

# Density Functions

Distributions are often described in terms of their density or density functions.

Density functions are functions that describe how the proportion of data or likelihood of the proportion of observations change over the range of the distribution.

Two types of density functions are probability density functions and cumulative density functions.

- **Probability Density function:** calculates the probability of observing a given value.
- **Cumulative Density function:** calculates the probability of an observation equal or less than a value.

A probability density function, or PDF, can be used to calculate the likelihood of a given observation in a distribution. It can also be used to summarize the likelihood of observations across the distribution's sample space. Plots of the PDF show the familiar shape of a distribution, such as the bell-curve for the Gaussian distribution.

Distributions are often defined in terms of their probability density functions with their associated parameters.

A cumulative density function, or CDF, is a different way of thinking about the likelihood of observed values. Rather than calculating the likelihood of a given observation as with the PDF, the CDF calculates the cumulative likelihood for the observation and all prior observations in the sample space. It allows you to quickly understand and comment on how much of the distribution lies before and after a given value. A CDF is often plotted as a curve from 0 to 1 for the distribution.

Both PDFs and CDFs are continuous functions. The equivalent of a PDF for a discrete distribution is called a probability mass function, or PMF.