PERFORMANCE TASK

PRE-FINALS MODELING AND SIMULATION

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EXPONENTIAL DISTRIBUTION

The exponential distribution is one of the widely used or most commonly used continuous distributions that is often used to model the time elapsed between events.

PROPERTIES

- Records the interval or the time elapsed between events.
- Can be viewed as a continuous analogue of the geometric distribution

EXAMPLE:

Suppose you are playing a game with tough boss fights. A particular boss has a set of moves, with each attack separated by time intervals. The interval between each attack is an example of an exponential distribution.

NORMAL DISTRIBUTION

The normal distribution also known as Gaussian Distribution is defined by the probability density function for a continuous random variable in a system in which out of all the recorded events or variable the one in the middle or the mean is the most likely to occur.

PROPERTIES

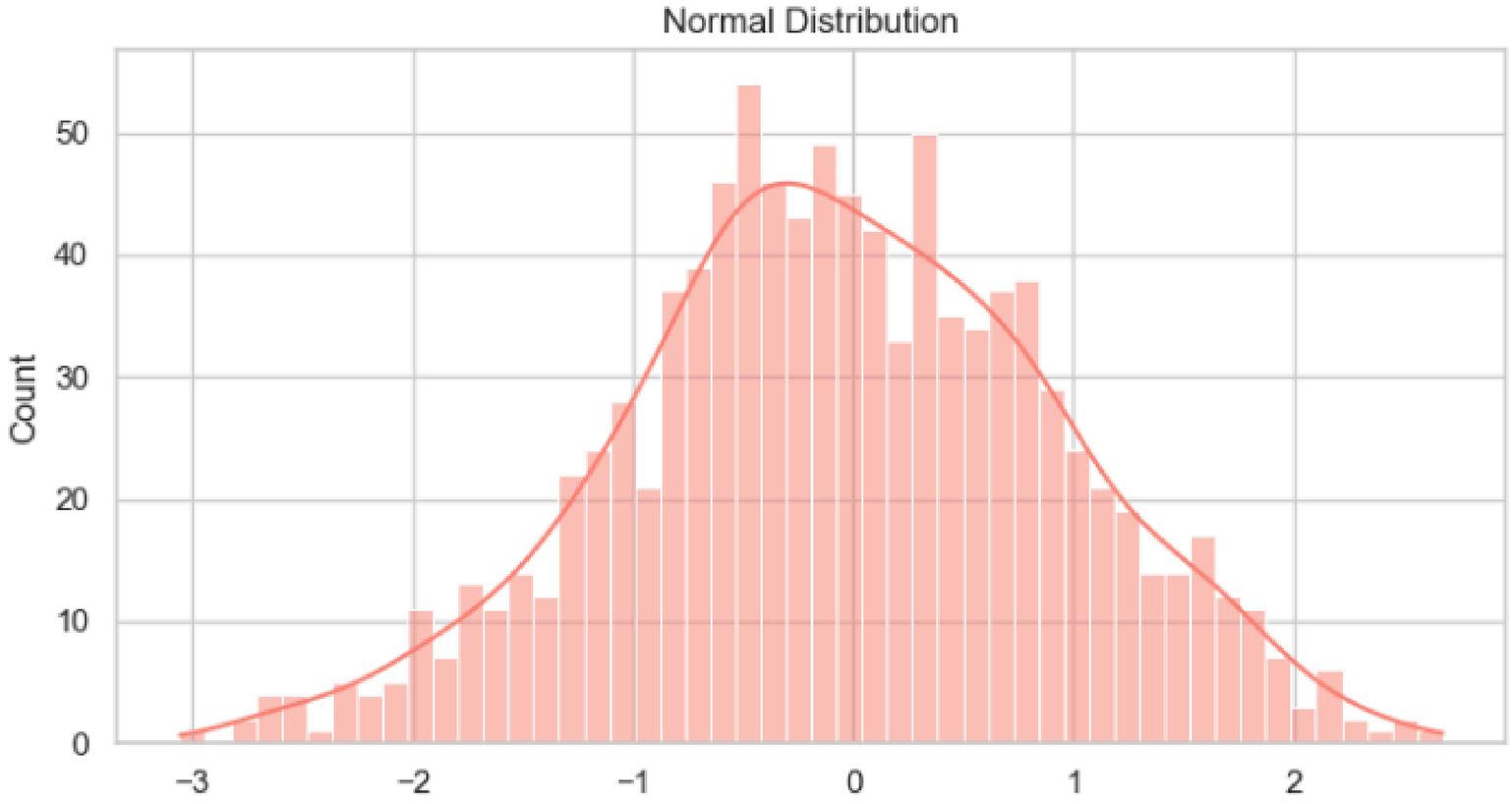
- The normal distribution when observed in a histogram or a graph creates a bell-like shape.

- The mean is most likely to occur.

EXAMPLE:

Imagine you're conducting an experiment where you measure the height of plants grown under the same conditions. When you plot all the recorded heights, you'll notice that most plants grow to an average height, while very short or very tall plants are rare — this pattern forms a normal distribution.

EXAMPLE:



POISSON DISTRIBUTION

The Poisson distribution is a discrete probability function that means the variable can only take specific values in a given list of numbers, probably infinite. Unlike the exponential distribution, Poisson distribution records how many times an event occurs in a specific time frame.

PROPERTIES

- Records how many times or how many events occur within a specific time frame.

- A distribution that results from the Poisson experiment.

EXAMPLE:

Suppose you're counting how many cars pass through a toll booth in one minute. The number of cars can vary each minute, but on average, say 5 cars pass through. The number of cars observed in each minute can be modeled by a Poisson distribution.

BINOMIAL PROBABILITY DISTRIBUTION

Is a discrete probability distribution that models the number of successes in a fixed number of independent trials where each trial has only two possible outcomes success or failure.

PROPERTIES

- Can be positive or negative (Success or Failure).
- Done on a fixed number of trials

EXAMPLE:

Suppose you are a student answering an exam without reviewing prior to the exam. You would have two possible outcomes, either you pass by sheer luck or b utilizing what you know so far or failing. Passing or Failing could be considered as true or false, two outcomes that will decide what would happen to you which is an example of Binomial Probability Distribution.

TRIANGULAR DISTRIBUTION

Is a distribution that provides a simplistic representation of the probability distribution when limited sample data is available. Its parameters are the minimum, maximum, and peak of the data.

PROPERTIES

- Continuous
- Shaped by three points (minimum, maximum, and peak of the data)
- Used in estimations.

EXAMPLE:

Suppose you're estimating the time needed to complete a design for a crypto trading dashboard. You believe it would take a minimum of 2 days, a maximum of 6 days, and most likely 4 days. Since you lack detailed data, you model your estimate using a triangular distribution with these three values.

LOGNORMAL DISTRIBUTION

It is a continuous probability distribution of a random variable whose logarithm is normally distributed.

PROPERTIES

- Forms a normal distribution

- Models things that cannot be negative and have skewed growth

EXAMPLE:

Modeling income distribution across different professions, where most earn around a typical range but some earn significantly more.

GAMMA DISTRIBUTION

Is a term used as a distribution which is defined as two parameters shape and inverse scale parameter. It is a distribution related to normal, exponential, chi-squared, and Erlang distribution.

PROPERTIES

- Has two parameters which are shape and rate parameter.

- Represented by Γ.

EXAMPLE:

Suppose you timed how long it takes to finish one assignment. If you want to model the total time it might take to complete several assignments, assuming the times are independent, that would be modeled by a gamma distribution.

BETA DISTRIBUTION

A continuous probability distribution defined on the interval [0, 1] and is shaped by two parameters, alpha and beta.

PROPERTIES

- Ranges from 0 to 1.

- Shape depends on the values of alpha and beta.

EXAMPLE:

Imagine you're pitching your product on Shark Tank. Each investor gives their opinion on how likely your product is to succeed in a large market. These opinions can be thought of as different probability estimates, and together, they can be modeled using a Beta distribution—showing a range of success probabilities between 0 and 1 based on experience and belief.

WEIBULL DISTRIBUTION

A continuous probability distribution used to model time until failure in reliability analysis and life data analysis.

PROPERTIES

- Flexible and is capable of representing increasing, constant or decreasing failure rates.

- Controlled by Shape and Scale.

EXAMPLE:

Suppose you're testing the battery life of two phones. On one, you use it normally—letting it rest while charging. On the other, you keep using it even when plugged in. Over time, you record how long it takes before you notice signs of battery degradation, like slower charging or faster draining. These "time until failure" observations can be modeled using a Weibull distribution, as they reflect different failure patterns based on usage behavior.

UNIFORM DISTRIBUTION

A distribution that could either be continuous or discrete where all outcomes are equally likely to occur or happen.

PROPERTIES

- The probability is constant and is never changing.
- Used when no bias or preference exists.

EXAMPLE:

Suppose you are flipping a coin, both head and tail have a 50% chance to be the result once the coin is flipped, that is an example of a uniform distribution.

THANK YOU