Naive Bayes

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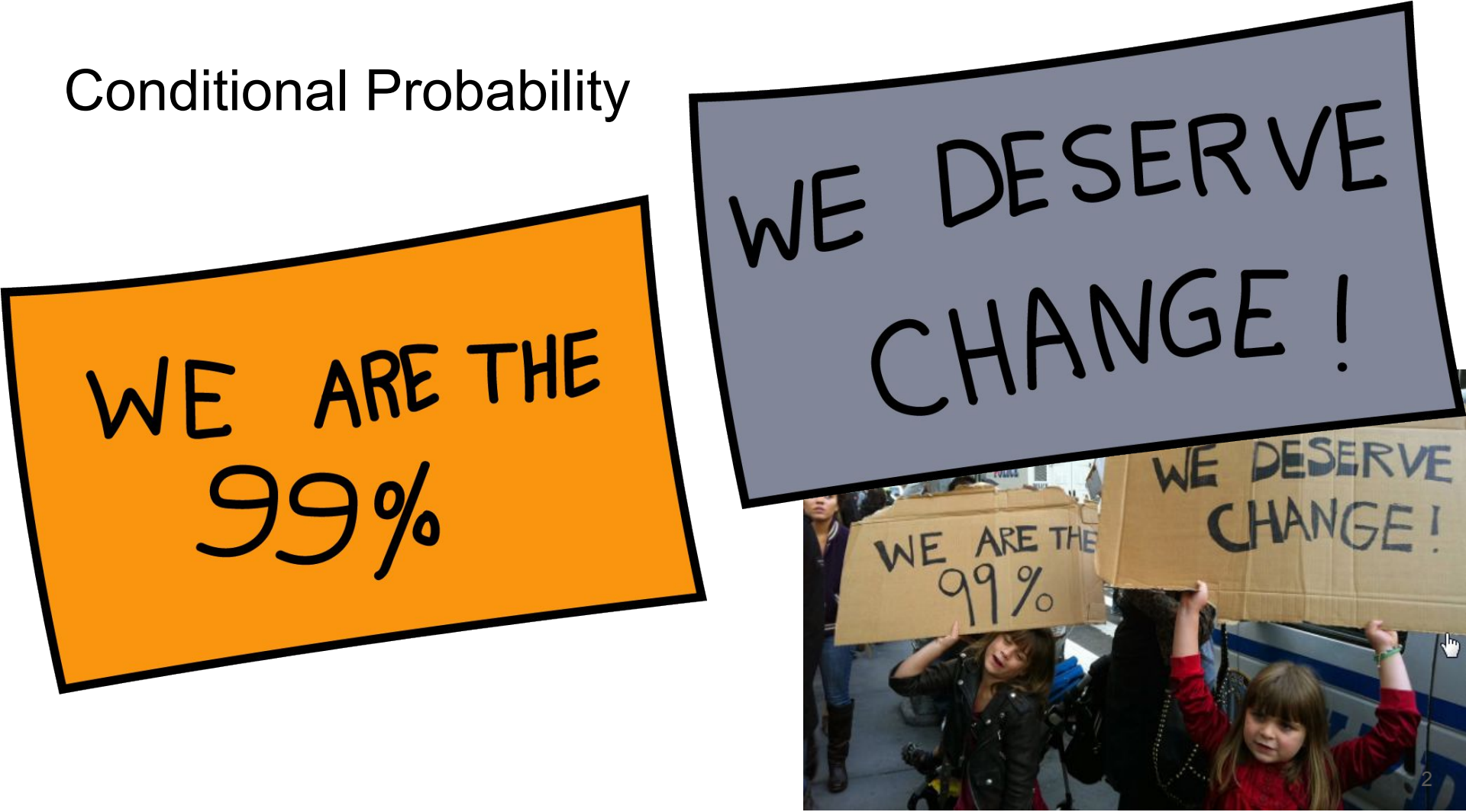
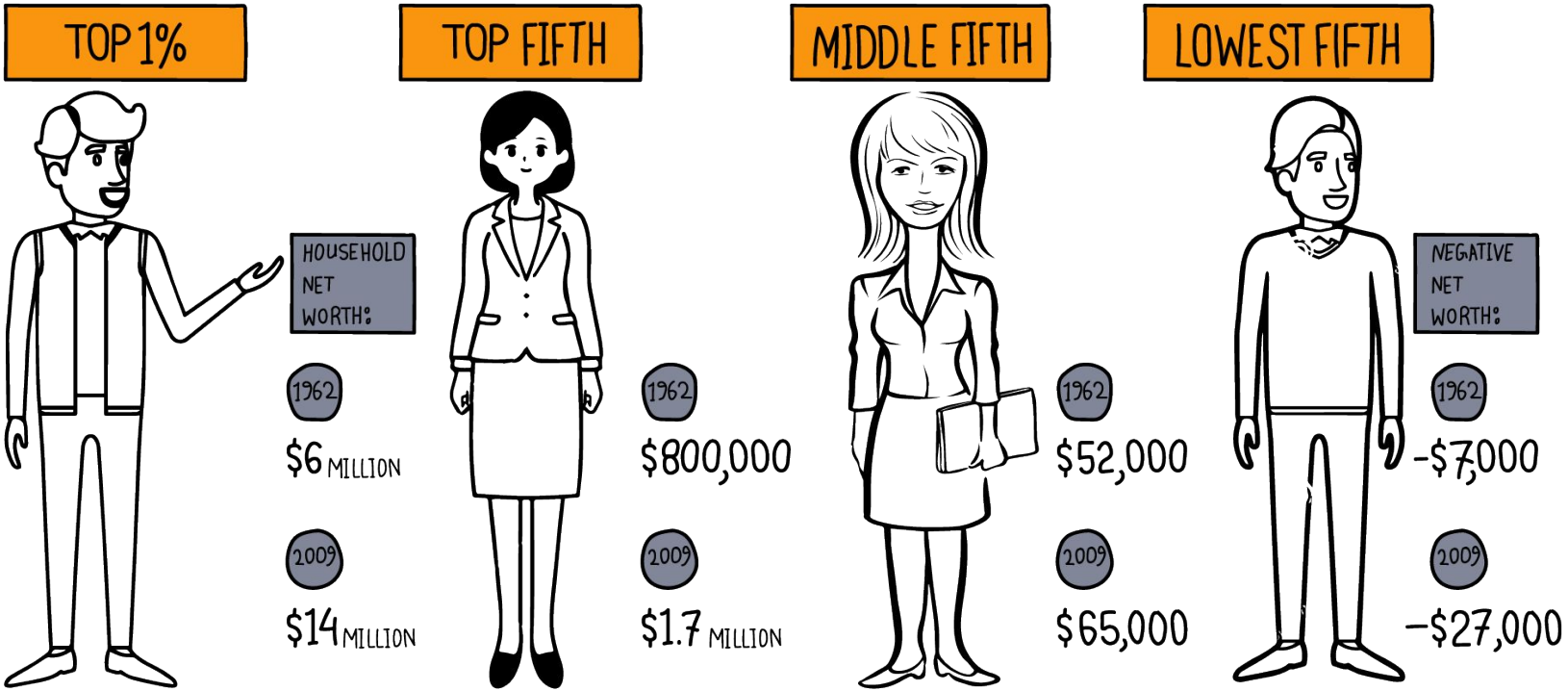
Conditional Probability



What are the chances of being part of the 1%?



Research

Research has shown that ¼ of the 1% is female

Math Alert:

¼ of 1% is female

or

.25 * .01 = .0025 is female

What are the chances of being FEMALE if you are 1%?

CHANCES OF BEING FEMALE AND IN THE 1%

=

CHANCES OF BEING FEMALE IF YOU ARE IN THE 1%

X

CHANCES OF BEING IN THE 1%

What are the chances of being 1% if you are FEMALE?

CHANCES OF BEING FEMALE AND IN THE 1%

=

CHANCES OF BEING IN THE 1% IF YOU ARE FEMALE

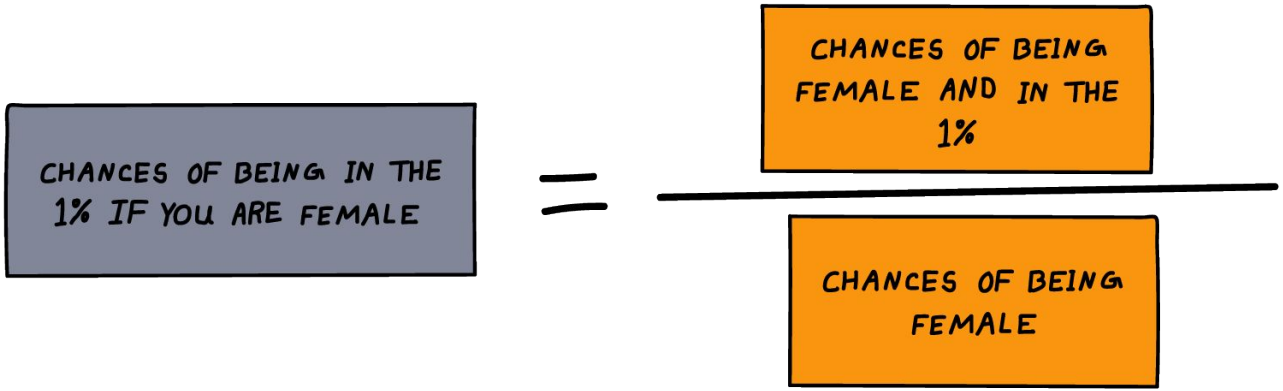
X

CHANCES OF BEING FEMALE

What are the chances of being 1% if you are FEMALE?

CHANCES OF BEING FEMALE AND IN THE 1% = CHANCES OF BEING IN THE 1% IF YOU ARE FEMALE × CHANCES OF BEING FEMALE

CHANCES OF BEING IN THE 1% IF YOU ARE FEMALE = $\frac{\text{CHANCES OF BEING FEMALE AND IN THE 1\%}}{\text{CHANCES OF BEING FEMALE}}$



$x * 0.5 = .0025$

$x = .0025 / 0.5$

$x = .005$

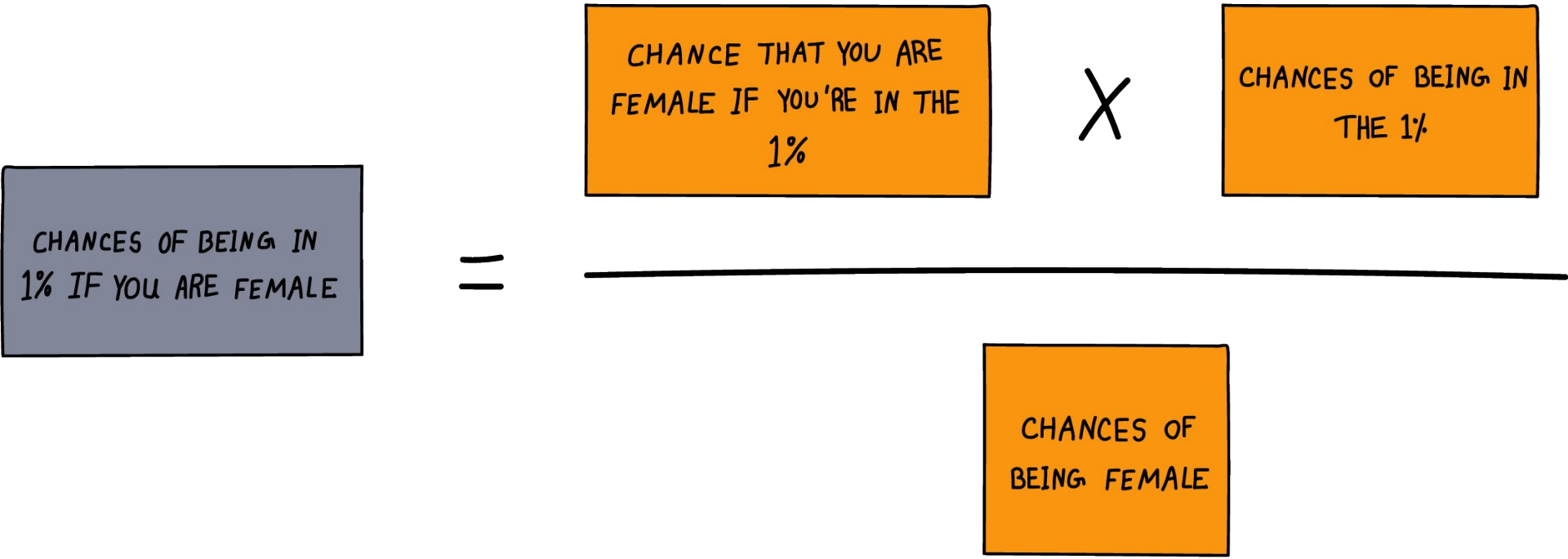
Bayes Rule" is just a formalization of the logic I just explained.

CHANCES OF BEING IN THE 1% IF YOU ARE FEMALE

$$=\frac{\text{CHANCES OF BEING FEMALE AND IN THE 1\%}}{\text{CHANCES OF BEING FEMALE}}$$

$$= \quad x = .0025 / 0.5$$

$$= \quad x = \frac{(.25 * .01)}{0.5}$$


CHANCES OF BEING IN 1% IF YOU ARE FEMALE
=
CHANCE THAT YOU ARE FEMALE IF YOU'RE IN THE 1%
X
CHANCES OF BEING IN THE 1%
CHANCES OF BEING FEMALE


CHANCES A, GIVEN B
=
CHANCES OF B, GIVEN A
X
TOTAL CHANCES OF A
CHANCES OF B

Bayes Theorem

Likelihood

How probable is the evidence given that our hypothesis is true?

Prior

How probable was our hypothesis before observing the evidence?

$$P(H \mid e) = \frac{P(e \mid H)\, P(H)}{P(e)}$$

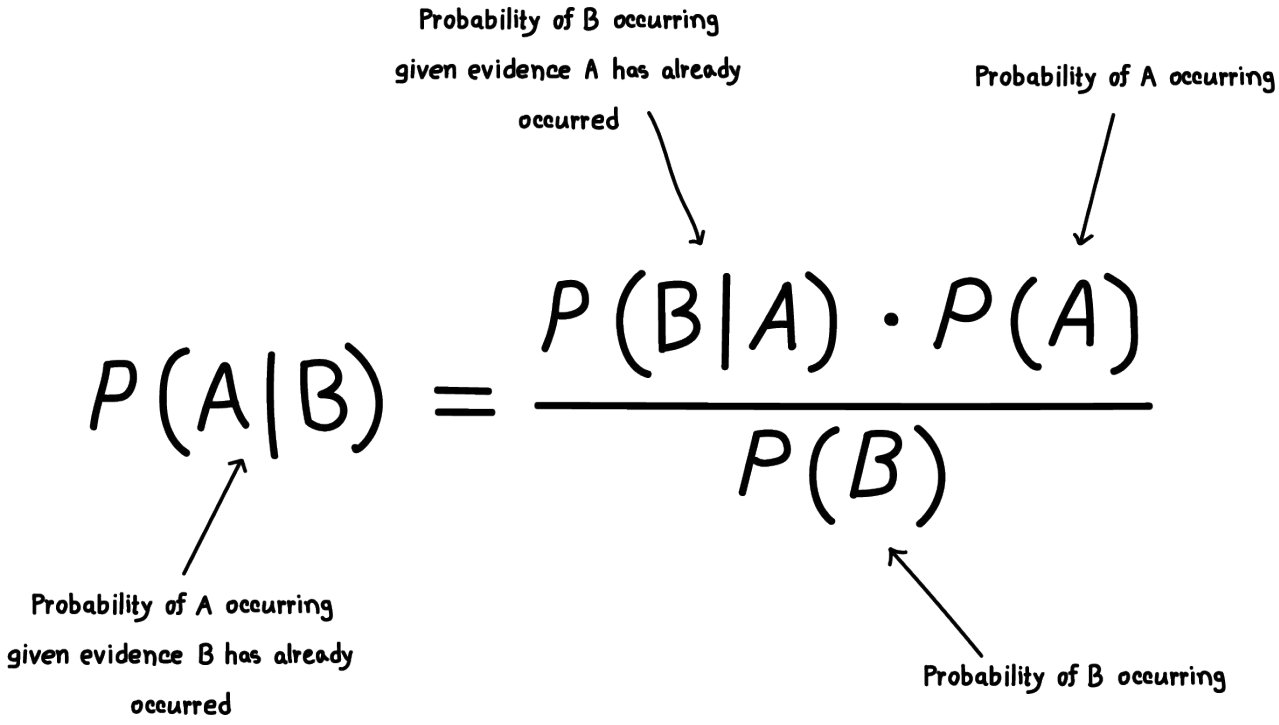
Posterior

How probable is our hypothesis given the observed evidence?
(Not directly computable)

Marginal

How probable is the new evidence under all possible hypothesis?
$P(e) = \sum P(e \mid H)\, P(H)$

Use Bayes to discover the chances that you are in the 1% IF you are male



$$P(A|B) = \frac{(0.75) \times (.01)}{0.5}$$

Bayes' Theorem

Bayes' Theorem is a rule (and formula) in probability theory that can help you assess the probability of an event happening given prior knowledge about conditions related to that event.

Mathematically, it looks like this:

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

Note: $P(B)$ must not be zero

"P" means probability.

$P(A)$ means the probability of event A happening independently → whether or not event B happens.

$P(B)$ means the same for event B

$P(A|B)$ means the probability of event A happening given that event B does happen

$P(B|A)$ is the inverse; it's the probability of event B happening given that event A happens.

By taking the probability of event B into consideration, you can come to a more accurate conclusion about the probability of event A happening