

Statistics-Probability Distributions

1. Bernoulli Distribution

- Also known as a binary distribution
- Used to model the outcome of a single trial or experiment with two possible outcomes (e.g., heads/tails, pass/fail)
- Probability mass function: $P(X=k) = p^k * (1-p)^{(1-k)}$, where $k=0,1$ and p is the probability of success

Example: Flipping a coin once. The outcome is either heads (success) or tails (failure). In this case, $p=0.5$.

2. Binomial Distribution

- Used to model the number of successes in a fixed number of independent trials, each with two possible outcomes
- Probability mass function: $P(X=k) = C(n,k) * p^k * (1-p)^{(n-k)}$, where $k=0,1,\dots,n$ and n is the number of trials

Example: Drawing 5 cards from a standard deck without replacement. The outcome can be the number of hearts drawn (success). In this case, $n=5$ and $p=13/52$.

3. Poisson Distribution

- Used to model the number of events occurring in a fixed interval of time or space
- Probability mass function: $P(X=k) = e^{(-\lambda)} * (\lambda^k)/k!$, where $k=0,1,\dots$ and λ is the average rate of events

Example: Number of phone calls received by a call center per hour. The outcome can be the number of calls received in an hour.

4. Normal Distribution

- Also known as the Gaussian distribution
- Used to model continuous data that cluster around the mean with a symmetrical bell-shaped curve
- Probability density function: $f(x) = (1/\sqrt{(2\pi\sigma^2)}) * e^{-(x-\mu)^2/(2\sigma^2)}$, where μ is the mean and σ is the standard deviation

Example: Heights of adults in a population. The outcome can be any value within the normal range.

5. Exponential Distribution

- Used to model the time between events or failures
- Probability density function: $f(x) = \lambda * e^{(-\lambda x)}$, where $x > 0$ and λ is the rate parameter

Example: Time between failures of a machine. The outcome can be any value greater than 0.

These distributions are widely used in statistics to model real-world phenomena, but they have different properties and applications.

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