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Design and Analysis of Experiments

09 - Non-normal data

Version 2.11

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"*Nothing has such power to broaden the mind as the ability to investigate systematically and truly all that comes under thy observation in life.*"

Marcus Aurelius Antoninus Augustus
121 – 180
Roman emperor and stoic philosopher.

Image: http://www.yourbest100.com/people/top-100-philosophers/

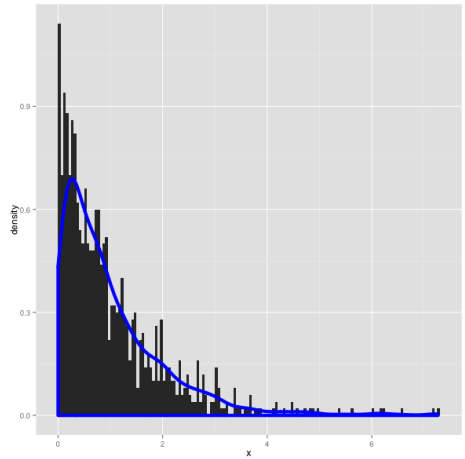
Simple comparisons

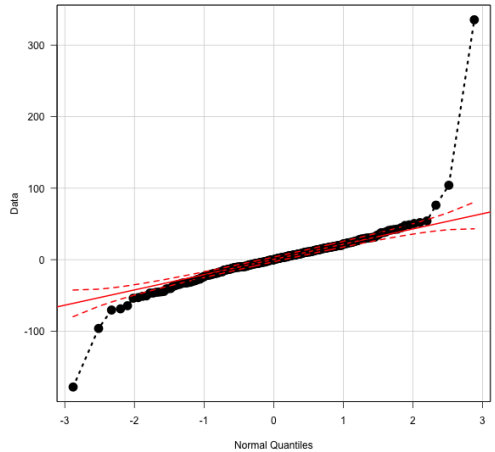
Non-normal data

Up to this point, we have been using methods that rely on strong distributional assumptions - particularly on the assumption of *normality* - to perform inference on mean values;

The Central Limit Theorem allows this assumption to be relaxed in some cases (e.g., large sample sizes, unimodal symmetrical distributions, etc.);

However, scientists and engineers frequently have to deal with data that does not conform with the normality assumption (relaxed or not) of traditional t-tests.





Simple comparisons

Non-normal data

The most common strategies to deal with non-normal samples are:

- Data transformation;
- Rank-based methods;
- Bootstrap-based methods;
- Distribution-specific methods.

In this lecture we'll introduce the first three approaches. The use of distribution-specific methods (e.g., generalized linear models) will be discussed in future versions of this course.

Data transformations

Main concepts

It is very common for phenomena to present behaviors that can be characterized by distributions other than the normal;

Data transformations

Log transformation

Data transformations

Square root transformation

Data transformations

Other transformations

Rank-based methods

Main concepts

Rank-based methods

Inference on one median

Rank-based methods

Inference on two medians

Rank-based methods

Paired design

Bootstrap

Main concepts

Bootstrap

Confidence intervals

Bootstrap

Inference using bootstrap

Final remarks

Some considerations

Bibliography

Required reading

1

Recommended reading

1
2

About this material

Conditions of use and referencing

Please reference this work as:

Felipe Campelo (2015), *Lecture Notes on Design and Analysis of Experiments*.
Online: https://github.com/fcampelo/Design-and-Analysis-of-Experiments
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  author={Felipe Campelo},
  howPublished={\url{https://github.com/fcampelo/Design-and-Analysis-of-Experiments}},
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