Python

1. What is Python
2. Installation of Python – VS Code, PyCharm, Anaconda, Google Colab
3. 100 Python main function names
4. Integer, float, Boolean operations (like math calculations), arithmetic (+-*/===='=='), logical operators (and, or, xor)
5. What is variable, types, about print and format combinational operations, basics of strings
6. Strings and methods (user input)
7. List and tuple
8. Sets, Dictionaries (enumerate, zip)
9. Conditionals
   1. if, elif, else
10. Match, case
11. For loops, for–else, nested loops
12. Break, continue, pass, list comprehension, dictionary comprehension
13. While loops, while-else
14. Comments, docstrings, about functions and modules
15. Types of functions, scope of function working and creating functions
    1. Parameters, arguments, *args, **kwargs
    2. Global variable, local variable
16. Creating module, import module help(), dir() aliasing, renaming

Python Topics

1. Lambda function, map, reduce, filter
2. Iterator, generator, decorator
3. Modules & packages
   - Math
   - Random
   - Date time
   - OS
   - Sys
   - Re module
   - if __name__ == "__main__" in Python
4. File handling
5. Logging
6. Error and exceptions handling
7. What is object, class, __init__ method, instance variables
8. Types of methods in Python
   - Instance method
   - Class method
   - Static method
9. Public, private, protected members and methods
10. Inheritance and Types of Inheritance
11. Polymorphism, encapsulation, abstract method

Python Troubleshooting

1. Errors in Python

2. How to search on Google to find error corrections using Google, Stack Overflow, and documentation

UI Frameworks

1. Flask / Fast API / Streamlit

Projects

1. Calculator

2. Snake game

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Data Analytics Using Python

Module: Introduction to Numerical Computing with NumPy

28. Introduction to NumPy

- What is NumPy?

- Benefits of using NumPy

- Installing and importing NumPy

29. Core Operations in NumPy

- Array creation techniques (arrays, arange, linspace, zeros, ones, etc.)

- Indexing, slicing, and iterating

- Mathematical and statistical operations

- Copies vs. views in NumPy

- String operations in NumPy

- Reshaping and broadcasting

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Module 2: Data Handling with Pandas

30. Introduction to Pandas

- What is Pandas and why is it important?

- Understanding Series and DataFrames

- Creating and manipulating DataFrames and Series

31. Data Wrangling and Manipulation

- Indexing and Selecting Data
  - .loc[], .iloc[], Boolean indexing
- Data Aggregation
  - Using groupby() for grouping and aggregation
  - Aggregation functions: mean(), sum(), count(), etc.
- Data Merging and Combining
  - merge(), concat(), join()

32. Grouping Operations

- Hierarchical indexing

- Split-apply-combine strategy using groupby()

Module 3: Data Cleaning and Preprocessing

34. Data Cleaning Techniques

- Handling missing values (isna(), fillna(), dropna())
- Removing duplicates
- Renaming columns
- Converting data types
- Handling outliers (z-score, IQR)

35. Data Transformation

- Sorting and ordering
- Merging and concatenating datasets
- Pivot tables and crosstabs
- Melting and reshaping datasets

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Module 4: Data Visualization

36. Data Visualization Using Python Libraries

- **Matplotlib Basics**
  - Line plots, bar charts, histograms, scatter plots
- **Seaborn for Statistical Visualizations**
  - Distribution plots, box plots, violin plots, pair plots
- **Plotly for Interactive Visuals**
  - Introduction to interactive dashboards and charts

Types of Plots Covered:

- Univariate Analysis (histograms, box plots, etc.)
- Bivariate Analysis (scatter plots, correlation heatmaps)
- Multivariate Analysis (pair plots, facet grids)
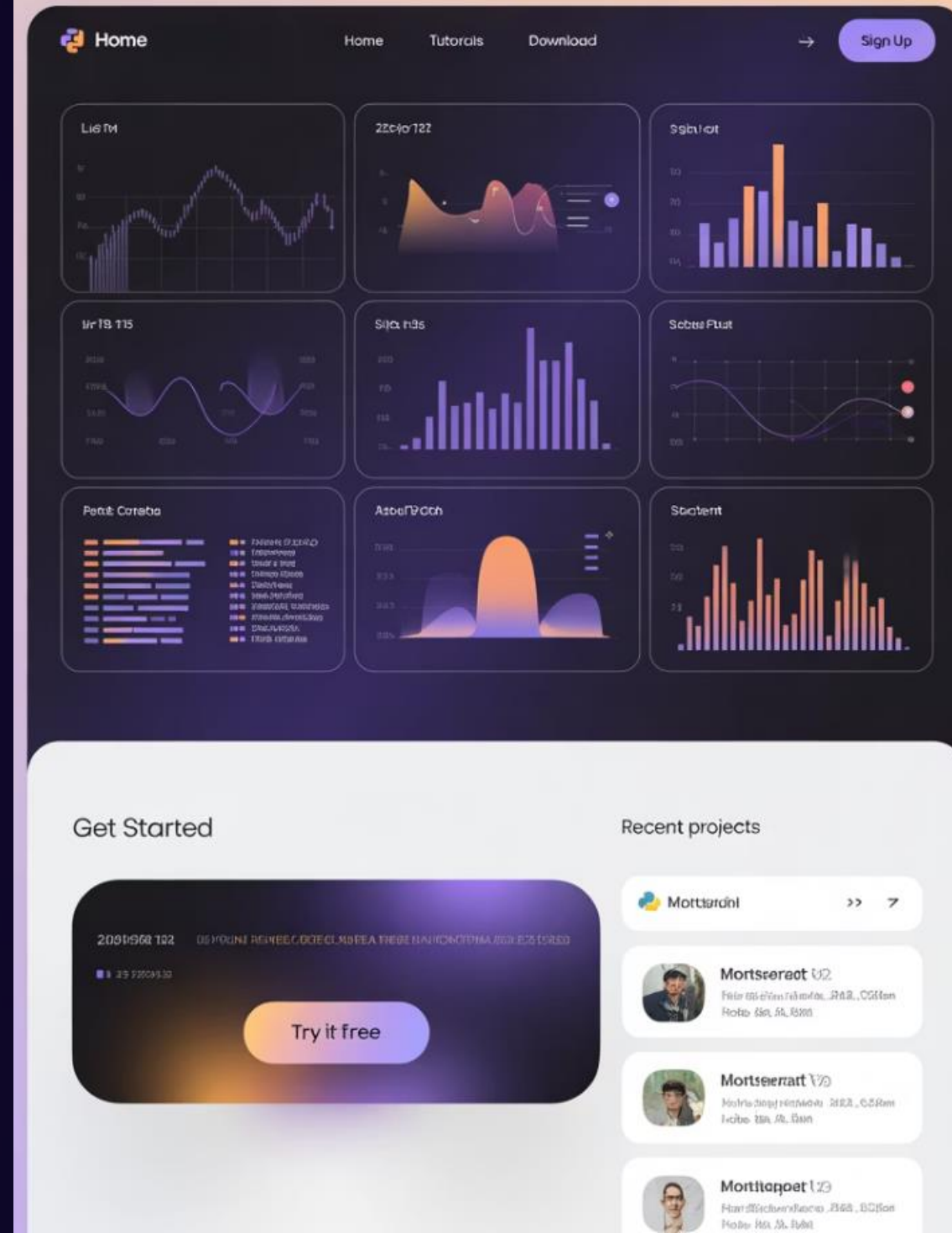
MySQL

1. **Introduction to Databases and SQL**
   - Definition of databases and SQL (Structured Query Language).
   - Importance of databases in storing and managing data.
   - Overview of SQL as a standard language for interacting with relational databases.
2. **Data Types and SQL Commands**
   - **Data Definition Language (DDL)**
     - Creating and modifying database objects (tables, views, indexes).
     - Common data types: INTEGER, VARCHAR, DATE, etc.
   - **Data Manipulation Language (DML)**
     - Inserting, updating, and deleting data from tables.
   - **Data Control Language (DCL)**
   - **Transaction Control Language (TCL)**
   - **Data Query Language (DQL)**
3. **Basic SQL Commands**
   - SELECT statement: Retrieving data from tables.
   - FROM clause: Specifying the source tables.
   - WHERE clause: Filtering rows based on conditions.
   - Logical operators: AND, OR, NOT.
   - CASE statement: Conditional logic.
   - NULL functions: Handling NULL values.
   - Comments: Adding comments in SQL code.

Advanced SQL Topics

1 **Filtering and Sorting**

- Advanced filtering using IN, OR, and NOT operators.
- Sorting data with GROUP BY and ORDER BY clauses.

2 **SQL Joins**

- Inner Join: Retrieving matching rows from multiple tables.
- Left/Right Outer Join: Retrieving all rows from one table and matching rows from the other.
- Full Outer Join: Retrieving all rows from both tables.
- Self Join: Joining a table with itself.
- Cross Join: Cartesian product of two tables.

3 **SQL Aggregations**

- Common aggregations: COUNT, SUM, MIN, MAX, AVG.
- Using aggregate functions with GROUP BY clause.

4 **Subqueries**

- Using subqueries to nest one SELECT statement within another.
- Correlated subqueries and non-correlated subqueries.

5 **Window Functions**

- ROW_NUMBER(): Assigning a unique sequential integer to each row.
- RANK(): Assigning a rank to each row based on specified criteria.
- DENSE_RANK(): Similar to RANK(), but without gaps in ranking.
- LAG and LEAD: Accessing data from previous or next rows in a result set.
- Using SUM, COUNT, AVG with window functions.
- Creating Views.

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Tableau

1. Introduction to Tableau
   - Understanding Tableau and its role in data visualization.
   - Installation of Tableau Desktop 10.
   - Connecting Tableau to various datasets.

2. Inserting Data into Tableau
   - Importing different types of data into Tableau, including Excel sheets, CSV files, databases, etc.

3. Visualizing Data Using Tableau
   - Utilizing appropriate plots, charts, and maps to visualize the data effectively.
   - Creating various types of visualizations such as bar charts, line charts, scatter plots, pie charts, geographic maps, etc.

4. Tableau for Data Science
   - Exploring Tableau's capabilities for data analysis in the context of data science.
   - Analyzing, blending, joining, and calculating data within Tableau.

5. Data Manipulation in Tableau
   - Working with data hierarchies to organize and structure data effectively.
   - Understanding data blending and its applications in Tableau.

6. Enhancing Visualizations with Tableau Features
   - Utilizing parameters to add interactivity and flexibility to visualizations.
   - Creating calculated fields to perform custom calculations and derive insights from the data.

7) Filtering and Dashboard Creation

- Creating interactive dashboards

- Adding actions to dashboards

- Implementing filters and quick filters to refine and focus visualizations

- Designing interactive dashboards to present insights and analysis effectively

8) Advanced Features in Tableau

- Incorporating actions to enhance the interactivity and user experience of dashboards

- Exploring advanced features such as forecasting, trend lines, and statistical functions

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Math for Data Science

1. **Introduction to Basic Statistics Terms**

   - Overview of fundamental statistical concepts and terminology.

2. **Types of Statistics**

   - Descriptive statistics: Summarizing and describing data.

   - Inferential statistics: Making inferences and predictions about populations based on sample data.

3. **Types of Data**

   - Categorical data: Data that falls into categories or groups.

   - Numerical data: Data represented by numbers.

4. **Measures of Central Tendency**

   - Mean

   - Median

   - Mode

5. **Measures of Dispersion**

   - Range

   - Variance

   - Standard Deviation

6. **Random Variables**

   - Variables whose possible values are outcomes of a random phenomenon.

Mathematics for data Science

Statistical Concepts

1. Outliers
   - What is an outlier
   - Detection of outliers
   - Removing outliers
2. Skewness
   - What is skewness
   - Types of skewness
3. Covariance and Correlation
   - Covariance
   - Correlation
4. Probability Density Function and Mass Function
   - What is probability
   - Sample, population, types of sampling techniques
   - Probability distributions for continuous and discrete random variables
5. Types of Probability Distribution
   - What is distribution
   - Types of probability distribution
     - Binomial Distribution
     - Poisson Distribution
     - Normal Distribution (Gaussian Distribution)
     - Bernoulli Distribution
     - Uniform Distribution
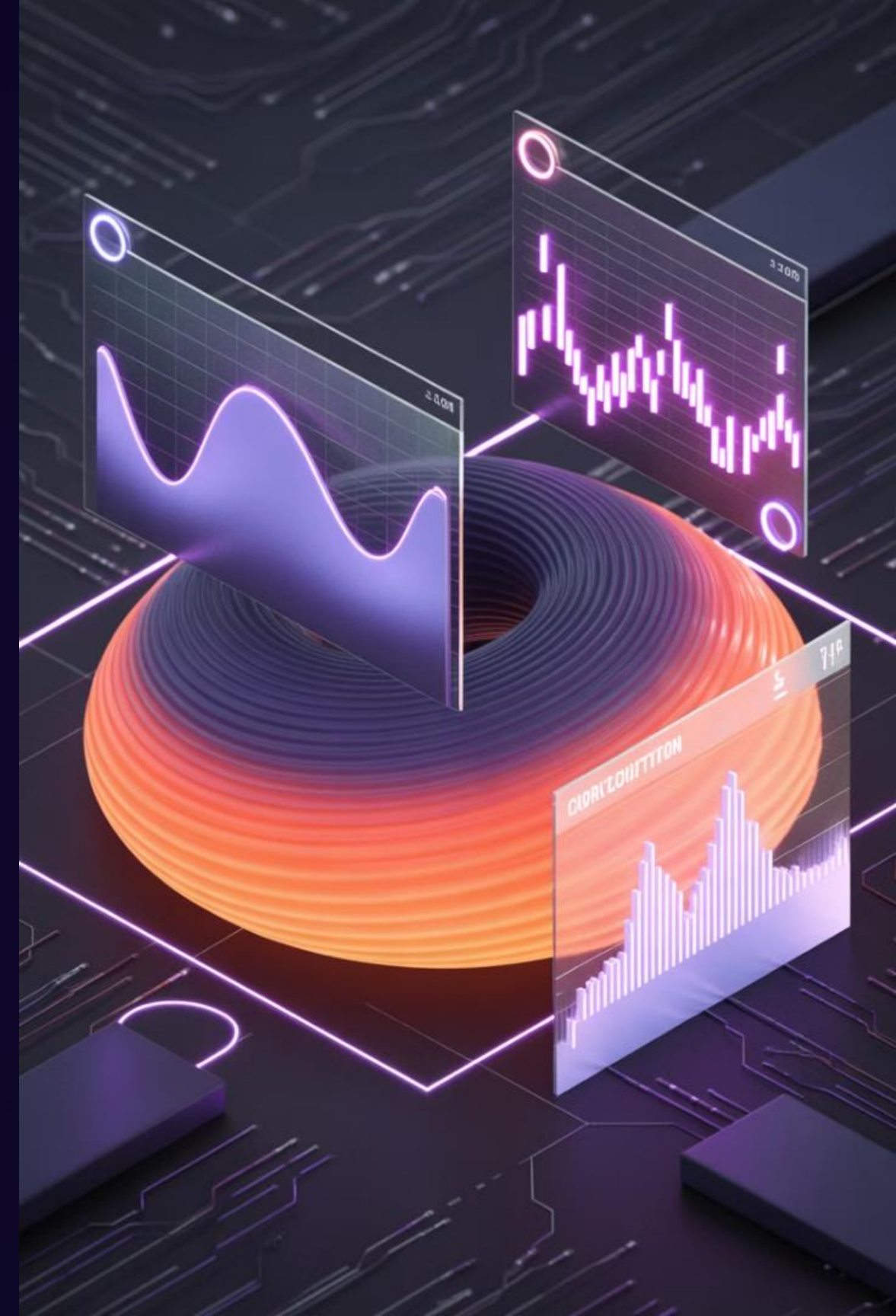
1. T-stats, F-test, T-distribution

2. T-stats vs. Z-stats: Overview

3. When to Use a T-test vs. Z-test

4. **Chi-square Test**

5. **Central Limit Theorem and Applications**

6. **Confidence Intervals**

   - Confidence Interval (CI)

   - Confidence Intervals and the Margin of Error

   - Interpreting Confidence Levels and Confidence Intervals

7. **Estimation and Hypothesis Testing**

   - What is Hypothesis

   - Types of Hypothesis

     - P-value

     - Null Hypothesis (H_o)

     - Alternative Hypothesis (H_a)

     - One-tailed Alternative Hypothesis

     - Two-tailed Alternative Hypothesis

     - Type 1 & Type 2 Error

8. Bayes' Theorem

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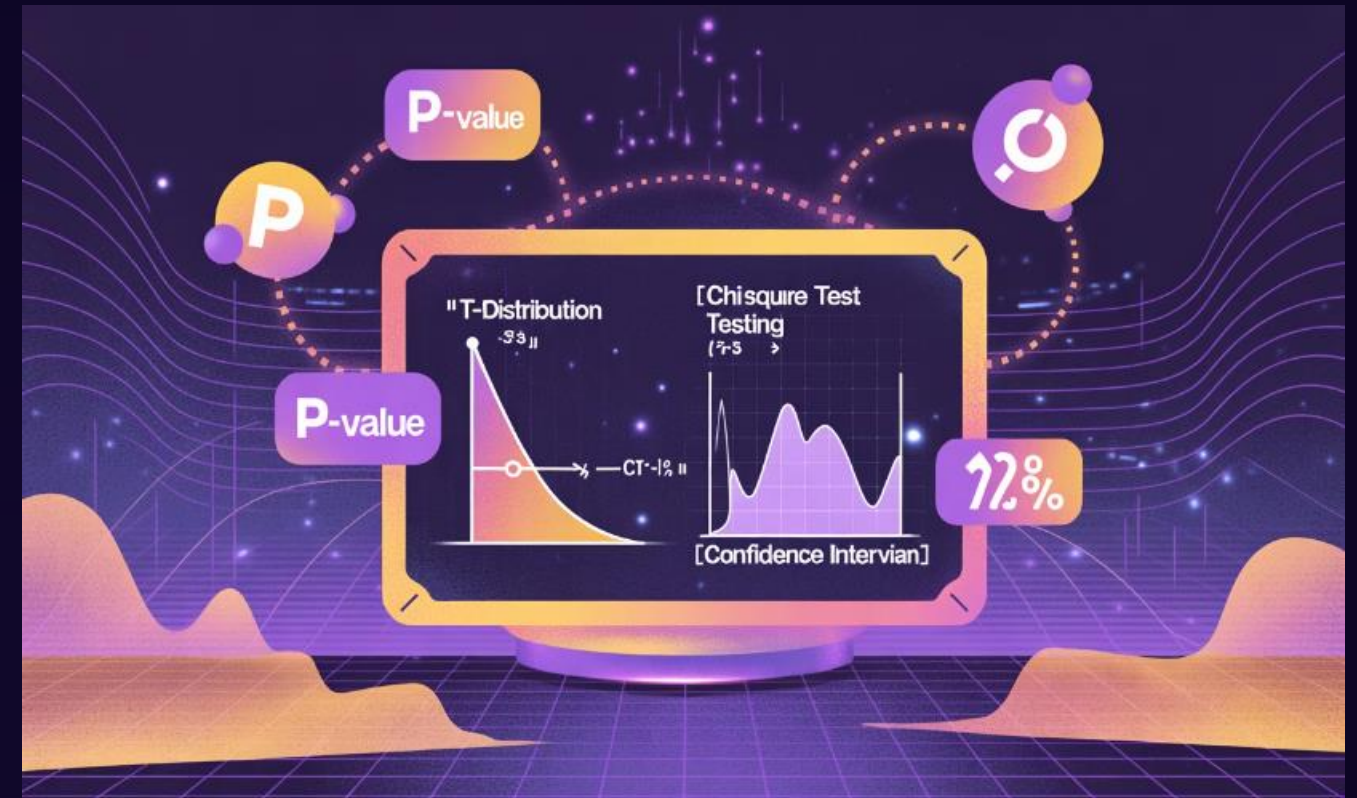
- **Chi-Square Test**
  - Chi-Square Distribution Using Python
  - Chi-Square For Goodness Of Fit Test
- **A/B Testing**
- **ANOVA Test**

Machine Learning

1. Intro to ML and how machines learn
2. Linear Regression (OLS)
   - Practical Linear Regression
     - Types of regression
     - Assumptions of linear regression
   - Bias-Variance Trade-off
   - Gradient Descent
     - How gradient descent works
     - Types of gradient descent
   - Cross-validation and Hyperparameter Tuning
   - Regression metrics (MSE, RMSE, R^2, adjusted R^2)

Challenge - Supervised Learning Algorithms

1. Classification Techniques
   - Logistic Regression
     - Classification metrics (precision, recall, F1 score, ROC, AUC)
   - Project
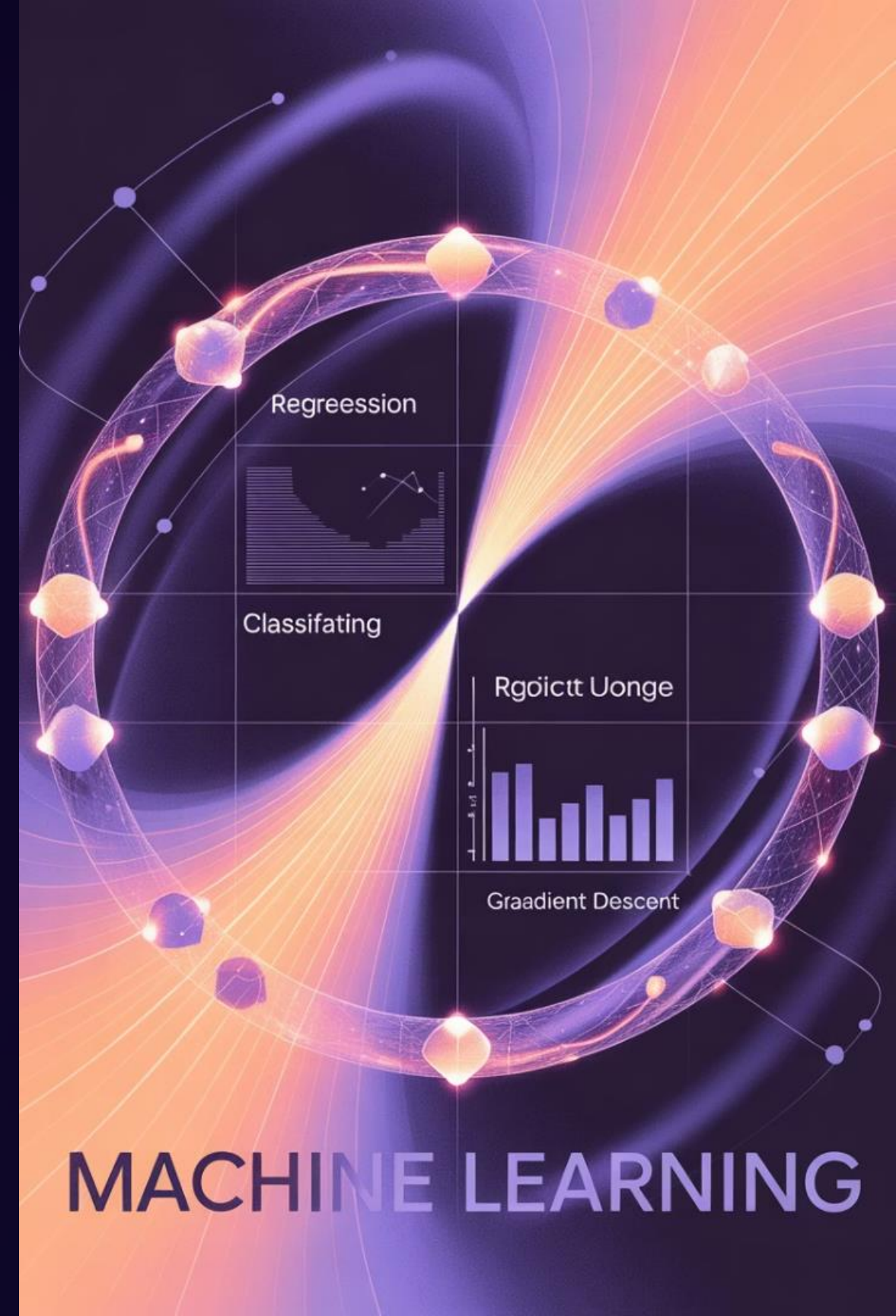
4) Both Classification and Regression Algorithms

- i) Decision Tree
- ii) Ensemble Methods
    - a) Bagging
        - 1) Random Forest
    - b) Boosting
        - 1) Gradient Boost
    - c) Stacking
- iii) Support Vector Machines (SVM)
- iv) KNN

Challenge - Supervised Learning Algorithms – II

5) Unsupervised Learning Algorithms

- i) K-Means Clustering, K-Median
- ii) Hierarchical Clustering
- iii) DBSCAN

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