Measures of Skewness
Data Science and A.I. Lecture Series

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  1. **Absolute Measures of Skewness**

Measures of Skewness

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- These measures help understand the manner and extent of asymmetry in a distribution.
- Two types of measures of skewness:
  1. **Absolute Measures of Skewness**
  2. **Relative Measures of Skewness**

Absolute Measures of Skewness

Based upon Mean, Median, and Mode:

Based upon Quartiles:

Remarks:

Absolute Measures of Skewness

Based upon Mean, Median, and Mode:
- $S_k = \text{Mean} - \text{Mode}$

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- Difference between mean and mode measures skewness.

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Remarks:

- Difference between mean and mode measures skewness.
- Quartiles measure skewness due to their relative positions in the distribution.

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Examples of Absolute Measures of Skewness

Based upon Mean, Median, and Mode:

- $S_k = \text{Mean} - \text{Mode}$

Example

For a dataset with:

- Mean $(\mu) = 50$
- Mode $= 45$

$$S_k = 50 - 45 = 5$$

Examples of Absolute Measures of Skewness

Based upon Mean, Median, and Mode:

- $S_k = \text{Mean} - \text{Mode}$

Example

For a dataset with:

- Mean $(\mu) = 50$
- Mode $= 45$

$$S_k = 50 - 45 = 5$$

- $S_k = \text{Mean} - \text{Median}$

Examples of Absolute Measures of Skewness

Based upon Mean, Median, and Mode:

- $S_k = \text{Mean} - \text{Mode}$

Example

For a dataset with:

- Mean $(\mu) = 50$
- Mode $= 45$

$$S_k = 50 - 45 = 5$$

- $S_k = \text{Mean} - \text{Median}$

Example

For a dataset with:

- Mean $(\mu) = 70$
- Median $= 65$

$$S_k = 70 - 65 = 5$$

Based upon Quartiles:

Examples of Absolute Measures of Skewness

Based upon Quartiles:

- $S_k = Q_3 + Q_1 - 2Q_2$

Based upon Quartiles:

- $S_k = Q_3 + Q_1 - 2Q_2$

Example

For a dataset with:

- $Q_1 = 25$, $Q_2 = 35$, $Q_3 = 45$

$$S_k = 45 + 25 - 2(35) = 70 - 70 = 0$$

Examples of Absolute Measures of Skewness

Based upon Quartiles:

- $S_k = Q_3 + Q_1 - 2Q_2$

Example

For a dataset with:

- $Q_1 = 25$, $Q_2 = 35$, $Q_3 = 45$

$$S_k = 45 + 25 - 2(35) = 70 - 70 = 0$$

- $S_k = Q_3 + Q_1 - 2(\text{Median})$

Examples of Absolute Measures of Skewness

Based upon Quartiles:

- $S_k = Q_3 + Q_1 - 2Q_2$

Example

For a dataset with:

- $Q_1 = 25$, $Q_2 = 35$, $Q_3 = 45$

$$S_k = 45 + 25 - 2(35) = 70 - 70 = 0$$

- $S_k = Q_3 + Q_1 - 2(\text{Median})$

Example

For a dataset with:

- $Q_1 = 40$, Median $(Q_2) = 50$, $Q_3 = 60$

$$S_k = 60 + 40 - 2(50) = 100 - 100 = 0$$

Relative Measures of Skewness

Used for comparison between distributions:

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- Karl Pearson's Coefficient of Skewness

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- Kelly's Coefficient of Skewness

Relative Measures of Skewness

Used for comparison between distributions:

- Karl Pearson's Coefficient of Skewness
- Bowley's Coefficient of Skewness
- Kelly's Coefficient of Skewness
- Coefficients Based on Moments

All Formulas: Coefficient of Skewness

1. Pearson's 1st Coefficient of Skewness:

$$\text{Skewness} = \frac{\text{Mean} - \text{Mode}}{\text{S.D.}}$$

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3. Quartile Coefficient of Skewness or Bowley's Coefficient of Skewness

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$$\text{Skewness} = \frac{Q_3 + Q_1 - 2Q_2}{\text{S.D.}}$$

4. Percentile Coefficient of Skewness or Kelly's Coefficient of Skewness

$$\text{Skewness} = \frac{P_{90} + P_{10} - 2\text{Median}}{P_{90} - P_{10}}$$

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5. Coefficients Based on Moments:

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$$\text{Skewness} = \frac{\text{Mean} - \text{Mode}}{\text{S.D.}}$$

Example: Given:

- Mean $(\mu) = 65$
- Mode $= 60$
- Standard Deviation (S.D.) $= 10$

Example: Pearson's 1st Coefficient of Skewness

1. Pearson's 1st Coefficient of Skewness:

$$\text{Skewness} = \frac{\text{Mean} - \text{Mode}}{\text{S.D.}}$$

Example: Given:

- Mean $(\mu) = 65$
- Mode $= 60$
- Standard Deviation (S.D.) $= 10$

$$\text{Skewness} = \frac{65 - 60}{10} = 0.5$$

Pearson's 2nd Coefficient of Skewness

Formula:

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Formula:

$$\text{Skewness} = \frac{3(\text{Mean} - \text{Median})}{\text{S.D.}}$$

Example: Given:

- Mean $= 60$
- Median $= 55$
- Standard Deviation $= 12$

Pearson's 2nd Coefficient of Skewness

Formula:

$$\text{Skewness} = \frac{3(\text{Mean} - \text{Median})}{\text{S.D.}}$$

Example: Given:

- Mean $= 60$
- Median $= 55$
- Standard Deviation $= 12$

$$\text{Skewness} = \frac{3(60 - 55)}{12} = 1.25$$

Quartile Coefficient of Skewness or Bowley's Coefficient of Skewness

Formula:

$$\text{Skewness} = \frac{Q_3 + Q_1 - 2Q_2}{\text{S.D.}}$$

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Example:

Formula:

$$\text{Skewness} = \frac{Q_3 + Q_1 - 2Q_2}{\text{S.D.}}$$

Example: Given:

- $Q_1 = 30$
- $Q_2 = 35$
- $Q_3 = 40$
- Standard Deviation (S.D.) $= 8$

Formula:

$$\text{Skewness} = \frac{Q_3 + Q_1 - 2Q_2}{\text{S.D.}}$$

Example: Given:

- $Q_1 = 30$
- $Q_2 = 35$
- $Q_3 = 40$
- Standard Deviation (S.D.) $= 8$

$$\text{Skewness} = \frac{40 + 30 - 2(35)}{8} = 0.0$$

Percentile Coefficient of Skewness or Kelly's Coefficient of Skewness

Formula:

$$\text{Skewness} = \frac{P_{90} + P_{10} - 2\text{Median}}{P_{90} - P_{10}}$$

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Example:

Formula:

$$\text{Skewness} = \frac{P_{90} + P_{10} - 2\text{Median}}{P_{90} - P_{10}}$$

Example: Given:

- $P_{90} = 80$
- $P_{10} = 20$
- Median $(Q_2) = 50$

Percentile Coefficient of Skewness or Kelly's Coefficient of Skewness

Formula:

$$\text{Skewness} = \frac{P_{90} + P_{10} - 2\text{Median}}{P_{90} - P_{10}}$$

Example: Given:

- $P_{90} = 80$
- $P_{10} = 20$
- Median $(Q_2) = 50$

$$\text{Skewness} = \frac{80 + 20 - 2(50)}{80 - 20} = 0.0$$