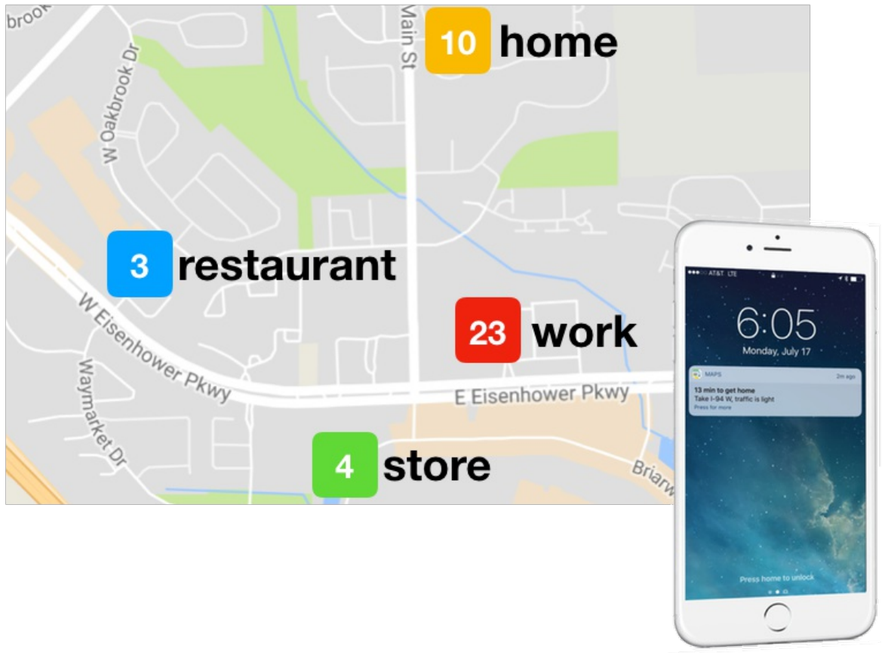
SUPERVISED LEARNING IN R: CLASSIFICATION

Understanding Bayesian methods

Brett Lantz
Instructor

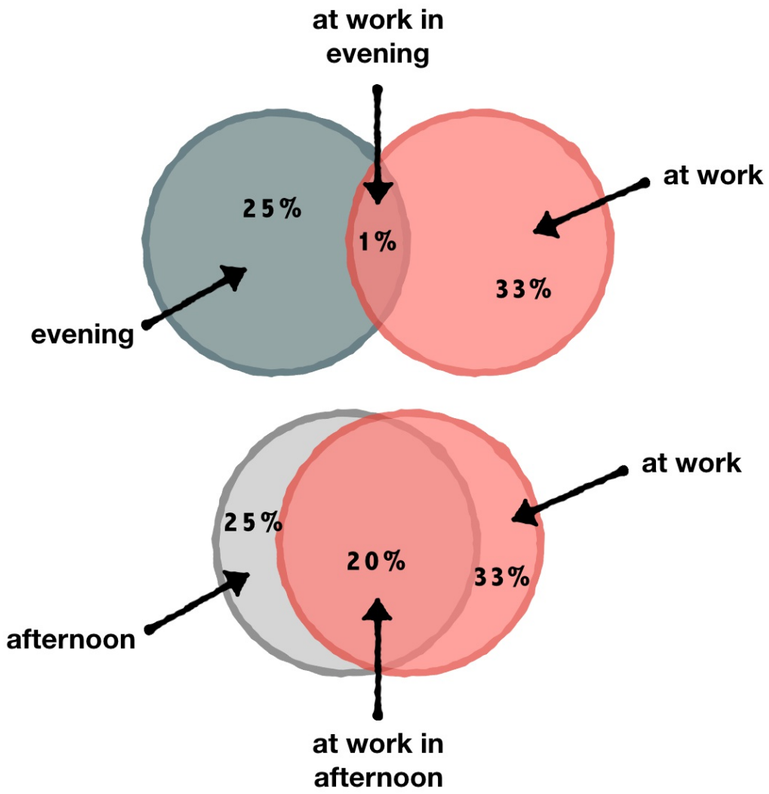
Estimating probability



The **probability** of A is denoted P(A)

- P(work) = 23 / 40 = 57.5%
- P(store) = 4 / 40 = 10.0%

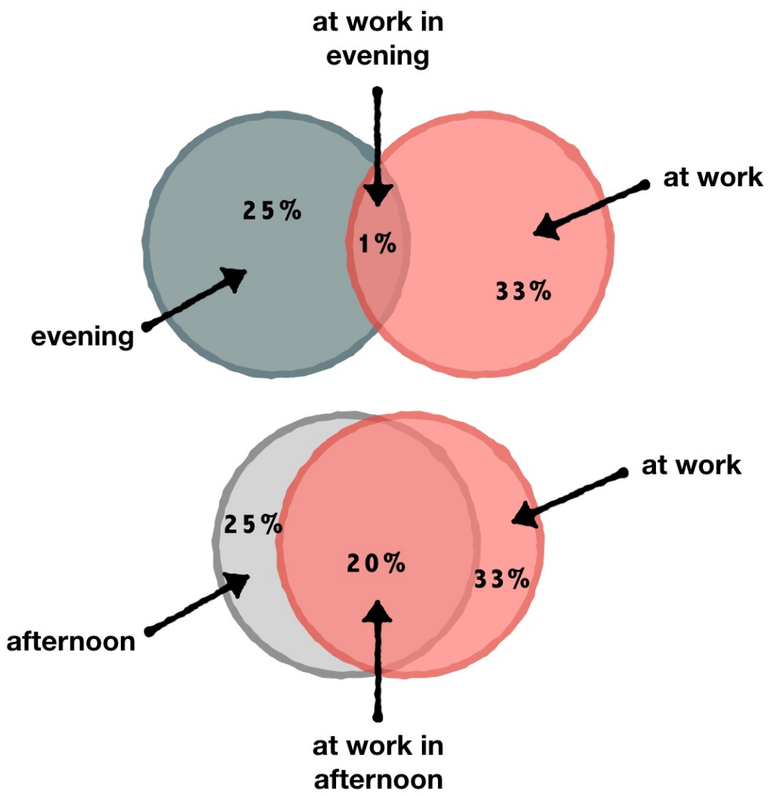
Joint probability and independent events



The **joint probability** of events A and B is denoted P(A and B)

- P(work and evening) = 1%
- P(work and afternoon) = 20%

Conditional probability and dependent events



The **conditional probability** of events A and B is denoted P(A | B)

- P(A | B) = P(A and B) / P(B)
- P(work | evening) = 1 / 25 = 4%
- P(work | afternoon) = 20 / 25 = 80%

Making predictions with Naive Bayes

```
# building a Naive Bayes model
library(naivebayes)
m <- naive_bayes(location ~ time_of_day, data = location_history)
```

```
# making predictions with Naive Bayes
future_location <- predict(m, future_conditions)
```

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Let's practice!

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Understanding NB's "naivety"

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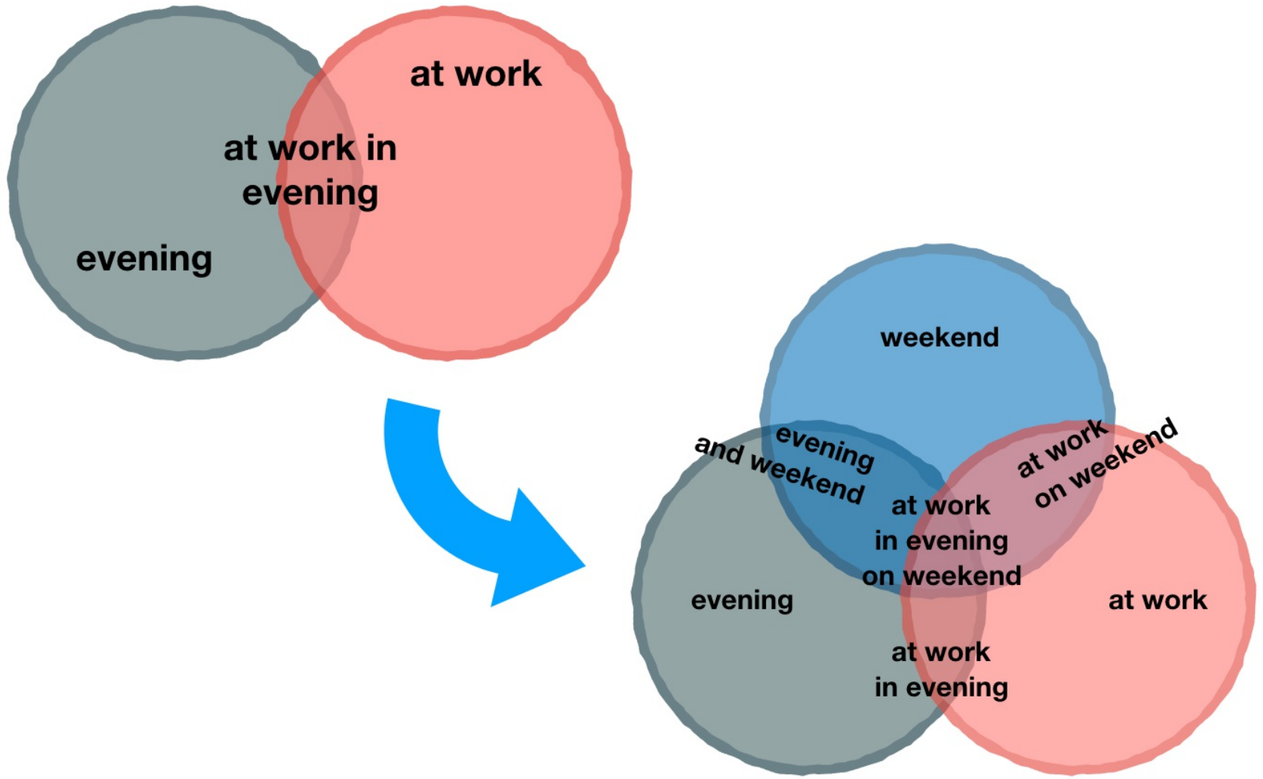
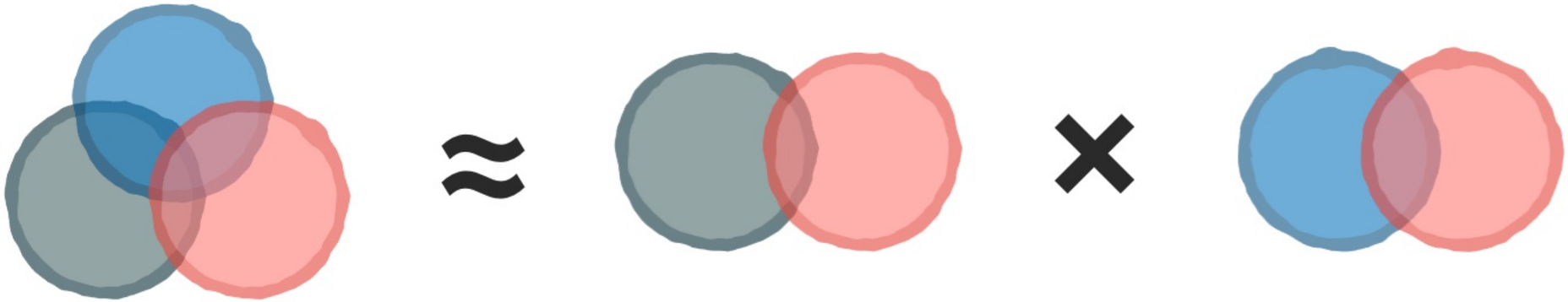
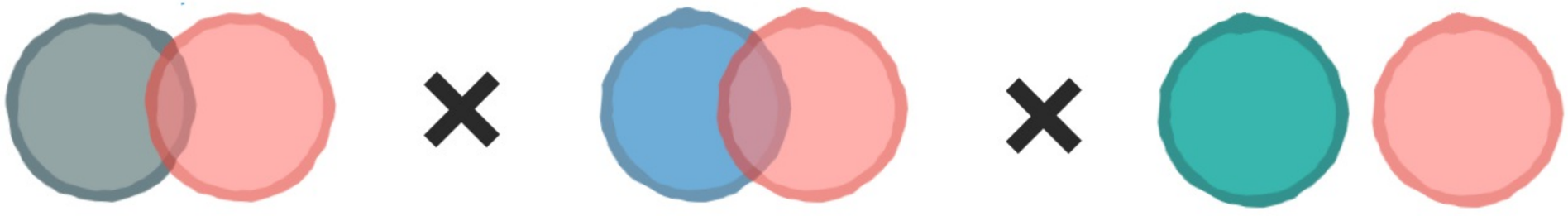
The challenge of multiple predictors



A "naive" simplification

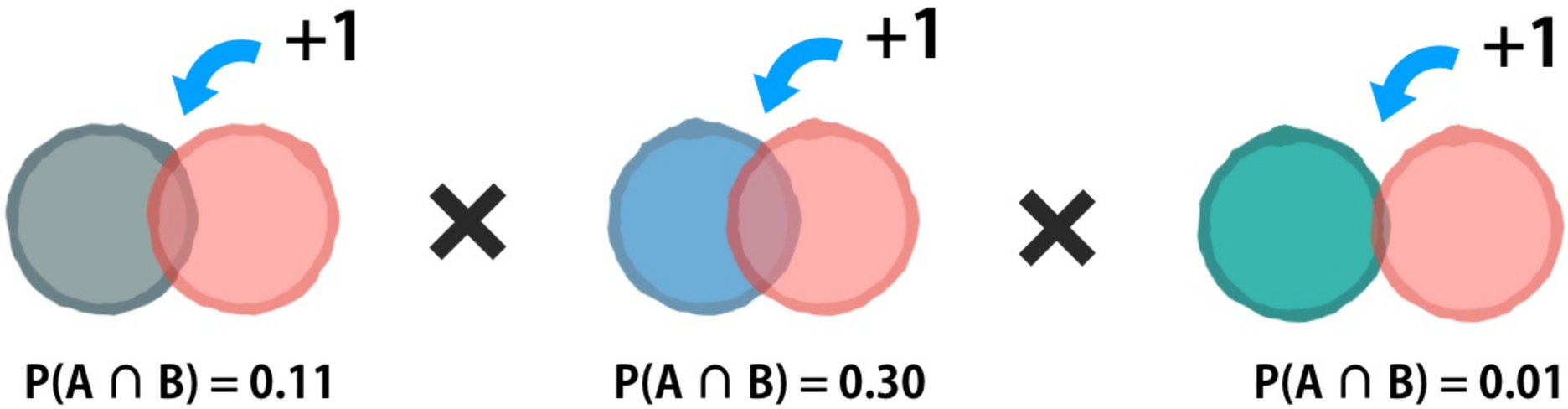


An "infrequent" problem



$P(A \cap B) = 0.10$ $P(A \cap B) = 0.30$ $P(A \cap B) = 0.00$

The Laplace correction



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Applying Naive Bayes to other problems

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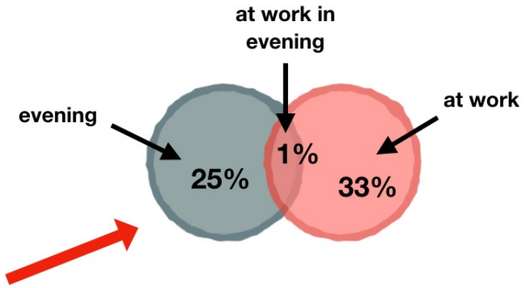
How Naive Bayes uses data

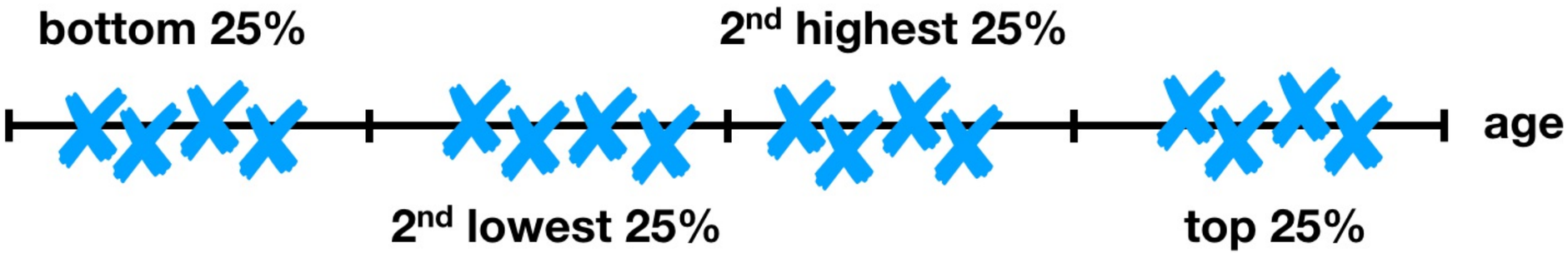
locations

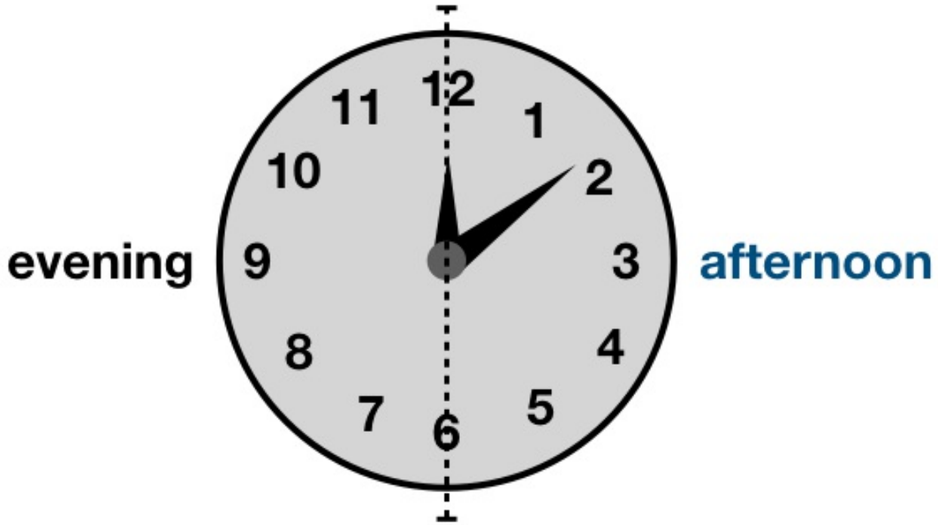
Filter

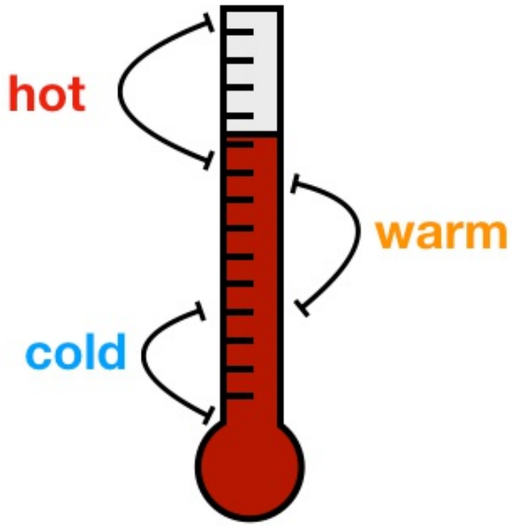
	month	day	weekday	daytype	hour	hourtype	location
1	1	4	wednesday	weekday	0	night	home
2	1	4	wednesday	weekday	1	night	home
3	1	4	wednesday	weekday	2	night	home
4	1	4	wednesday	weekday	3	night	home
5	1	4	wednesday	weekday	4	night	home
6	1	4	wednesday	weekday	5	night	home
7	1	4	wednesday	weekday	6	morning	home
8	1	4	wednesday	weekday	7	morning	home
9	1	4	wednesday	weekday	8	morning	home
10	1	4	wednesday	weekday	9	morning	office
11	1	4	wednesday	weekday	10	morning	office
12	1	4	wednesday	weekday	11	morning	office
13	1	4	wednesday	weekday	12	afternoon	office



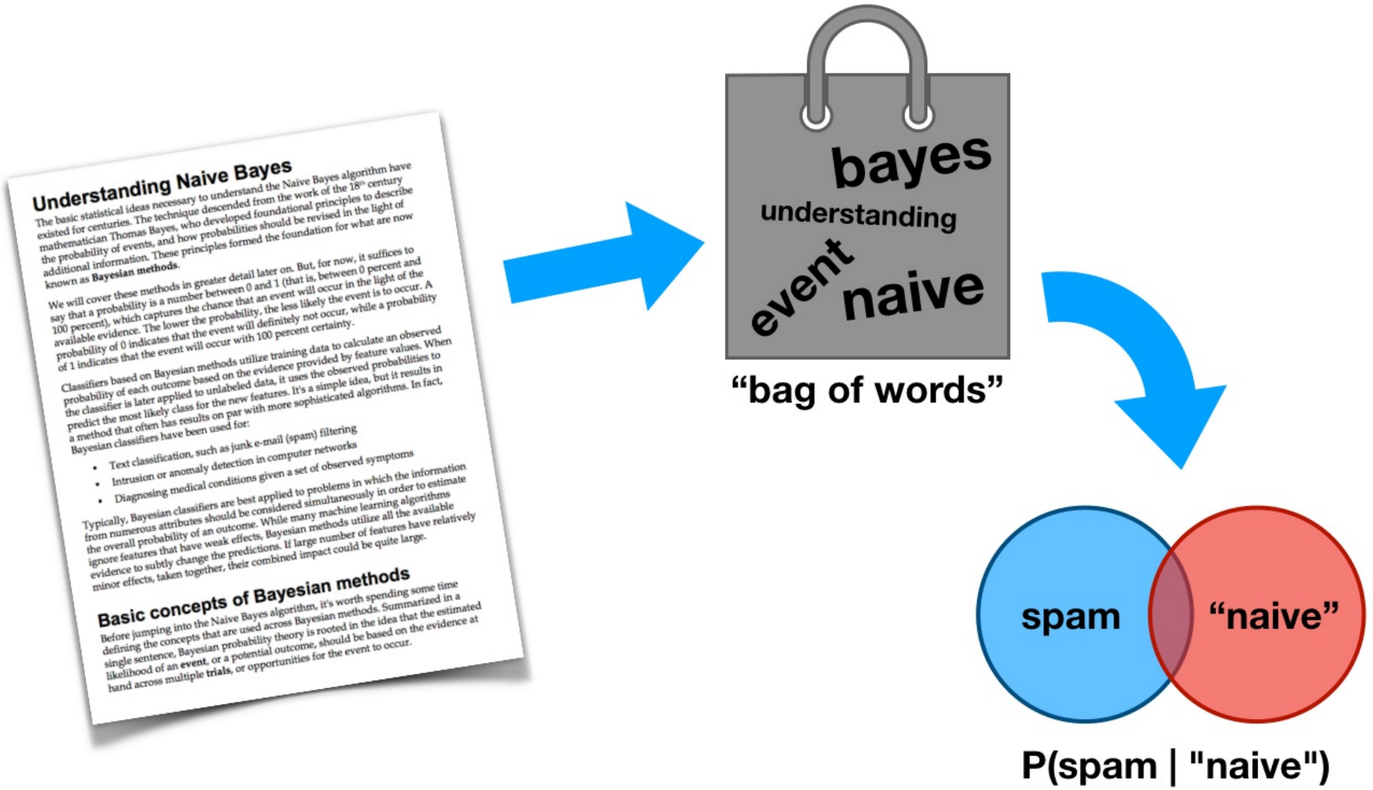
Binning numeric data for Naive Bayes







Preparing text data for Naive Bayes



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