Foundations of Machine Learning
AI2000 and AI5000

FoML-14
Probabilistic Generative Models - Discrete features

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So far in FoML

- What is ML and the learning paradigms
- Probability refresher
- MLE, MAP, and fully Bayesian treatment
- Linear Regression with basis functions - regularization & model selection
- Bias-Variance Decomposition/Tradeoff (Bayesian Regression)
- Decision Theory - three broad classification strategies
- Probabilistic Generative Models - Continuous data

Probabilistic Generative Models - Discrete features

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Probabilistic Generative Models - Discrete

- Input: discrete feature vectors $\mathbf{x}_n = (x_1, \ldots, x_D)^T$

- For simplicity, consider binary feature values $x_i \in \{0, 1\}$

Probabilistic Generative Models - Discrete

- For D-dim input
  - The no. of parameters to express each class conditional density $p(\mathbf{x}/C_k)$

Probabilistic Generative Models - Discrete

- The ‘Naive Bayes’ Assumption - feature values are treated as independent when conditioned on class C_k

$$p(\mathbf{x}/C_k) =$$

Probabilistic Generative Models - Discrete

- Posterior probability

$$p(C_k/\mathbf{x}) =$$

$$a_k(\mathbf{x}) =$$

Probabilistic Generative Models - Discrete

- Analogous results can be obtained for non-binary components
  - Exercise!
- Derive the ML estimates for the Binary case
  - Exercise!

Next
Discriminative Models