Concepts

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Abstract

Useful concepts of probability and statistics.

Contents

1 Concepts

1.1 Law of total probability

It is common practice to compute the sum of total probability of all available options.

Thinking **forwardly**. Which means starting from the **reason** to the **result**.

Theorem 1.1. *Law of total probability*
For random variables A and B, we have

$$P(A) = \sum P(A|B_i) \cdot P(B_i), \forall B_i \in B$$

It is automatically accepted that all the B_is are all separable, and mutually exclusive with each other, which means

$$P(B_i, B_j) = P(B_i) \cdot P(B_j), i \neq j$$
$$P(B_i, B_i) = P(B_i)$$

It is a prior rule to be accepted, and we will accept it if not specified.

Thinking **backwardly**. If we have already known that A only has one option (noted as a), which is also inevitable ($P(A = a) = 1$).

Proposition 1.1. *Sum of probability of every options is ONE*
We have $P(a) = 1$ and $P(a|B_i) = 1, \forall B_i \in B$. Thus,

$$1 = \sum P(B_i), \forall B_i \in B$$

Since a can be something that naturally happens regardless of the choice of B, the proposition may not affected by the choice of a. Thus, the total probability of all options of B is 1.