# Robustness vs. Resistance in Statistical Methods

## Robustness

Robustness refers to a statistical method's ability to perform reasonably well even when the underlying assumptions of the model are violated. A robust method maintains its efficiency and reliability despite deviations from ideal conditions.

\*\*Example\*\*: The t-test is robust to moderate violations of the normality assumption, especially with larger sample sizes. According to the Central Limit Theorem, even if the underlying population is not perfectly normal, the sampling distribution of the mean approaches normality as sample size increases. This makes the t-test perform reliably even when data are somewhat non-normal, demonstrating robustness to this assumption violation.

## Resistance

Resistance specifically refers to a statistical method's insensitivity to outliers or extreme values in the data. A resistant method is one whose results are not dramatically affected by a small number of unusual observations.

\*\*Example\*\*: The median is a resistant measure of central tendency, unlike the mean. If we have the dataset {1, 2, 3, 4, 100}, the median (3) remains unchanged if the outlier 100 is replaced with 1000, whereas the mean would drastically change (from 22 to 202). This demonstrates the median's resistance to extreme values, making it valuable for skewed distributions or data with outliers.

In summary, robustness concerns a method's performance when model assumptions are violated (including but not limited to outliers), while resistance specifically addresses a method's stability in the presence of outliers or extreme values.