Beyesian

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Problem Description

You are studying turtles on an island with two beaches. The turtle populations on each beach are as follows:

On West Beach:
90% of turtles are Green Sea Turtles
10% of turtles are Loggerhead Sea Turtles
On East Beach:
60% of turtles are Green Sea Turtles
40% of turtles are Loggerhead Sea Turtles

While walking on a foggy day, you get lost and end up on one of the beaches, but you can't tell which one it is due to the fog. You find a turtle and identify it as a Loggerhead Turtle. The question is: What is the probability that you are on East Beach?

Bayes' Theorem

To solve this problem, we can use Bayes' Theorem, which helps us find the probability of an event given prior knowledge of conditions that might be related to the event.

The formula for Bayes' Theorem is: $P(A|B) = \frac{P(B|A)P(A)}{P(B)}$

In this case Where:

$P(East)$ is the prior probability that I am in the *East bench.*
$P(East|Loggerhead)$ is the posterior probability of being on *East bench* that I have found a logger head turtle.
$P(Loggerhead|East)$ is the conditional probability of I have found a logger head turtle and then being on *East bench.*
$P(Loggerhead)$ is the Overall Probability to found a turtle in the island.

From the question, we could know:

	$East$	$West$
$P(East|Loggerhead)$	7	26
$P(East|Loggerhead)$	10	30

$P(East|Loggerhead) = 0.6$ and $P(West|Loggerhead) = 0.1$

so based on the overall Probability equation we could know that

$$P(Loggerhead) = P(East|Loggerhead)P(East) + P(West|Loggerhead)P(West)$$

Joint probability

$$\frac{P(East, Loggerhead)}{P(Loggerhead)} = P(East|Loggerhead)$$

Bayes Factor

$$BF10 = \frac{P(East|Loggerhead)}{P(East|Green)}$$