Homework #02: Compound probability

Isaac Ayala Lozano

2020-01-15

Let A and B be two events for a sample space S. Proofs are presented for the compund probability of $A \cup B$ employing Venn diagrams for the general case and the particular case where A and B are mutually exclusive.

1 General case

The probability of $A \cup B$ is given by $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. The probability of $A \cap B$ is subtracted because that subset is contained in both A and B ($A \cap B \subset A, A \cap B \subset B$), hence added twice. Thus the compound probability is obtained by adding the probability of A and B subtracted by the probability of $A \cap B$, as shown in figure 1.

2 Particular case

For the particular case where $A \cap B = \emptyset$, the probability of $A \cup B$ is equivalent to the sum of probabilities of A and B, subtracted by the probability of $A \cap B$ which is zero in this case: $P(A \cup B) = P(A) + P(B) - P(A \cap B) = P(A) + P(B) - 0 = P(A) + P(B)$.
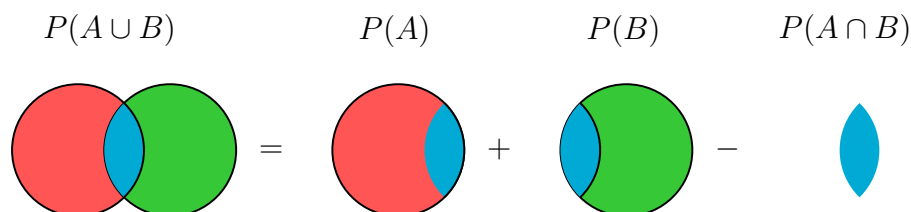

Figure 1: Compound probability.