Types of Probability Density Function

There are several types of continuous distributions thus, different probability density functions are used. Some important continuous distributions are given below:

- Normal Distribution
- Standard Normal Distribution
- Student - t Distribution
- Chi-Square Distribution
- Continuous Uniform Distribution

The next section covers the probability density function formula for these distributions.

Types of Probability Density Functions

Normal Distribution: $f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{-1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$

Standard Normal Distribution: $f(x) = \frac{1}{\sqrt{2\pi}} e^{\frac{-x^2}{2}}$

Student-t Distribution: $f(x) = \frac{\Gamma\left(\frac{\nu+1}{2}\right)}{\sqrt{\nu\pi}\,\Gamma\left(\frac{\nu}{2}\right)} \left(1+\frac{x^2}{\nu}\right)^{-\frac{\nu}{}}$

Chi-Square Distribution: f(x) = $f(x) = \frac{x^{\frac{k}{2}-1} e^{\frac{-x}{2}}}{2^{\frac{k}{2}}\Gamma\left(\frac{k}{2}\right)}$

Continuous Uniform Distribution: f(x) = $f(x) = \frac{1}{b-a}$

Normal Distribution Probability Density Function

A random variable that follows a normal distribution is denoted as X∼N(μ,σ2)�∼�(�,�2). Here, μ� is the mean and σ�^{2} is the variance and they form the parameters of the normal distribution. The graph of a normal distribution is a bell curve and is symmetric about the mean. The formula for the type of probability density function for a normal distribution is given below:

f(x) = 1σ√2Πe−12(x−μσ)21�2Π�−12(�−��)2

Standard Normal Distribution Probability Density Function

When a continuous random variable, X, follows a normal distribution such that the mean equals 0 and the standard deviation is equal to 1 then such a probability distribution is known as a standard normal distribution. It is denoted as X∼N(0,1)�∼�(0,1)The formula for the probability density function of a standard normal distribution is given as follows:

f(x) = 1√2πe−x2212��−�22

Student T Distribution Probability Density Function

A continuous random variable following a student t distribution is denoted as X∼t(v)�∼�(�), where v� denotes the degrees of freedom. A [student t distribution](#) is used when the sample size is very small and a normal distribution cannot be used. The probability density function of a student t distribution is given as follows:

f(x) = Γ(v+12)√vπΓ(v2)(1+x2v)−v+12Γ(�+12)��Γ(�2)(1+�2�)−�+12

Here, ΓΓ represents the gamma function

Chi-Squared Distribution Probability Density Function

Chi squared distribution is widely used for hypothesis testing. It can be defined as the sum of squares of k independent standard normal variables. It is denoted as X∼χ2(k)�∼�2(�). The type of probability density function used for a chi squared distribution is given as follows:

f(x) = xk2−1e−x22k2Γ(k2)��2−1�−�22�2Γ(�2), x > 0.

f(x) = 0, otherwise

Continuous Uniform Distribution Probability Density Function

A [uniform distribution](#) is used to describe a random experiment such that the outcome lies between two values. The notation is given as X∼U(a,b)�∼�(�,�). The probability density function when x lies between a and b is given as follows:

f(x) = 1 / (b - a)