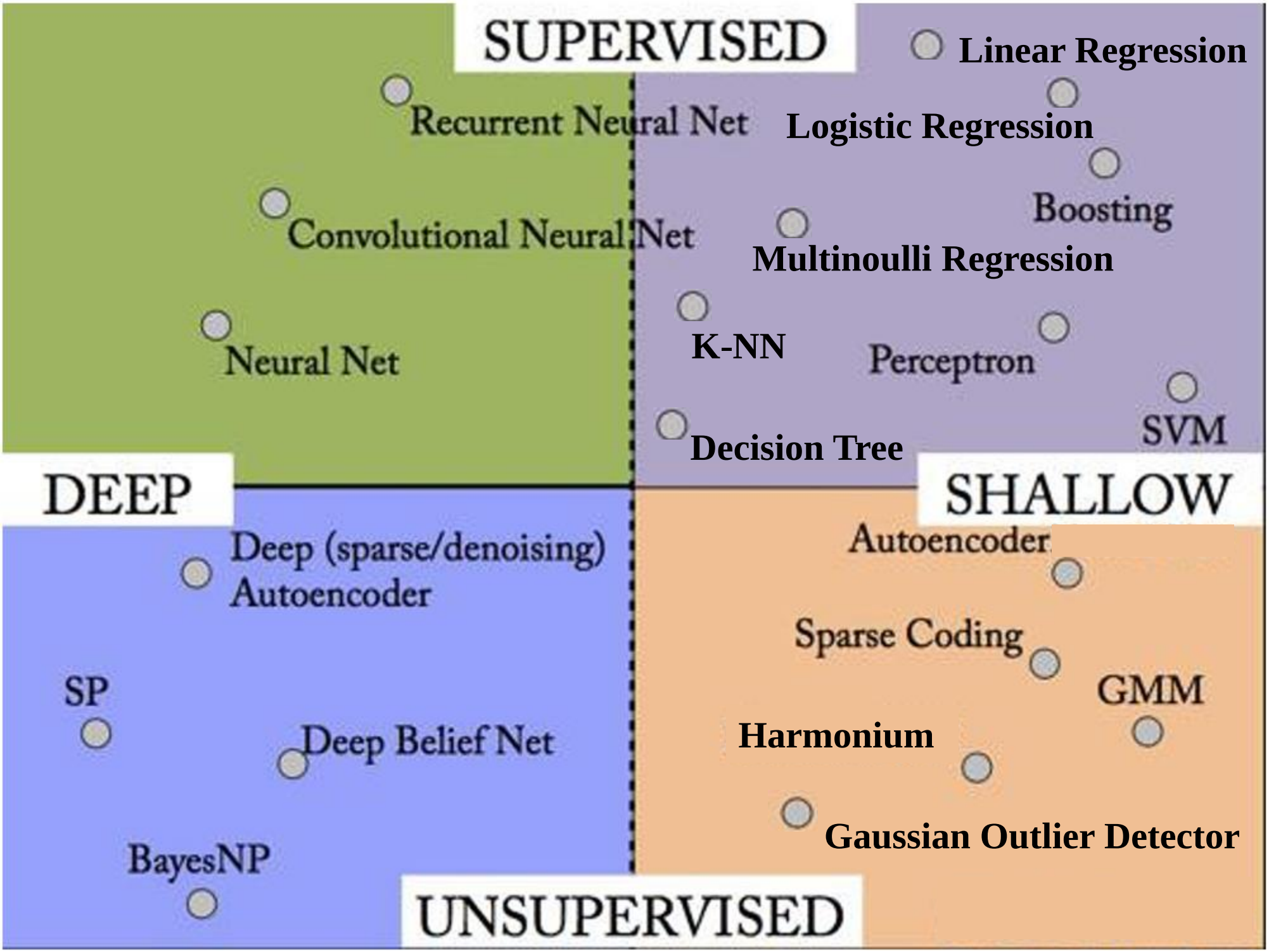
Introduction to Machine Learning

CSCI-635

10/13/2023


SUPERVISED
Linear Regression
Recurrent Neural Net
Logistic Regression
Boosting
Convolutional Neural Net
Multinoulli Regression
K-NN
Neural Net
Perceptron
SVM
Decision Tree
DEEP
SHALLOW
Deep (sparse/denoising) Autoencoder
Autoencoder
Sparse Coding
SP
GMM
Deep Belief Net
Harmonium
Gaussian Outlier Detector
BayesNP
UNSUPERVISED

Generation vs. Discrimination

Generative Models

- Represent both the data and the labels
- Often, makes use of conditional independence and priors
- Examples
  - Naïve Bayes classifier
  - Bayesian network
  - Single/Dual-wing harmonium
  - Variational autoencoder
- Models of data may apply to future prediction problems

Discriminative Models

- Learn to directly predict the labels from the data
- Often, assume a simple boundary (e.g., linear)
- Examples
  - Logistic regression
  - SVM, perceptron, discriminants
  - Decision tree / An ensemble
  - MLP
- Often easier to predict a label from the data than to model the data

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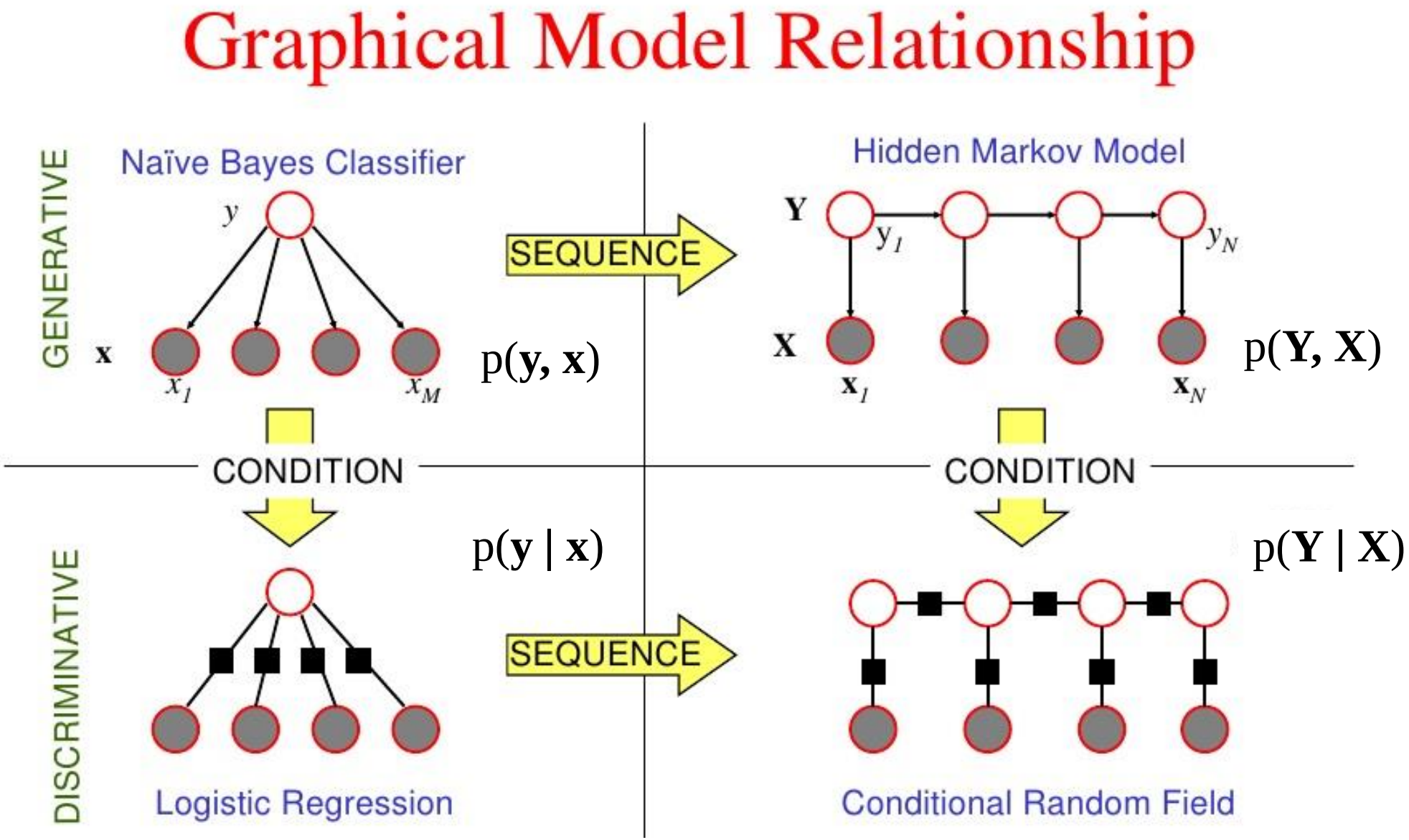
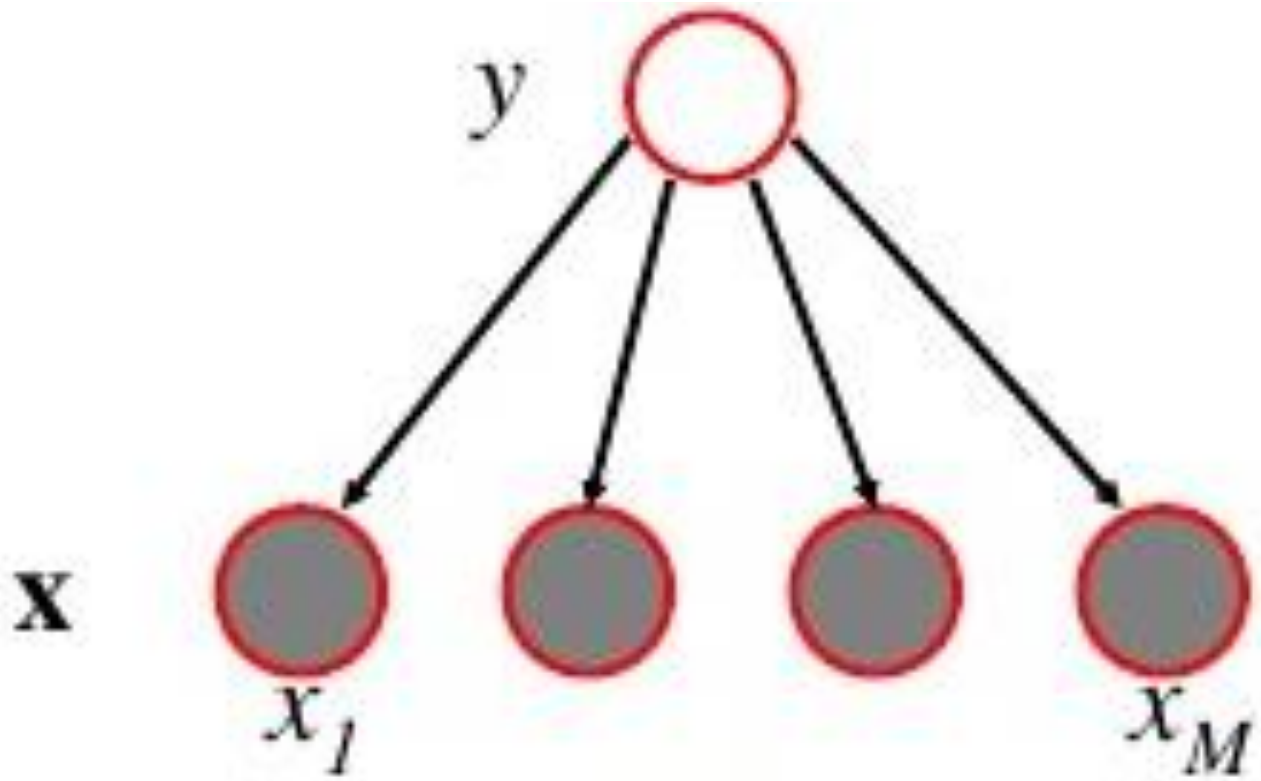
Graphical Models

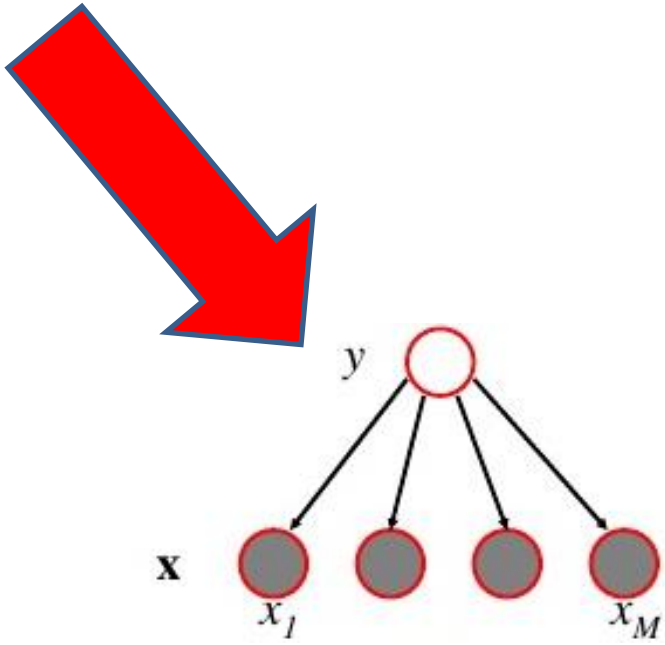


Construction: Crafting a Naïve Bayes graphical model!


y
x
x_1
x_M

Class-Labeled Training Tuples from the *AllElectronics* Customer Database

RID	age	income	student	credit_rating	Class: buys_computer
1	youth	high	no	fair	no
2	youth	high	no	excellent	no
3	middle_aged	high	no	fair	yes
4	senior	medium	no	fair	yes
5	senior	low	yes	fair	yes
6	senior	low	yes	excellent	no
7	middle_aged	low	yes	excellent	yes
8	youth	medium	no	fair	no
9	youth	low	yes	fair	yes
10	senior	medium	yes	fair	yes
11	youth	medium	yes	excellent	yes
12	middle_aged	medium	no	excellent	yes
13	middle_aged	high	yes	fair	yes
14	senior	medium	no	excellent	no



QUESTIONS?