

CS 129.18

Naive Bayes Classifiers

Conditional Probability

$$P(A \mid B) = \frac{P(A \cap B)}{P(B)}$$

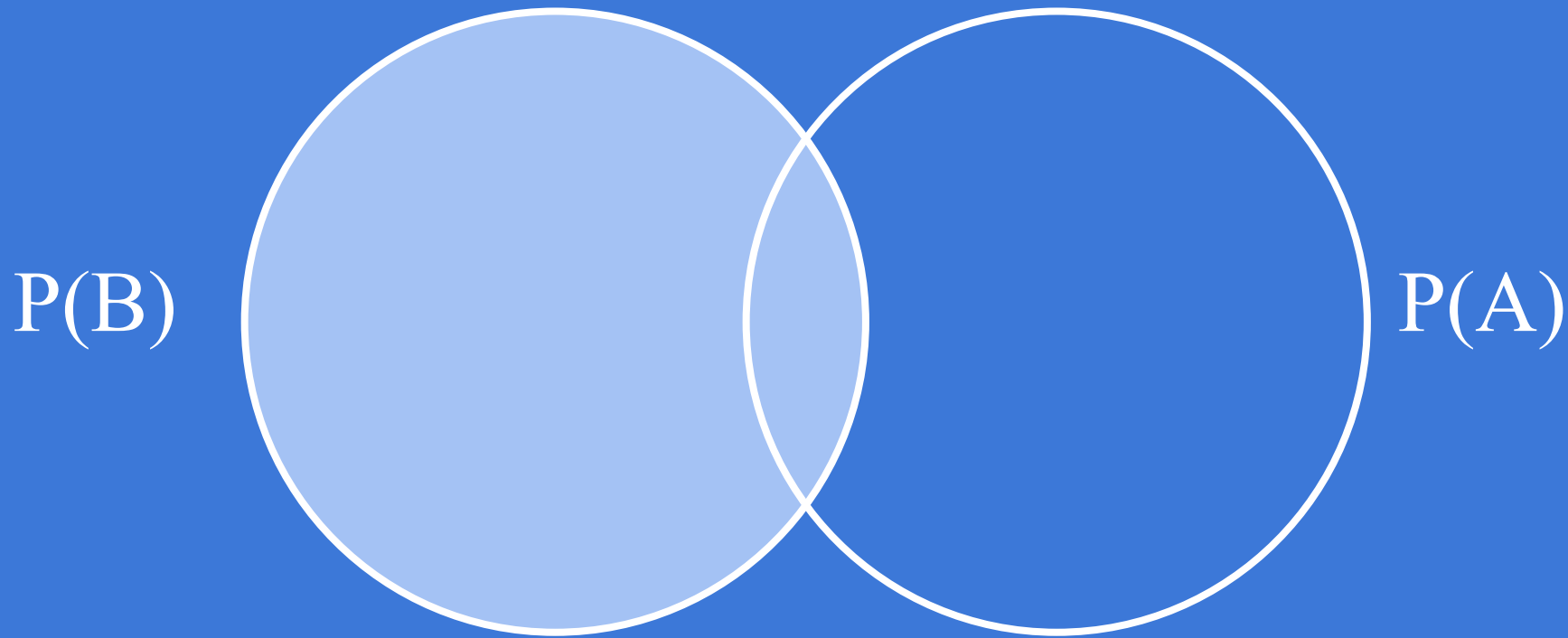
Probability of A happening, given B happened

Conditional Probability

Probability A and B occurs

$$P(A | B) = \frac{P(A \cap B)}{P(B)}$$

Probability of A happening, given B happened



Ratio of the intersection of A and B, with
probability of B happening

The percentage of adults who are male and alcoholic are 2.25%. What is the probability of being an alcoholic, given being a man?

Assume: 50% probability of being a man

Given:

$P(A)$ = % of being alcoholic

$P(B)$ = % of being man

$P(A \cap B) = 0.0225$

$$P(A \mid B) = \frac{P(A \cap B)}{P(B)}$$

$$P(B \mid A) = \frac{P(B \cap A)}{P(A)}$$

$P(B \cap A)$ is actually $P(B \mid A) \times P(A)$

Bayes Theorem

$$P(A | B) = \frac{P(B|A) \times P(A)}{P(B)}$$

Your friend tells you that she has 2 Charmanders, and at least one of them is shiny. What is the probability that all of them are shiny?

Given:

Each Pokemon has 0.002% or $1/512$ chance of being shiny

$$P(A \mid B) = \frac{P(\text{at least 1 shiny} \mid 2 \text{ shinies}) \times P(2 \text{ shinies})}{P(\text{at least 1 shiny})}$$

P(B | A) is actually 100%!

$1/512 * 2$

$$P(A | B) = \frac{P(\text{at least 1 shiny} | 2 \text{ shinies}) \times P(2 \text{ shinies})}{P(\text{at least 1 shiny})}$$

$1/512$

Approximately 1% of women aged 40-50 have breast cancer. A woman with breast cancer has 80% chance of testing positively on a mammogram, while a woman *without* has a 10% chance of a false positive.

What is the probability that a woman has breast cancer given that she just had a positive test?

Given:

$P(A)$ = having breast cancer

$P(B)$ = having a positive test

Spam Detection

NBC for Spam

Bayes Theorem

$$P(\text{spam} \mid \text{words}) = \frac{P(\text{words} \mid \text{spam}) \times P(\text{spam})}{P(\text{words})}$$

Thank you