

# A short course on robust statistics david e tyler rutgers

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Robust Statistics: A Guide to Understanding Its Concepts and Applications\*\*

### **Introduction**

Robust statistics is a branch of statistics that focuses on developing and using statistical methods that are resistant to the effects of outliers and other atypical observations. The aim of robust statistics is to provide more reliable and accurate results even when the data may not conform to the usual assumptions of statistical models.

### **Key Concepts**

#### **What is the Influence Function?**

The influence function measures the sensitivity of a statistic to changes in the data. It indicates how much the value of the statistic changes when a single data point is modified or removed.

#### **What is the Most Robust Statistic?**

The most robust statistic is the one with the smallest possible influence function. This means that it will be less affected by outliers and other atypical observations.

#### **What are Robust Statistical Methods?**

Robust statistical methods are statistical techniques designed to be resistant to outliers. Examples of robust statistical methods include the median, interquartile

range, and robust regression.

### **How to Know if Data is Robust?**

Data can be considered robust if it exhibits little or no sensitivity to changes in individual data points or subpopulations. The influence function can be used to assess the robustness of data by comparing it to the influence functions of known robust statistics.

### **Purpose of Robustness**

The purpose of robustness is to ensure that statistical results are reliable and accurate even when the data may not fit the assumptions of traditional statistical methods. This is especially important in applications where outliers or atypical observations can have a significant impact on the results.

### **Most Robust Research Method**

The most robust research method is the one that uses robust statistical methods throughout the entire research process, from data collection to analysis and interpretation.

### **Advantages of Robustness Analysis**

Robustness analysis offers several advantages, including:

- Reduced influence of outliers
- More accurate and reliable results
- Increased generalizability of findings
- Improved robustness of statistical models

### **Calculating Robust Mean**

The robust mean is a measure of central tendency that is resistant to outliers. It can be calculated using a variety of methods, including the median, trimmed mean, and iteratively reweighted least squares.

### **Factors That Make Data Robust**

Data can be made robust by:

- Removing or downweighting outliers
- Using robust statistical methods
- Increasing the sample size
- Ensuring the independence of observations

### Formula for Robustness

There is no universal formula for robustness, as it depends on the specific statistic and the nature of the data. However, the influence function can provide a measure of the robustness of a statistic.

### Robustness in Statistical Tests

- **ANOVA Robust to:** ANOVA is generally robust to violations of normality, but it can be affected by outliers.
- **T-test Robust to:** The T-test is robust to small violations of normality, but it can be sensitive to outliers and heavy-tailed distributions.

### Influence Function in Statistics

The influence function measures the change in a statistic when one observation in the data set is changed.

### Influence in Statistics

Influence refers to the extent to which a single data point can affect the value of a statistic.

### Influence Plot Function

The influence plot function is a graphical representation of the influence function. It shows how the statistic changes as each data point is changed.

### Influence Function Maximum Likelihood

The influence function of a maximum likelihood estimator is proportional to the score function of the likelihood function.

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