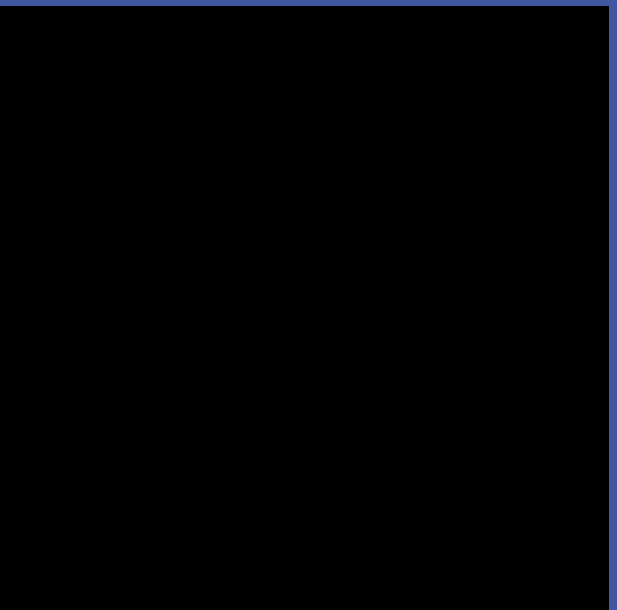
Data Operations

Lesson



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Why is it important to know the type of an attribute?

Importance of Attribute Types

Why is it important to know the type of an attribute?

This dictates:

- What **statistics and tests** can be calculated
- What **transformations** can be performed
- How **learning algorithms** can use the attribute

Mode

- The **most common value** for an attribute
- Can be calculated for **all data types**

-3 2 2 4 5 **7** **7** **7** 10

Median

- The Median is the **middle-ranked** value
  - Sort all your values, take the middle one
  - If the count is even, average the two middle values
- Summary of distribution that is **robust to outliers**
- Can be calculated for the following data types:
  - Ordinal
  - Interval
  - Ratio

-3 2 2 4 **5** 7 7 7 10

Mean

Unweighted arithmetic mean

$$\bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i$$

Weighted arithmetic mean

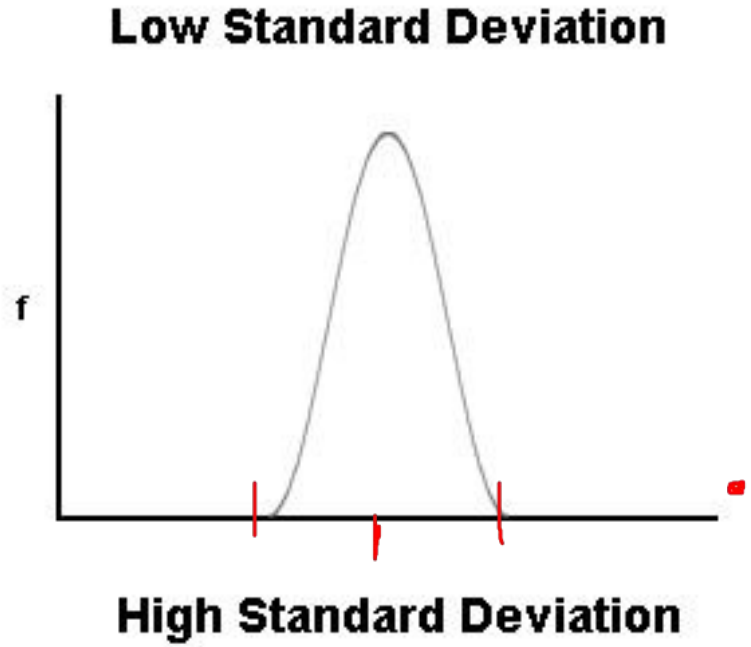
$$\bar{x} = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i}$$

- Can be calculated for **Interval and Ratio** data types
- *Can you take the mean of an ordinal attribute?*

Spread

- **Range:** max-min
- **Variance:** s^2

$$s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2$$



- **Standard Deviation:** s
  - Square root of the variance
  - Measures spread about the mean
  - Zero if and only if all the values are equal
- **Median Absolute Deviation**
  - Median of distances from the mean

Transformation: Z-score Normalization

- Values normalized by mean and standard deviation

$$z(x_i) = \frac{x_i - \overline{x}}{s}$$

- Centered around 0
- Distance in units of standard deviation
- Can be calculated for **Ratio and Interval** data
- *Remember Z-values when we talk about normalization*

More Summary Statistics & Tests

- **Nominal:** mode, entropy, Chi-squared (χ^2) test
- **Ordinal:** median, percentiles, rank correlation, rank sum test, sign test
- **Interval:** mean, standard deviation, Pearson's correlation, *t*-test, *z*-score
- **Ratio:** Geometric mean, harmonic mean, percent variation
- Each type can use the stats above too (e.g. Ratio data can have a median)

Learning Objectives: Operations

You now should be able to:

Identify **operations** and **transformations** that can applied to different types of data

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Exercises

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Practice Question: Operations

Which of these following operations can be applied to **ordinal** data?

A. Mean
B. Median
C. Standard Deviation
D. Mode