difference between discrete random variable and continuous random variable

The key difference between discrete random variables and continuous random variables lies in the nature of their possible values and the way these values are distributed.

1. Discrete Random Variable:
   * A discrete random variable is one that can only take on a countable number of distinct values, usually integers. These values are often the result of counting or enumerating, such as the number of goals scored in a soccer game, the number of students in a class, or the number of defects in a product.
   * The probability distribution of a discrete random variable is represented by a probability mass function, which assigns probabilities to each possible value.
   * The probability of any specific value occurring is positive, and the sum of the probabilities of all possible values is equal to 1.
2. Continuous Random Variable:
   * A continuous random variable is one that can take on any value within a certain range or interval. These values are often the result of measurement, such as height, weight, or time. Continuous random variables can take any value within a specified range, and between any two values, there are infinitely many other possible values.
   * The probability distribution of a continuous random variable is represented by a probability density function, which gives the relative likelihood of the random variable taking on a given value.
   * The probability of a specific value occurring is infinitesimally small, so instead, we calculate probabilities over intervals.

In summary, discrete random variables are associated with countable, distinct values, while continuous random variables are associated with uncountably infinite values within a range. They require different mathematical treatments and have different interpretations in probability theory and statistics.