

Naive Bayes

By: Dr. Ernesto Lee

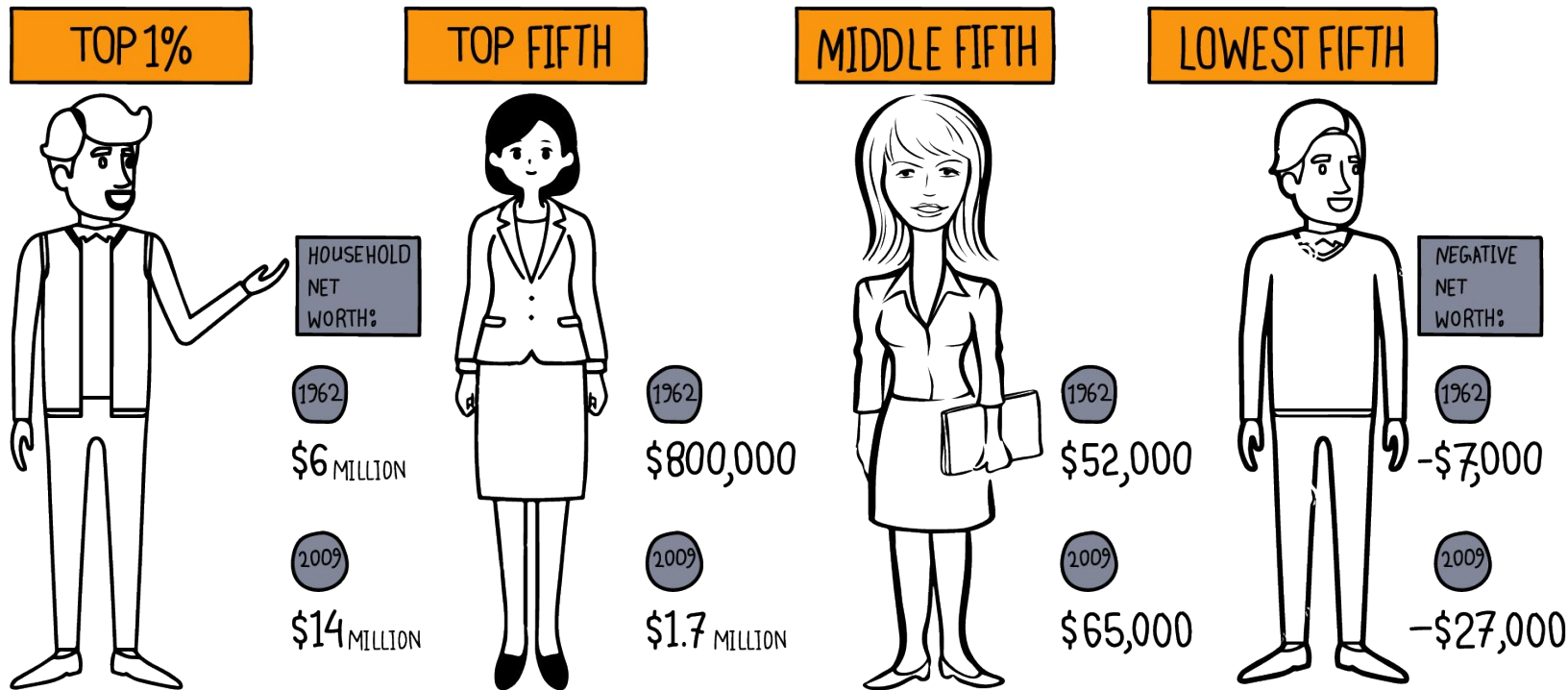
Conditional Probability

WE ARE THE
99%

WE DESERVE
CHANGE!



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



Research

Research has shown that $\frac{1}{4}$ of the 1% is female
Math Alert:

$\frac{1}{4}$ of 1% is female

or

$$.25 * .01 = .0025 \text{ is female}$$

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

X

CHANCES OF BEING
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CHANCES OF BEING IN THE
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CHANCES OF BEING
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CHANCES OF BEING
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CHANCES OF BEING IN THE
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X

CHANCES OF BEING
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CHANCES OF BEING IN THE
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=

CHANCES OF BEING
FEMALE AND IN THE
1%

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

=

CHANCES OF BEING
FEMALE AND IN THE
1%

CHANCES OF BEING
FEMALE

$$= x = .0025 / 0.5$$

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

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

A hand-drawn diagram illustrating Bayes' Theorem. On the left, a grey rectangular box contains the text "CHANCES A, GIVEN B". To its right is an equals sign. Further right is a horizontal line representing a fraction. Above this line, there are two orange rectangular boxes: the left one contains "CHANCES OF B, GIVEN A" and the right one contains "TOTAL CHANCES OF A", with a large handwritten "X" between them. Below the horizontal line, centered, is another orange rectangular box containing the text "CHANCES OF B".

$$\text{CHANCES A, GIVEN B} = \frac{\text{CHANCES OF B, GIVEN A} \times \text{TOTAL CHANCES OF A}}{\text{CHANCES OF B}}$$

Bayes Theorem

Likelihood

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

Prior

How probable was our hypothesis before observing the evidence?

$$P(H | e) = \frac{P(e | H) P(H)}{P(e)}$$

Posterior

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

Marginal

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

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

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

Diagram illustrating the components of Bayes' Theorem:

- $P(A|B)$: Probability of A occurring given evidence B has already occurred
- $P(B|A)$: Probability of B occurring given evidence A has already occurred
- $P(A)$: Probability of A occurring
- $P(B)$: Probability of B occurring

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

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 \rightarrow 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