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## Statistical Distributions

The probability distribution refers to all the possible results that a random variable may have, that is, it describes the behavior of said variable within a range of values or possible results.

The random variable can be discrete or continuous. A discrete random variable is one represented by integers, characterized by the limit of values it can take. On the other hand, a continuous random variable does not have this separation or limitation, it can take any value within the established limit.

### Types of Distribution

The type of distribution depends on the type of variable being treated. There are many, below, the main or best known:

- For continuous variables: in the case that the random variable is continuous, the associated distribution is a normal or Gaussian type distribution.
- For discrete variables: in the case that the random variable is discrete, there may be several types of distributions, the main ones being the binomial distribution, the hypergeometric distribution and the Poisson distribution.

### Normal Distribution

The normal distribution is a bell-shaped curve, with the axis of symmetry at the point corresponding to the mean of the universe  $\mu$ . The distance between the bell axis of symmetry and the inflection point of the curve is equal to  $\sigma$ , the standard deviation of the population.

This distribution considers two parameters, which are the mean or mean ( $\mu$ ) and the standard deviation ( $\sigma$ ). Thanks to these two parameters, it has an associated equation, from which a graph known as a Gaussian bell is developed.

This graph is symmetric with respect to the mean and its opening or width is given by the standard deviation. In turn, the graph reflects the probability distribution of the variable under study.

Three other types of distributions are developed from this normal distribution:

- Student's T
- Chi-square
- Fisher's F

## **Binomial Distribution**

It was developed by Jacob Bernoulli, it has various applications in the area of biostatistics, specifically in conducting experiments, it is also known as distribution by Bernoulli.

The binomial distribution is a discrete probability distribution that measures the number of successes in a sequence of  $n$  Bernoulli trials independent of each other, with a fixed probability  $p$  of occurrence of success between trials. A Bernoulli experiment is characterized by being dichotomous, that is, only two outcomes are possible. One of these is called success and has a probability of occurrence  $p$  and the other, failure, with a probability  $q = 1 - p$ . In the binomial distribution, the previous experiment is repeated  $n$  times, independently, and it is about calculating the probability of a certain number of successes. For  $n = 1$ , the binomial actually becomes a Bernoulli distribution.

An experiment or study has a binomial distribution when the following conditions are met:

In the experiment there are only two possible outcomes, success or failure.

- Repeating the same experiment presents a result that is independent of the previous results.
- The probability of success or failure is constant.
- Each experiment has the same number of replicas.

## **Hypergeometric Distribution**

This type of distribution is related to non-replacement and random sampling. In sampling without replacement, no selected item is returned or discarded until the sampling is complete.

In turn, this type of distribution occurs in cases where the absence or presence of some characteristic is investigated.

It is similar to the binomial, but in the case of the hypergeometric, the probability associated with each result does not remain constant, this due to the characteristic of sampling without replacement. However, if the number of samples is very large, the distribution can be close to a binomial.

## Poisson distribution

It was developed by Siméon Denis Poisson, this type of distribution explains the probability that a certain event occurs a certain number of times in a set time.

The Poisson distribution starts from the binomial distribution: When in a binomial distribution the experiment is performed a very high number "n" of times and the probability of success "p" in each trial is low, then the distribution model of Poisson: It must be fulfilled that:

- $p < 0.10$
- $p * n < 10$  It

should be noted that in this distribution the number of successes that occur per unit of time, area or product is totally random and that each time interval is independent of another given interval, just as each area is independent of another given area and each product is independent of another given product.

In general, this type of distribution occurs when the appearance of some rare event or event is observed in said established time.

In addition to being viewed as the probability at a set time, it can also be viewed as the probability of success in a unit area or product number.

In this type of distribution, the probability of success is also independent in each established interval, so it is not constant. Some event or process involving a Poisson distribution is stable.

On the other hand, knowing the number of events that occur in a set interval does not mean that you can predict the number of events that will occur in the next.

## References

Riquelme, M (2018) Probability Distribution. April 29, 2021. Website: [https://www.webyempresas.com/distribucion-de-probabilidad/#%C2%BFQue\\_es\\_la\\_distribucion\\_de\\_probabilidad](https://www.webyempresas.com/distribucion-de-probabilidad/#%C2%BFQue_es_la_distribucion_de_probabilidad)

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