# Summary Statistics

# Categorical Variables

# Frequency table

| Type | Frequency |
|---|---:|
| Action | 32 |
| Adventure | 1 |
| Animation | 12 |
| Comedy | 27 |
| Drama | 21 |
| Fantasy | 2 |
| Horror | 17 |
| Romance | 11 |
| Thriller | 13 |
| Total | 136 |

# Relative frequency table

| Type | Rel. Freq. |
|---|---:|
| Action | 0.235 |
| Adventure | 0.007 |
| Animation | 0.088 |
| Comedy | 0.199 |
| Drama | 0.154 |
| Fantasy | 0.015 |
| Horror | 0.125 |
| Romance | 0.081 |
| Thriller | 0.096 |
| Total | 1 |

# Quantitative
# Variables

# Measures of
# Center

# Mean

**Formula:** $\overline{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$

**Interpretation: center of mass**

**Resistant?**

# Median

**Formula:**

- if $n$ is odd, then find the center value
- if $n$ is even, then find the average of the two center values

**Interpretation: center value (50th percentile)**

**Resistant?**

# Outliers

**When using statistics that are not resistant to outliers:**

1. **Check whether there was a data recording error**
2. **If there wasn't, check whether the outlier is part of the target population.**
3. **If it is, run analysis <u>with and without</u> the outlier. Report both analyses and on their differences.**

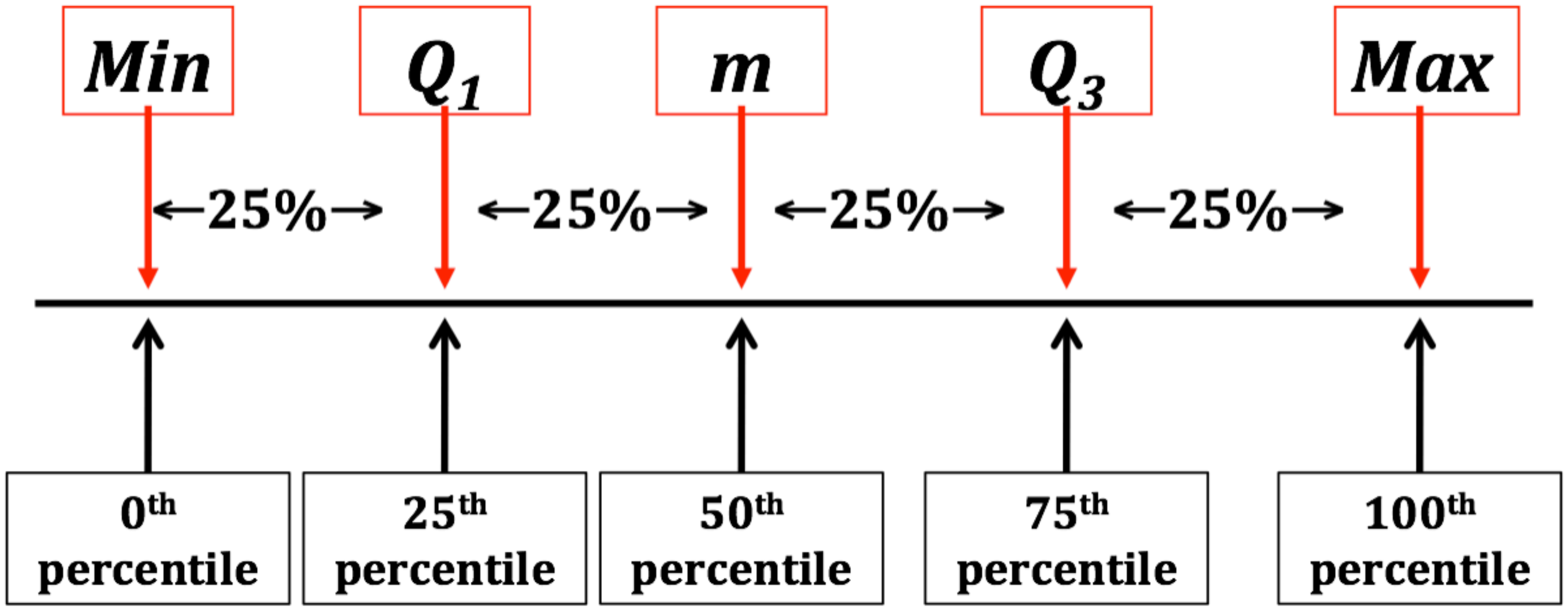
# Other Measures of
# Location

# Percentiles

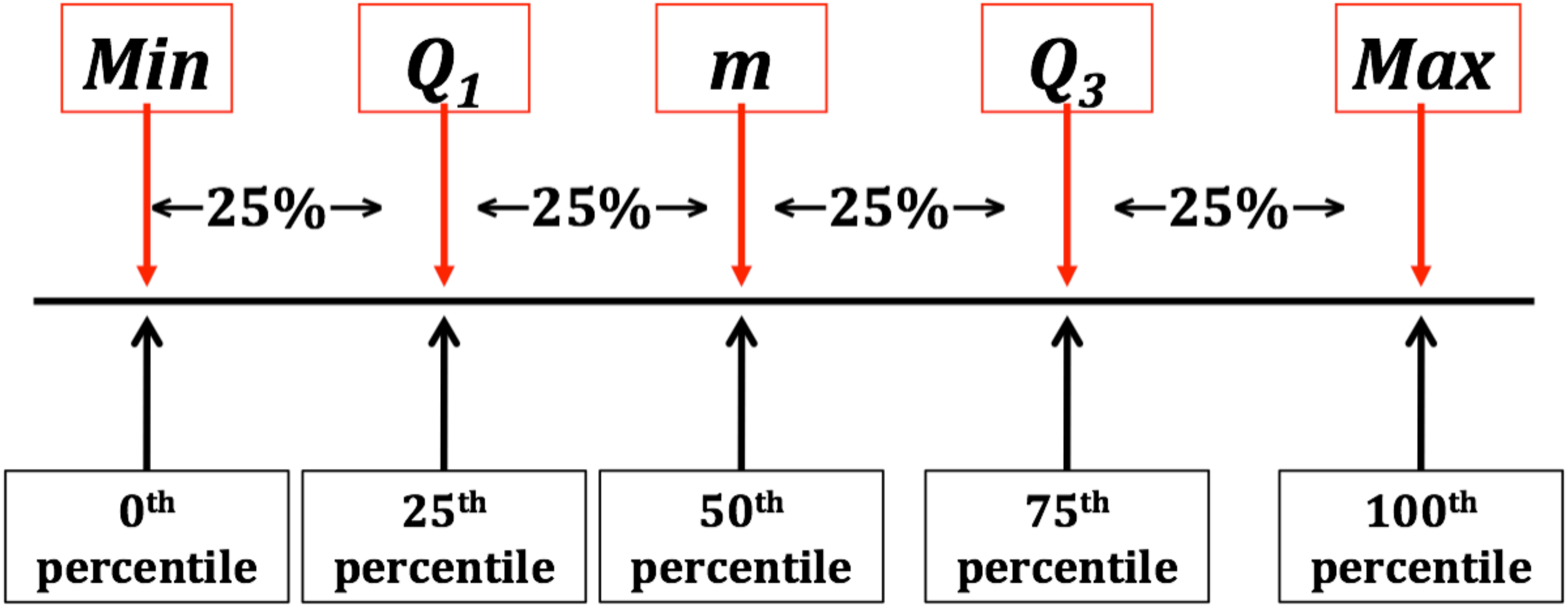
**The $p^{\text{th}}$ percentile is the value that is greater than $p\%$ of the data.**

# Quartiles

**<u>Quartiles</u> divide the ordered data into four equal parts.**

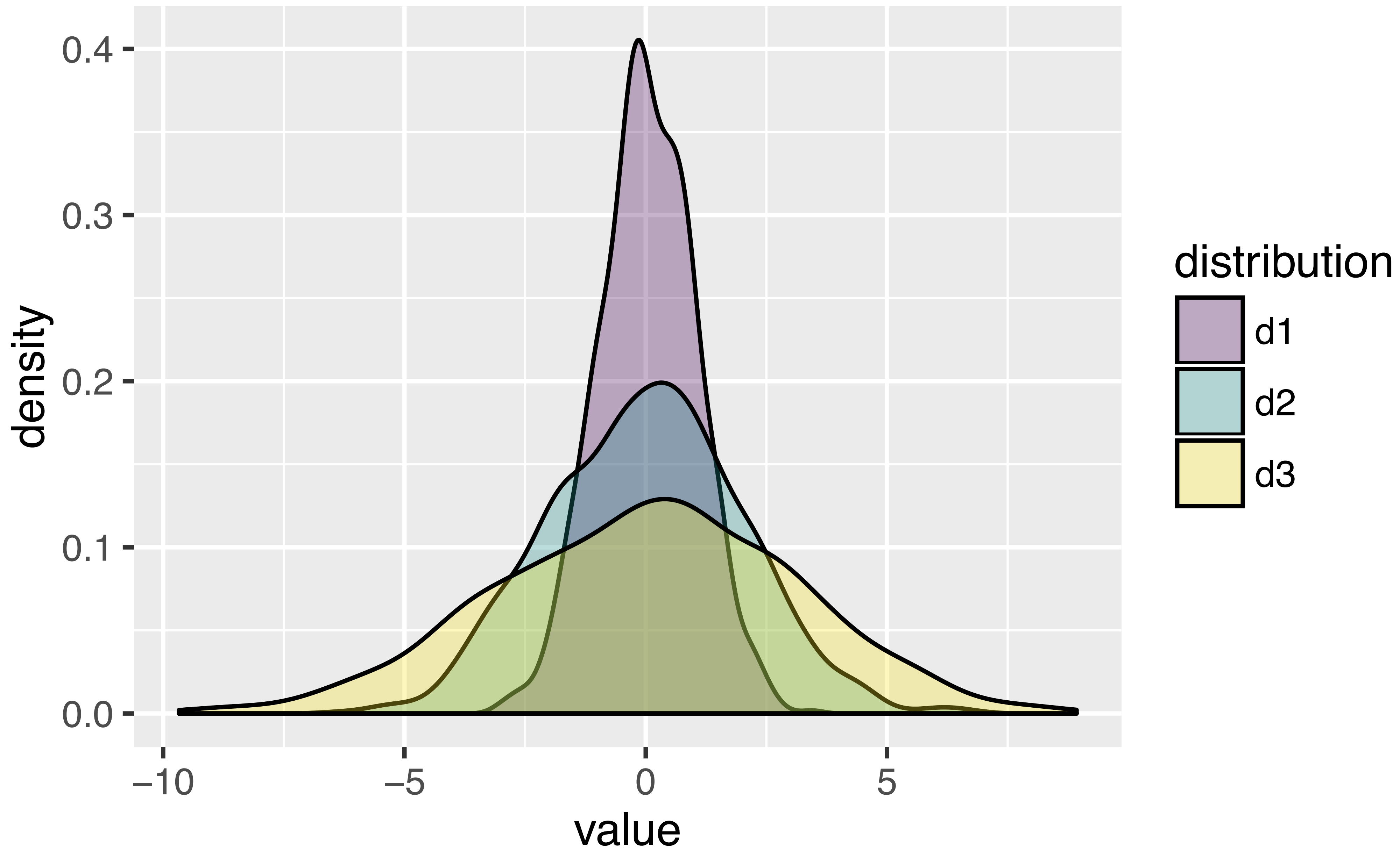


# Five number summary



# Measures of Spread

# Why we need to measure the spread



# Standard deviation

**Formula:** $s = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x_i - \overline{x})^2}$

**Interpretation: "average" distance a typical value falls from the mean**

**Resistant?**

## 95% rule

**If a distribution is approximately symmetric and bell shaped, approximately 95% of the data values fall within two standard deviations of the mean.**

# Interquartile range (IQR)

**Formula:** $Q_3 - Q1$

**Interpretation: spread of the central 50% of the values**

**Resistant?**

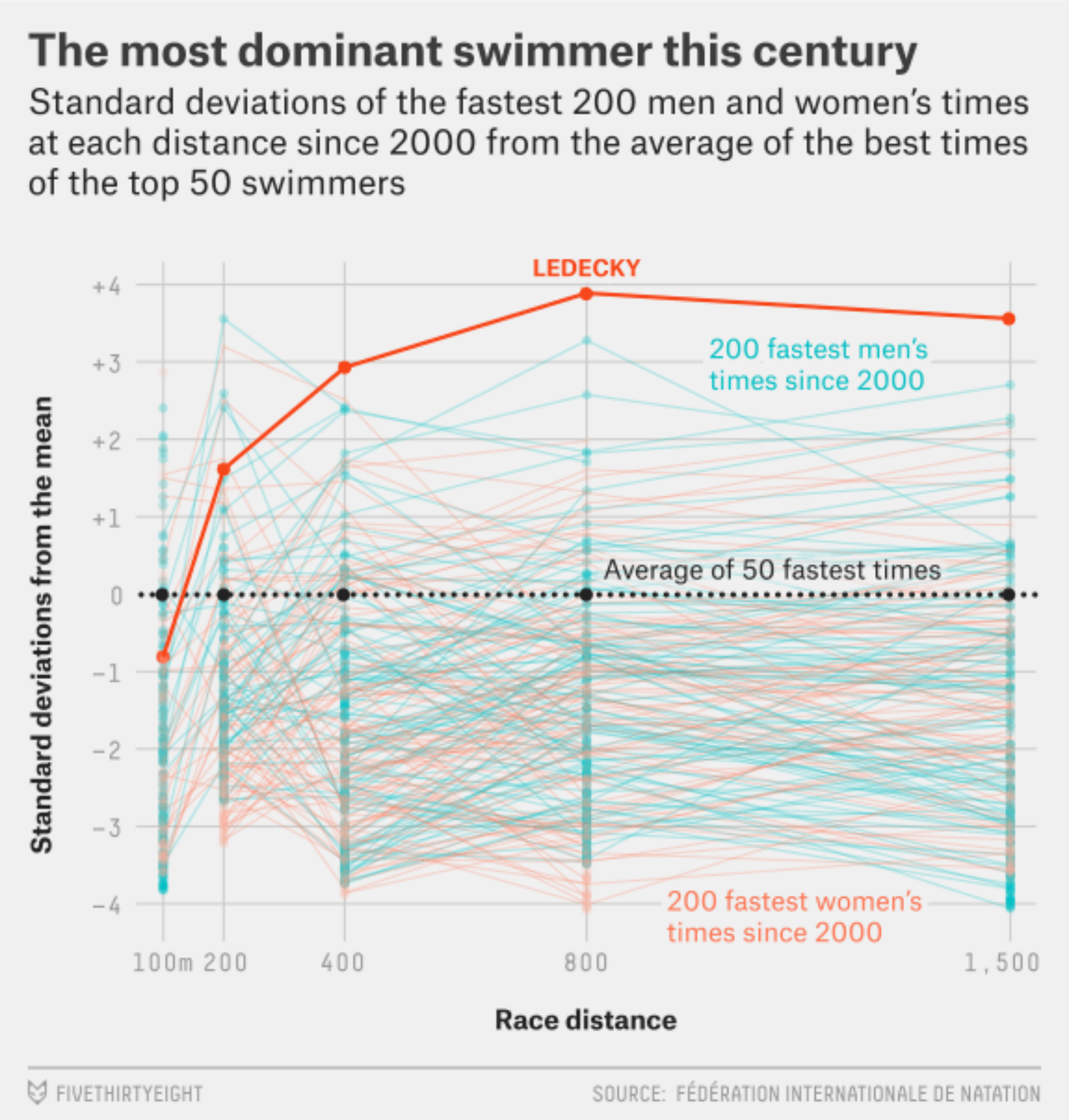
# Range

**Formula:** $\max - \min$

**Interpretation: distance between the extremes**

**Resistant?**

# Standardization




# Why use "standard deviations" from the mean on the y-axis?

# Standardized values

**The <u>z-score</u> is the number of standard deviations a value fall from the mean**

**For samples:** $z = \dfrac{x - \overline{x}}{s}$

**For populations:** $z = \dfrac{x - \mu}{\sigma}$

## Properties of z-scores

- unitless
- $z < 0 \rightarrow$ data value is below the mean
- $z > 0 \rightarrow$ data value is above the mean
- The larger the z-score, the more unusual the data value

# Properties of z-scores

- All observations are on the same scale
  - mean 0
  - standard deviation 1
- Standardizing does not change shape of the distribution
  - shifts location (by subtracting off mean)
  - rescales distribution (by dividing by the standard deviation)

## Example

**The average score on the ACT English exam is 21.0 with a standard deviation of 4.0.**

**The average score on the SAT Verbal exam is 520 with a standard deviation of 100.**

**If Ann scores a 27 on the ACT English exam and Denise scores a 770 on the SAT Verbal exam, who has the better score?**

## Example

**The average score on the ACT Math exam is 20.7 with a standard deviation of 4.1.**

**The average score on the SAT Math exam is 510 with a standard deviation of 100.**

**If Jim scores a 15 on the ACT Math exam and Dwight scores a 340 on the SAT Math exam, who has the better score?**