Types of Statistics: Descriptive vs Inferential

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1. Descriptive Statistics

Definition: Descriptive statistics are used to *organize*, *summarize*, and *present* data in an informative way.

Purpose: Describe the main features of a dataset (usually a sample) clearly and concisely.

Key Techniques

- **Measures of Central Tendency:**
  - **Mean:** $\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$
  - **Median:** Middle value when data is sorted
  - **Mode:** Most frequently occurring value
- **Measures of Dispersion:**
  - **Variance:** $\sigma^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2$
  - **Standard Deviation:** $\sigma = \sqrt{\sigma^2}$

Example:
Given heights of students: 150, 160, 170, 180 cm.
Calculate:

- Mean: $\frac{150 + 160 + 170 + 180}{4} = 165$ cm
- Median: 165 cm
- Mode: No repeated value

2. Inferential Statistics

Definition: Inferential statistics use a sample to make *predictions*, *conclusions*, or *inferences* about a larger population.

Purpose: Generalize results from a sample to a population.

Key Concepts

- **Sample:** A subset taken from the population
- **Population:** The entire group of interest
- **Common Techniques:**
  - Hypothesis Testing (e.g., Z-test, T-test)

- Confidence Intervals
- Regression Analysis

Example:
Suppose we collect the heights of 10 students from a college of 1000 students.
From this sample, we estimate the *average height* of all 1000 students using statistical methods.

3. Key Differences

Aspect	**Descriptive Statistics**	**Inferential Statistics**
Purpose	Summarize data	Make predictions/conclusions
Data Used	Actual data (sample)	Sample data to infer about population
Techniques	Mean, median, variance, etc.	Z-test, T-test, etc.
Example	Mean height of 10 students = 165 cm	Estimate avg. height of 1000 students