Statistics-Binomial Distribution

What is the Binomial Distribution?

The Binomial Distribution is a discrete probability distribution that models the number of successes in a fixed number of independent trials, where each trial has two possible outcomes (success or failure). It's a popular distribution used to analyze binary data.

Key Characteristics:

1. **Fixed Number of Trials**: The binomial distribution involves a fixed number of independent trials.
2. **Binary Outcomes**: Each trial has only two possible outcomes: success or failure.
3. **Constant Probability of Success**: The probability of success remains the same for each trial.
4. **Independent Trials**: The outcome of one trial does not affect the outcome of another.

Probability Mass Function (PMF)

The PMF for the Binomial Distribution is given by:

P(X = k) = (nCk) * (p^k) * ((1-p)^(n-k))

where:

- P(X = k) is the probability of exactly k successes
- n is the fixed number of trials
- k is the number of successes (0 ≤ k ≤ n)
- p is the probability of success in each trial (0 < p < 1)
- nCk is the binomial coefficient, which represents the number of ways to choose k items from a set of n distinct items.

Example:

Suppose we want to find the probability that a coin lands heads up exactly 3 times out of 5 tosses. We can use the Binomial Distribution with:

n = 5 (number of trials) k = 3 (number of successes, i.e., heads) p = 0.5 (probability of success in each trial, since the coin is fair)

Using the PMF formula, we get:

P(X = 3) = (5C3) * (0.5^3) * ((1-0.5)^2) = 10 * (0.125) * (0.25) = 0.3125

Therefore, the probability of getting exactly 3 heads out of 5 coin tosses is approximately 31.25%.

This example illustrates how the Binomial Distribution can be used to analyze binary data and calculate probabilities for a fixed number of independent trials with constant success probability.

Curated by Brajesh Kumar