

Dispersion Measures

Agenda

- What is Statistics?
- Central Tendency Measures
- **Dispersion Measures**
- Data Distributions



Dispersion Measures

Measures of Dispersion describe the data spread or how far the measurements are from the center.

The Measures of Dispersion are:

- Range
- Variance/Standard Deviation
- Mean Absolute Deviation
- Interquartile Range

Dispersion Measures: Examples

Range

- Exploring the data to know the spread

Variance/Standard Deviation

- Defects in a process
- Price fluctuations in assets (stocks, real estate, and bonds)

Quartile

- Employee satisfaction survey analysis

Percentile

- Growth charts for children
- Test scores

Decile

- Test scores
- Response to a marketing campaign

Dispersion Measures: Calculations

Calculate Range, Variance, and Standard Deviation for the dataset {2,2,3,5,5,5,7,14}.

- **Range** = $14 - 2 = 12$
- **Variance**: Sum the square of the Deviations from the Mean and divide by number of records

Observation	Value	Deviation from Mean	Square of Deviation
1	2	-3.375	11.390625
2	2	-3.375	11.390625
3	3	-2.375	5.640625
4	5	-0.375	0.140625
5	5	-0.375	0.140625
6	5	-0.375	0.140625
7	7	1.625	2.640625
8	14	8.625	74.390625
Total	43	0	105.875

Variance: $105.875/8 = 13.234$

- **Standard Deviation**: Square root of Variance = 3.64

Dispersion Measures: Key Definitions

- Range: Difference between lowest and highest value of data
 - Range = Maximum – Minimum
 - Ignores outliers
 - Does not recognize the data distribution and consider two points in its estimation
- Mean Absolute Deviation (MAD): Mean of the absolute values of the deviations
$$\text{MAD} = \frac{\sum (|x - \text{mean}(x)|)}{n}$$
 where n is the size of the sample

Dispersion Measures: Key Definitions (Cont'd)

- Variance indicates how close to or far from the Mean are most of the values for a particular variable
 - Lower Variance → Values are concentrated around Mean
 - Larger Variance → Values are spread away from the Mean

Population Variance	$\sigma^2 = \frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2$
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- Standard Deviation is square root of Variance

Population Standard Deviation	$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2}$
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