Essential Statistics for Data Science

Topics:
Inferential Statistics, Descriptive Vs Inferential Statistics.

Sampling Distribution, Central Limit Theorem

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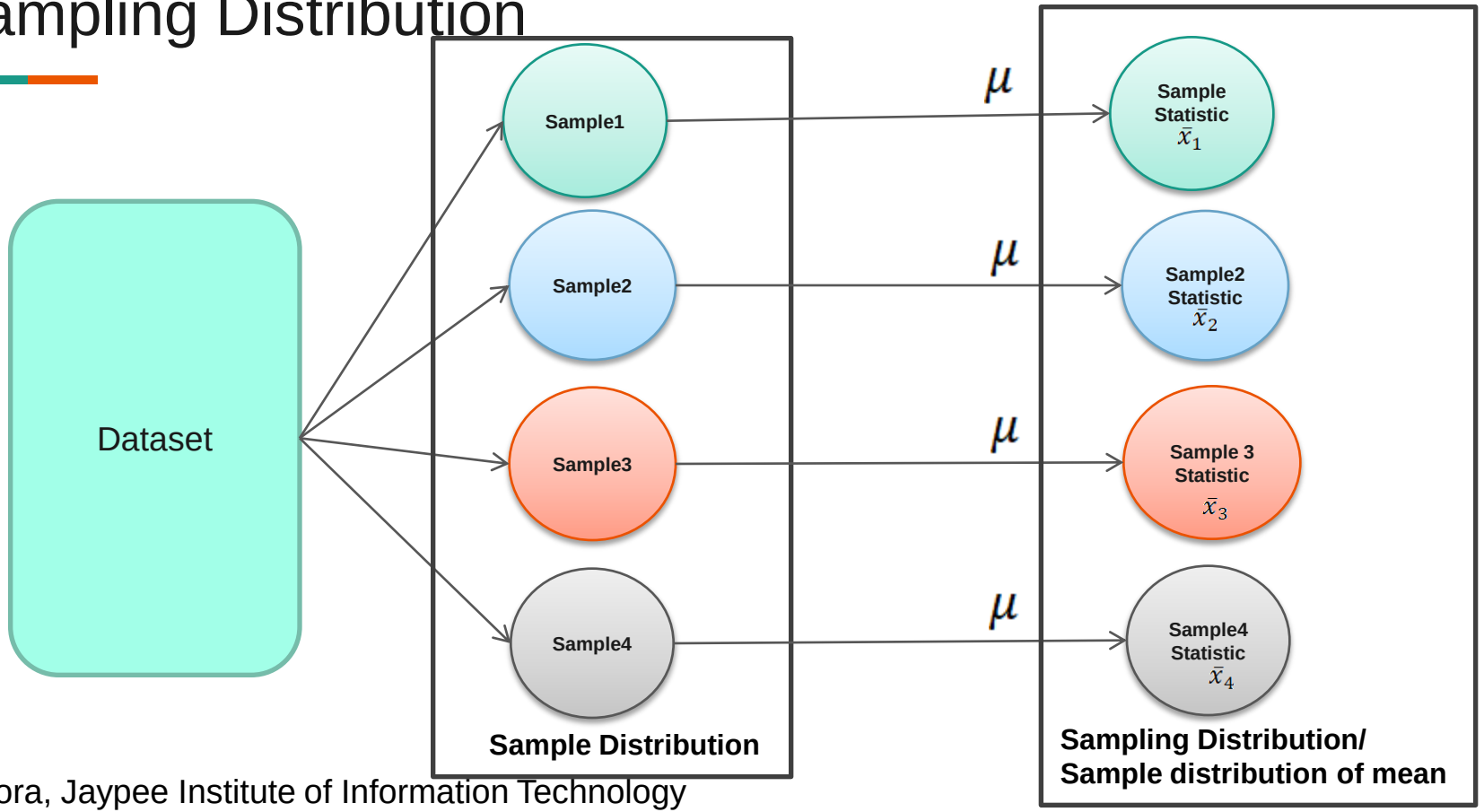
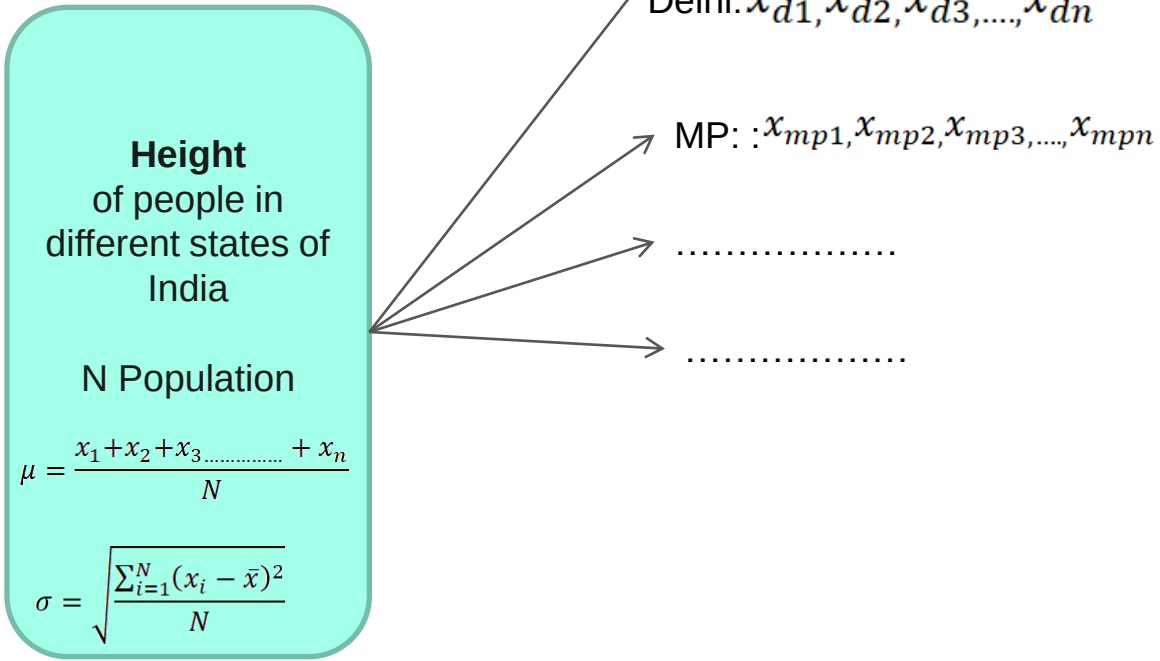
Deterministic Vs Inferential Statistics

Deterministic Statistics	Inferential Statistics
Measure for definitive measurement	Note the margin of error of research performed
Data Summary: Bar Graph, Histogram, pie chart, etc.	**Data Summary:** Takes sample data and makes inferences about the sample population. i.e used to make inference or draw a conclusion of population.
Measures of Central Tendency: Mean, Median, Mode **Measures of dispersion:** Range, Variance, standard deviation	Uses probability to determine how confident we can be that the conclusion we make is correct Normal (Gaussian distribution), Binomial distribution, etc.

Sampling Distribution



Sampling Distribution



Sample Distribution

$\overline{x_d}$ σ_d

$\overline{x_{mp}}$ σ_{mp}

Sampling distribution

$$mean(\bar{x}) \approx \mu$$

$$SD(\bar{x}) < \sigma$$

Central Limit Theorem (CLT)

- Three mean values:

$$\mu \rightarrow original\ Population\ Mean$$

$$\overline{x_{mp}}, \overline{x_d} \rightarrow Sample\ Mean\ varies\ for\ each\ sample$$

$$\bar{x} \rightarrow mean\ of\ Sample\ means$$

- **CLT Part-I:** Sample is taken from population, So mean of Sample will approximately be same as of original population. Sample size (large/ small) does not matter. Even mean of samples will also be approximately same as shown below

$$\bar{x} \approx \mu \approx \overline{x_{mp}}, \overline{x_d}$$

Central Limit Theorem (CLT)

- **CLT Part-II:** The standard deviation of the sample means decreases as the sample size increases i.e

$$SD(\bar{x}) < \sigma$$

Its formula looks like

$$SD(\bar{x}) = \frac{\sigma}{\sqrt{n}}$$

this is known as standard error as well

↑ n increase ↓ Standard error decrease

- **CLT Part-III:** If the population follows a normal distribution, then the sampling distribution is also normal distribution. The distribution of the sample means approaches a normal distribution, under certain conditions,

$$\bar{x} \sim N(\mu_{\bar{x}}, \sigma_{\bar{x}} / \sqrt{n})$$

Online simulation Link: http://www.ltcconline.net/greenl/java/Statistics/clt/cltsimulation.html

CLT Theorem:

Distribution of sample statistics is nearly normal, centred at the population mean, and with a standard deviation equal to the population standard deviation divided by square root of sample size.

$$\bar{x} \sim N(\mu_x, \sigma_x / \sqrt{n})$$