Foundations of Statistics

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Preface

This is a Quarto book.

To learn more about Quarto books visit https://quarto.org/docs/books.

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1 Introduction

This is a book created from markdown and executable code.

See Knuth (1984) for additional discussion of literate programming.

2 Descriptive Statistics

population deviation

$$\sigma = \sqrt{\frac{\sum_{i=1}^{N}(X_i - \mu)^2}{N}}$$

standard deviation of a sample

$$s = \sqrt{\frac{\sum_{i=1}^{n}(X_i - \mu)^2}{n-1}}$$

is descriptive statistics, which is a description of the variation in measurements. However, the standard error of the mean is descriptive of the random sampling process, which is a probabilistic statement about how the sample size will provide a better bound on estimates of the population mean, in light of the central limit theorem.

For a sample of size n,

standard deviation of the sample mean

$$s.d(\bar{X}) = \frac{\sigma}{\sqrt{n}}$$

but since σ is unknow, we use standard error of the sample mean

$$s.e(\bar{X}) = \frac{s}{\sqrt{n}}$$

Put simply, the **standard error** of the sample mean is an estimate of how far the sample mean is likely to be from the population mean, whereas the **standard deviation** of the sample is the degree to which individuals within the sample differ from the sample mean.[9] If the population standard deviation is finite, the standard error of the mean of the sample will tend to zero ($s.e \to 0$)with increasing sample size, because the estimate of the population mean will improve, while the standard deviation of the sample s will tend to approximate the population standard deviation σ as the sample size increases.

2.1 Confidence interval

Suppose $X_1, ..., X_n$ is an independent sample from a population $Normal(\mu, \sigma^2)$.
Sample mean

$$\bar{X} = \frac{X_1 + ... + X_n}{n}$$

Sample variance

$$s^2 = \frac{1}{n-1} \sum_{i=1}^{n} (X_i - \bar{X})^2$$

Then

$$T = \frac{\bar{X} - \mu}{\frac{S}{\sqrt{n}}} = \frac{\bar{X} - \mu}{s.e}$$

s.e is the standard error of the sample mean

3 Summary

In summary, this book has no content whatsoever.

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[1] 2
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References

Knuth, Donald E. 1984. "Literate Programming." *Comput. J.* 27 (2): 97–111. https://doi.org/10.1093/comjnl/27.2.97.