INTRODUCTION TO PROBABILITY MODELS

Lecture 7

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BAYES RULE

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If $B_1, B_2, \cdots, B_n$ forms a partition of Ω, for any event A:

$$P(B_i|A) = \frac{P(B_i \cap A)}{P(A)}$$

$$= \frac{P(B_i \cap A)}{\sum_{i=1}^{n} P(A|B_i) \times P(B_i)}$$

LAW OF TOTAL PROBABILITY

TREE DIAGRAMS

To Better represent the structure of the probability, tree diagrams can be pretty useful

EXAMPLE 1

After the first exam, a student will go to the beach (event B) depending on whether they pass the exam (event A). The probability a student will pass is 0.9. If a student passes, they go to the beach with a probability of 0.8. However, a student who fails the exam will only go to the beach with a probability of 0.4.

1. What is the probability that a student went to the beach?
2. What is the probability that a student at the beach passed the test?
3. What is the probability that a student not at the beach failed the test?
4. Is going to the beach independent of whether the student passed the exam?

EXAMPLE 2

Let us assume that a specific disease is only present in 5 out of every 1,000 people. Suppose that the test for the disease is accurate 99% of the time a person has the disease and 95% of the time that a person lacks the disease. Find the probability that a random person will test positive for this disease.