Introduction to Statistics

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What is Statistics?

Statistics is the field of study that deals with:

- **Collection** of data
- **Organization** of data
- **Analysis** of data
- **Interpretation** of data
- **Presentation** of data

Purpose: The goal of all these activities is to **make informed decisions** using data.

Why Use Statistics?

When we have data, we can extract patterns, understand behavior, and support decisions. For example:

- Identify customer behavior
- Extract key insights and trends
- Improve business decisions

At the heart of it, statistics helps businesses grow by providing tools to make better, data-driven decisions.

Example: Age-Based Targeting in Online Shopping

Suppose we have the following age data from users interested in online shopping:

$$\{24, 27, 14, 13, 28, 29, 31, 32\}$$

Using statistics, we can compute:

- **Mean (Average) Age**:
$$\bar{x} = \frac{24 + 27 + \cdots + 32}{8}$$
- **Median Age**: Arrange data and find the middle value.
- **Distribution of Ages**: Create histograms or probability functions.

Understanding these statistics helps us decide which age group to target for marketing or promotional offers.

Visualizing the Data

Some common statistical visualizations include:

- **Histogram** — Shows frequency distribution
- **PDF (Probability Density Function)** — Smooth curve of histogram
- **CDF (Cumulative Distribution Function)** — Shows cumulative probability

These help in understanding the distribution and shape of the data.

Business Decision Example: ATM Deployment

Scenario: A bank wants to decide whether to open a new ATM at Location B (5 km from Location A).

- Use data from Location A: number of transactions, electricity costs, foot traffic
- Analyze using statistical methods: means, trends, graphs
- Present findings to stakeholders
- Make a decision based on statistical analysis

This is called statistical decision-making.

Applications of Statistics

Statistics is used across many domains:

- **Machine Learning & Data Science**
- **Data Analysis**
- **Business Analytics**
- **Risk Analysis**
- **Everyday Decision Making** (e.g., budgeting, shopping)
- **Scientific Research and Experiments**

Example: Covid-19 Vaccination

To ensure vaccine safety, scientists:

- Chose a sample of people
- Conducted trials
- Used **statistical analysis** to assess safety and efficacy

Conclusion

This session introduced key concepts in statistics. Even if some terms like histogram, PDF, or CDF are new, they will be explored in detail in upcoming lectures.

Key takeaway: Statistics helps us understand data and make better decisions in every field — from science to business to daily life.