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DATA 613 Data Science

Data Science: Final Project Status Update: Computing “n = 1 inference”

Wall, Boen and Tweedie (2001, hence WBT) offer an approach to calculating a finite confidence interval for the mean of a normal distribution when n = 1.

x ~ N(µ, σ2) represents a Normal distribution.

x = sample observation that follows this Normal distribution

µ = mean of the dataset

σ2 = variance of the dataset (square of the standard deviation)

Here, the confidence interval is of the following form:

𝜇 ∈ 𝑥 ± δ‖𝑥‖, where δ (delta) represents a positive scalar.

For our final project, our team will create an R package for computing confidence intervals for means when the sample size is n = 1. We will focus on the following aspects when maximizing functionality:

1. We will need to demonstrate a couple of methods for deriving δ, either through:
   1. numerically solving an equation for δ
   2. closed-form approximations (basic operations – addition, subtraction, etc.)
2. Our user should have the ability to set the coverage probability. In this case, “coverage probability” represents the opposite of the confidence interval. For example, if our confidence interval is 95%, the coverage probability is 1 – 0.95, or 0.05, represented by α (alpha).
3. Our package should allow the user to shift x by some constant ‘a’ and obtain:
   1. a new Normal distribution (x – a) ~ N(µ – a, σ2), and
   2. a new confidence interval 𝜇 ∈ (𝑥 – a) ± δ‖(𝑥 – a)‖.
4. In our package, we will allow the user to obtain p-values against a null (this allows the user to test a null hypothesis against some alternative hypothesis; for example, H0: p-value < 0.05, HA: p-value > 0.05)
5. We also hope to extend our package to finding confidence intervals of a similar form for when n >1; however, WBT finds that results are not ideal when n > 2.