

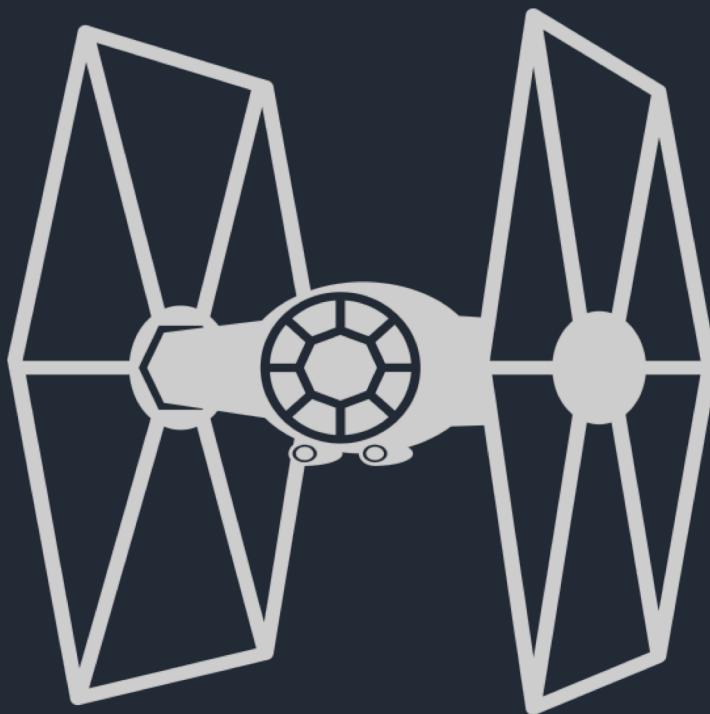
NEVER TELL ME THE ODDS!



**C3PO: SIR, THE POSSIBILITY OF
SUCCESSFULLY NAVIGATING AN ASTEROID
FIELD IS APPROXIMATELY 3,720 TO 1!**



WHAT HAPPENS NEXT ?



WHAT'S THE DIFFERENCE?

WHAT'S THE DIFFERENCE?



**IF WE TAKE THE EVIDENCE AT FACE
VALUE, BOTH CRASH. MOVIE ENDS.**

**IF WE TAKE THE PRIOR AT FACE
VALUE, HAN ALWAYS MAKES IT.
MOVIE'S BORING.**

BAYES RULE

$$P(H | E) = \frac{P(H) * P(E | H)}{P(H) * P(E | H) + P(\neg H) * P(E | \neg H)}$$

HOW DO WE SET THE PRIOR?

**HOW DO WE QUANTIFY HAN'S
PROWESS? AND WHAT DIFFERENCE
DOES IT MAKE?**

THE ANXIOUS: 1000:1 MAKES IT ALIVE



$$P(H|E) = \frac{0.999 * 0.00027}{0.999 * 0.00027 + 0.001 * 0.99973}$$

$$P(H|E) = \frac{0.00026973}{0.00026973 + 0.00099973}$$

$$P(H|E) = 0.2124762$$

THE CHILL: 25000:1 MAKES IT ALIVE



$$P(H|E) = \frac{0.99996 * 0.00027}{0.99996 * 0.00027 + 0.00004 * 0.99973}$$

$$P(H|E) = \frac{0.000269989}{0.0002699892 + 0.000039989}$$

$$P(H|E) = 0.8709936$$

THE SCREENWRITER: ∞: 1 MAKES IT ALIVE



$$P(H|E) = \frac{1 * 0.00027}{1 * 0.00027 + 0 * 0.99973}$$

$$P(H|E) = \frac{0.00027}{0.00027 + 0}$$

$$P(H|E) = 1$$

**“EVIDENCE SHOULD NOT DETERMINE
BELIEFS, BUT UPDATE THEM.”**

**BAYES RULE PROVIDES A PRINCIPLED
FRAMEWORK TO DO JUST THAT.**



**FROM A GALAXY FAR FAR AWAY
...BACK TO OUR WORLD**



**WHY DO WE MAKE TWO TESTS IN 24H
BEFORE SAYING SOMEBODY HAS NO
LONGER COVID-19?**

**HOW CERTAIN CAN WE BE ABOUT THIS
AFTER ONE TEST? AND AFTER TWO?**

WHAT IS OUR TARGET $P(H | E)$?

WHAT IS OUR TARGET $P(H | E)$?

**THE PROBABILITY SOMEBODY
DOESN'T HAVE COVID-19 ANYMORE
AFTER TESTING NEGATIVE.**

WHAT IS $P(E | H)$?

WHAT IS $P(E | H)$?

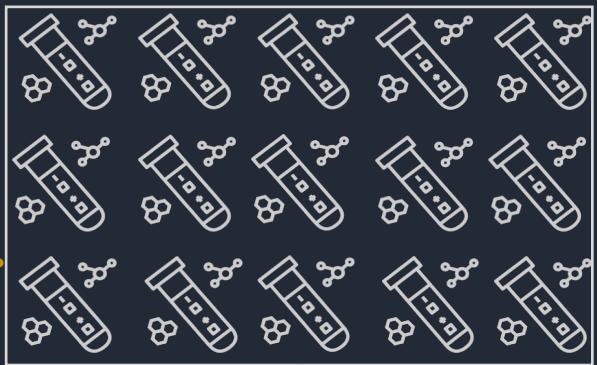
**THE PROBABILITY THE TEST CORRECTLY
IDENTIFIES SOMEBODY WITHOUT
COVID-19 OUT OF ALL THE NEGATIVE
TESTS.**

WHAT IS P(H)?

WHAT IS P(H)?

**THE PROBABILITY OF RECOVERING
FROM COVID-19 REGARDLESS OF TEST
RESULTS.**

P(E | H)



P(H)



SUPPOSE...

$$P(H) = 0.1$$

$$P(E | H) = 0.95$$

$$P(H | E) = \frac{0.1 * 0.95}{0.1 * 0.95 + 0.9 * 0.05} = 0.679$$

**ONE DAY LATER AND ONE NEGATIVE
TEST AFTER...**

**ONE DAY LATER AND ONE NEGATIVE
TEST AFTER...
 $P(E | H) = 0.95$**

**ONE DAY LATER AND ONE NEGATIVE
TEST AFTER...**

$$P(E | H) = 0.95$$

$$P(H) = 0.679$$

$$P(H | E) = \frac{0.679 * 0.95}{0.679 * 0.95 + 0.321 * 0.05} = 0.976$$



**BAYES RULE PROVIDES A POWERFUL
FRAMEWORK TO INTEGRATE NEW
EVIDENCE WITH PRIOR KNOWLEDGE
TO OPTIMALLY UPDATE OUR BELIEFS.**

SOURCES:

HAN SOLO & BAYESIAN PRIORS (COUNT BAYESIE) [\[URL\]](#)

THE BAYESIAN TRAP (VERITASIUM) [\[URL\]](#)

BAYES THEOREM AND MAKING PROBABILITY INTUITIVE (3BLUE1BROWN) [\[URL\]](#)

EMOJIS FROM OPENMOJI [\[URL\]](#)

ICONS FROM THENOUNPROJECT [\[URL\]](#):

MILLENIUM FALCON BY BEN DAVIS

TIE FIGHTER BY HERMAN D. SCHLOSMAN

GALAXY BY EUCALYP

EARTH BY DAVID

TEST BY HANDICON

MAN & WOMAN BY JUNIE

NUTSHELL BY PATRICJ TROUVÉ