CS 445
Introduction to Machine Learning

Naïve Bayes

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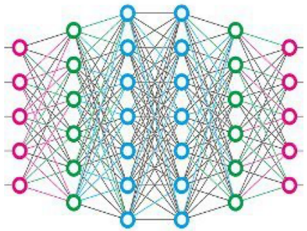
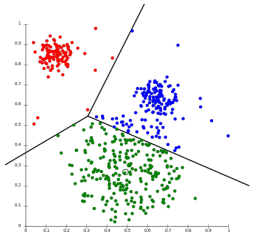
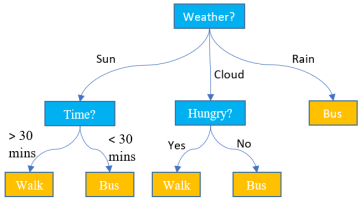






Plan for Today

Last time: review Probability (summing out, chain rule, bayes rule)

Today:

1. Introduce the Naïve bayes classifier
2. Discuss PA 2

Naïve Bayes

Classifier: Determine whether a child will go outside to play today

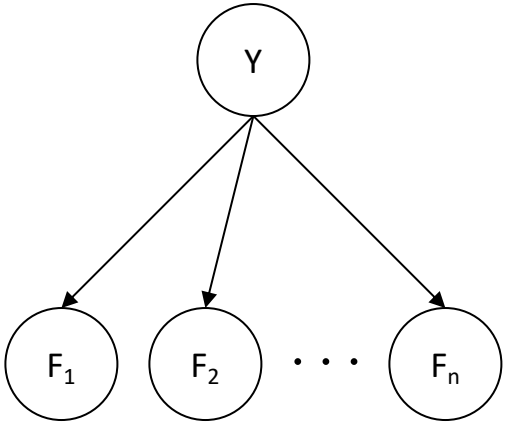
Outlook	Temp	Humidity	Play (Y/N)
sunny	hot	high	no
sunny	hot	high	no
rainy	cool	normal	no
overcast	hot	high	yes
rainy	mild	high	yes
rainy	cool	normal	yes
overcast	cool	normal	yes

How many probabilities will we need?

k^d probabilities !!!!

What makes the model Naïve ?

$$P(y|X) = \frac{P(X|y)P(y)}{P(X)}$$



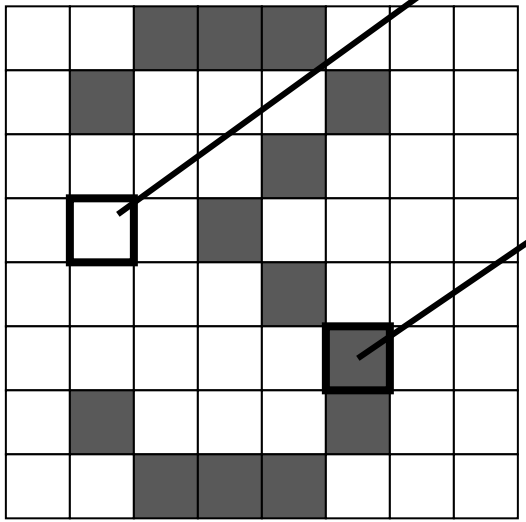
$$P(y|x) \propto P(x|y)P(y)$$

$$P(y|X) = \frac{P(X|y)P(y)}{P(X)} \propto P(y)\prod_{i=1}^{d} P(X_i|y)$$

Example: Digit Recognition

$P(Y)$

1	0.1
2	0.1
3	0.1
4	0.1
5	0.1
6	0.1
7	0.1
8	0.1
9	0.1
0	0.1



$P(F_{3,1} = on|Y)$

1	0.01
2	0.05
3	0.05
4	0.30
5	0.80
6	0.90
7	0.05
8	0.60
9	0.50
0	0.80

$P(F_{5,5} = on|Y)$

1	0.05
2	0.01
3	0.90
4	0.80
5	0.90
6	0.90
7	0.25
8	0.85
9	0.60
0	0.80

Spam Detection

- Naïve Bayes spam filter
- Data:
  - Collection of emails, labeled spam or ham
  - Note: someone has to hand label all this data!
  - Split into training, held-out, test sets
- Classifiers
  - Learn on the training set
  - (Tune it on a held-out set)
  - Test it on new emails

Dear Sir.

First, I must solicit your confidence in this transaction, this is by virture of its nature as being utterly confidencial and top secret. …

TO BE REMOVED FROM FUTURE MAILINGS, SIMPLY REPLY TO THIS MESSAGE AND PUT "REMOVE" IN THE SUBJECT.

99 MILLION EMAIL ADDRESSES
FOR ONLY $99

Ok, Iknow this is blatantly OT but I'm beginning to go insane. Had an old Dell Dimension XPS sitting in the corner and decided to put it to use, I know it was working pre being stuck in the corner, but when I plugged it in, hit the power nothing happened.