Experiment - 6.

Aim: To study CDF & PDF functions of different Continous Random Variables & the effect of parametric changes.

Software Used: - Matlab.

Continous Random Variable: - Discrete random variable appear in experiments in which we count. Continous Random Variable appear in experiment in which we measure. By Definition, a random variable X and is distribution are of continous, if its distribution function can be given by an integral:

$$F(x) = \int_{-\infty}^{\infty} f(v)\, dv$$

Uniform Random Variable: The distribution describes an experiment where there is an arbitiary outcome that lies b/w certain bounds. The bounds are defined by the parameters a & b, which are maximum & minimum values.

PDF $f_X(x) = \begin{cases} \frac{1}{b-a} & \text{for } x \in [a,b] \\ 0 & \text{otherwise} \end{cases}$

CDF $F_X(x) = \begin{cases} 0 & x < a \\ \frac{x-a}{b-a} & x \in [a,b] \\ 0 & x > b \end{cases}$

Mean $\bar{x} = \frac{1}{2}(a+b)$

Variance $\sigma_x^2 = \frac{1}{12}(b-a)^2$

Gaussian/Normal Random Variable:

This is the most important continous distribution because in application, many random variable are normal random variable. Furthermore, the normal distribution is a useful approximation of more complicated distribution & it also occurs in the proofs of various statistical tests.

PDF $f_X(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$

CDF $F_X(x) = \frac{1}{\sigma\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2} dx$

Mean $\bar{x} = \mu$ **Variance** $\sigma_x^2 = \sigma^2$

Rayleigh Random Variable

The Rayleigh random variable is a continous probability distribution for non negative valued random variable. A Rayleigh Distribution is often observed when the overall magnitude of a vector is related to its directional component.

PDF: $f_X(x) = \frac{x}{\sigma^2} e^{-\left(\frac{x^2}{2\sigma^2}\right)}$

CDF: $F_X(x) = 1 - e^{-\frac{x^2}{2\sigma^2}}$

Mean $\bar{x} = \sigma\sqrt{\pi/2}$

Variance: $\sigma_x^2 = \frac{4-\pi}{2}\sigma^2$