1 Statistical Measures

1.1 Mean

$$\text{mean}(\mathbf{x}) = \overline{x} = \frac{1}{N}\sum_{i=1}^{N} x_i$$

1.2 Median

$$\text{median}(\mathbf{x}) = \begin{cases} x_{(N+1)/2} & \text{if } N \text{ is odd} \\ \frac{x_{N/2}+x_{N/2+1}}{2} & \text{if } N \text{ is even} \end{cases}$$

1.3 Sample Variance

$$\text{var}(\mathbf{x}) = \frac{1}{N-1}\sum_{i=1}^{N}(x_i - \overline{x})^2$$

1.4 Sample Standard Deviation

$$\text{sd}(\mathbf{x}) = \sqrt{\text{var}(\mathbf{x})}$$

1.5 Sample Covariance

$$\text{cov}(\mathbf{x}, \mathbf{y}) = \frac{1}{N-1}\sum_{i=1}^{N}(x_i - \overline{x})(y_i - \overline{y})$$

1.6 Sample Correlation Coefficient

$$\text{cor}(\mathbf{x}, \mathbf{y}) = r_{xy} = \frac{\text{cov}(\mathbf{x}, \mathbf{y})}{\text{sd}(\mathbf{x})\,\text{sd}(\mathbf{y})}$$

1.7 Location and Scale Changes to Statistical Measures

Statistical Measure	Location Changes $\mathbf{x} + b$, $\mathbf{y} + c$	Scale Changes $a\mathbf{x}$, $d\mathbf{y}$
mean	variant $\text{mean}(\mathbf{x}) + b$	variant $a \cdot \text{mean}(\mathbf{x})$
median	variant	variant
var	invariant $\text{var}(\mathbf{x})$	variant $a^2 \cdot \text{var}(\mathbf{x})$
sd	invariant $\text{sd}(\mathbf{x})$	variant $|a| \cdot \text{sd}(\mathbf{x})$
cov	invariant $\text{cov}(\mathbf{x}, \mathbf{y})$	variant
cor	invariant $\text{cor}(\mathbf{x}, \mathbf{y})$	invariant $\text{cor}(\mathbf{x}, \mathbf{y})$ if $ad > 0$ else if $ad < 0$ then $-\text{cor}(\mathbf{x}, \mathbf{y})$