Esssentials of Applied Data Analysis IPSA-USP Summer School 2017

Continous Random Variables

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Continuous random variables

The rules that apply to discrete random variables also apply to continous random variables.

The main problem when we deal with a continuous random variable is that we cannot count every possible outcome and multiply it by the probability of that outcome occurin (remember: continous variables are and infinite set and uncontable!)

Expectation and variance of a continuous random variable

In other words, we cannot do this:

$$\sum_{i=1}^{n} P(X = x_i) = \sum_{i=1}^{n} f(x_i) = 1$$

or this

$$E[X] = \sum_{i=1}^{n} x_i * P(X = x_i) = \sum_{i=1}^{n} x_i * f(x_i)$$

or this

$$Var[X] = \sum_{i=1}^{n} [x_i - E[X]]^2 * P(X = x_i) = \sum_{i=1}^{n} [x_i - E[X]]^2 * f(x_i)$$

because can't count every x_i. What can we do instead?

We can use integrals (see Moore and Siegel, chap 7 for integrals) to sum the area of the continuous distributions and then calculate the expected value and variance:

$$\int_{-\infty}^{\infty} \text{f(x) dx} = 1$$

$$E[X] = \int_{-\infty}^{\infty} \text{x f(x) dx}$$

$$Var[X] = \int_{-\infty}^{\infty} [x - E[X]]^2 \text{f(x) dx}$$