Types of density in statistics

What is density in statistics?

In statistics, the term "density" typically refers to probability density functions (PDFs) or probability mass functions (PMFs), which describe the distribution of a random variable.

The type of density function you use depends on whether the random variable is discrete or continuous.

Here are the main types of density functions:

- **Probability Mass Function (PMF):**

Used for discrete random variables.

Gives the probability that a discrete random variable takes on a specific value.

Example: The PMF of a six-sided die represents the probabilities of rolling each number from 1 to 6.

- **Cumulative Distribution Function (CDF):**

Applies to both discrete and continuous random variables.

Gives the probability that a random variable is less than or equal to a specific value.

The CDF can be derived from the PMF or PDF.

Example: The CDF of a random variable X, denoted as F(X), gives $P(X \leq x)$ for any value x.

- **Joint Probability Density Function (Joint PDF):**

Used for multivariate continuous random variables (more than one variable).

Describes the joint distribution of multiple continuous random variables.

Example: The joint PDF of two continuous variables X and Y describes the likelihood of observing specific pairs of values (x, y) for X and Y.

- **Conditional Probability Density Function (Conditional PDF):**

Describes the probability distribution of a random variable given specific conditions or values of other variables.

Often used in Bayesian statistics and conditional probability calculations.

Example: The conditional PDF of a random variable X given that another variable Y has a particular value.