

The Law of Large Numbers and the central limit theorem

Kuntla Reddy Sekhar

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1 Introduction

The statement of law of large numbers and central limit theorem are understood using simulations. The assumptions and the limitations are discussed. this article concludes with some practical use cases and applications of central limit theorem.

2 The Law of Large Numbers

Let

$$X_1, X_2, X_3, \dots, X_n$$

be n independent random variables drawn from the same probability distribution. These random variables are generally known as i.i.d's. (Independent identically distribute) In particular we assume that the mean μ and standard deviation σ of the random variables are same. we define the mean of the sample as

$$\overline{X_n} = \frac{X_1 + X_2 + X_3 + \dots + X_n}{n} = \frac{1}{n} \sum_{i=1}^n X_i \quad (1)$$

The mean $\overline{X_n}$ itself is a random variable. The Law of large numbers and central limit theorem tells about the value and the distribution of the random variable.