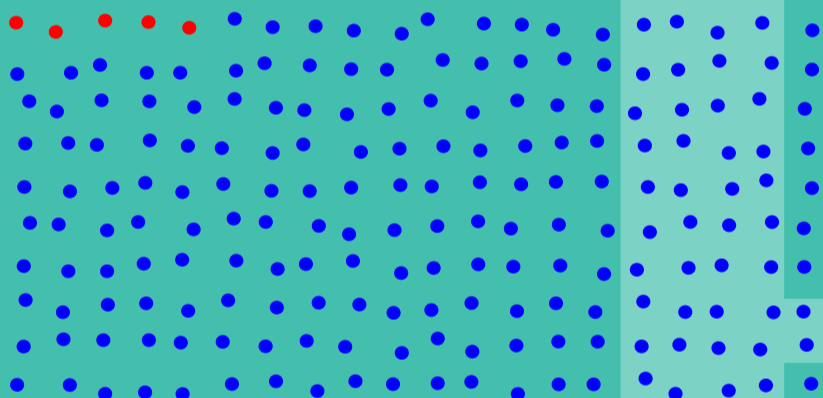


B is for Bayesian inference

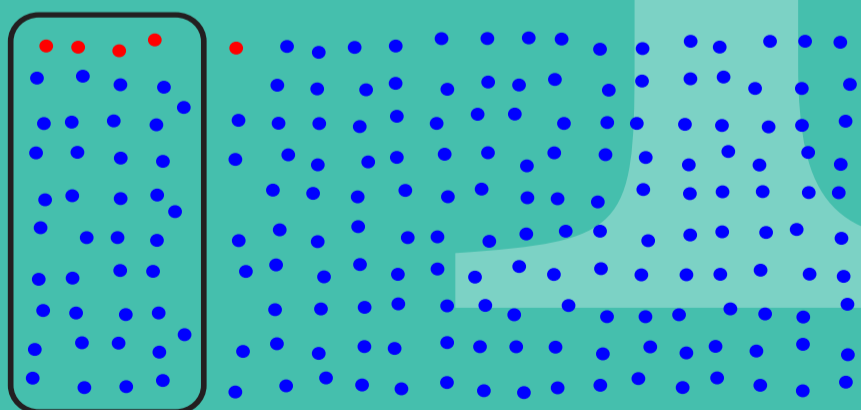
Bayesian probability considers the different possibilities that could have led to the evidence in front of you.

For example, imagine you've tested positive for a very rare disease. The test is 80% accurate, so the explanation which best fits the facts (the positive test) is that you do have the disease.

However, imagine you're one of 200 dots below. The red dots represent people who have the disease.



Let's test everyone, and draw a ring around the people who test positive. The test is 80% accurate, so we net 4 of the 5 cases (80%), and 39 out of the 195 disease-free people (20%).



Just looking at people who, like you, have tested positive, only 4 out of 43 (about 9%) actually have the disease; the rest are false positives.

Likelihood

How likely is it that you see the satellite data if the plane crashed there?

$$P(A|B) \propto \overbrace{P(B|A)} P(A)$$

Posterior

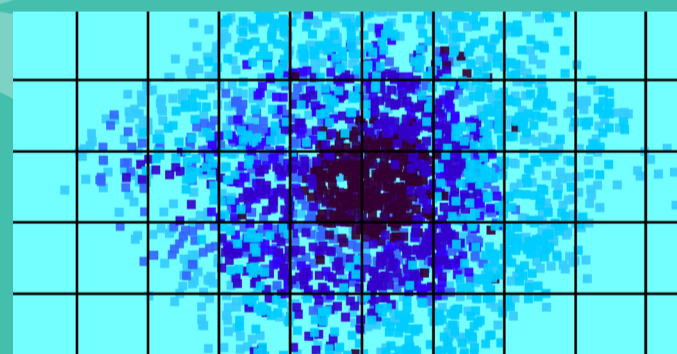
How likely is it that the plane crashed there given the satellite data we have?

Prior

How likely is it that the plane was there?

Bayes' Theorem is used in criminology, product recommendations, artificial intelligence, and recently in the search for the missing Malaysian Airliner MH370.

In this last case the number of different possibilities being considered is vast - in fact, it will involve an infinite range of potential crash sites - but the principle is exactly the same.



With each area of the search space we associate a number, based on how likely we would have been to see the satellite data if the plane had crashed in that place. The investigators start to search the areas with the highest values first and the grid is updated if the plane is not found. It's a remarkably simple method but incredibly powerful.



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