

Confidence interval for a coefficient of variation

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#####  
# Alternative 1. Using the non-central t-distribution #  
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# McKay AT. Distribution of the coefficient of variation and the extended t distribution,  
# JRSS 1932;95:695–698.  
  
# Data  
x <- c(326,302,307,299,329,250,324,286,319,288)  
  
library(MBESS)  
ci.cv(data=x, conf.level=.95)  
  
#####  
# Alternative 2. Resampling using bootstrap #  
#####  
  
# CV function  
CV <- function(x) sqrt(var(x))/mean(x)  
  
# Number of bootstrap samples  
bootstrap <- numeric(1000)  
  
# Do the resampling  
for (i in 1:1000) bootstrap[i] <- CV(sample(x,replace=T))  
  
# Original CV estimate  
CV(x)  
  
# Bootstrap CV estimate  
mean(bootstrap)  
  
# Bootstrap corrected CV estimate  
bias <- mean(bootstrap) - CV(x)  
CV(x) - bias  
  
# Confidence limits assuming normality  
CV(x) - bias - 1.96*sqrt(var(bootstrap))  
CV(x) - bias + 1.96*sqrt(var(bootstrap))  
  
# Efron's confidence limits  
quantile(bootstrap,0.025)  
quantile(bootstrap,0.975)  
  
# Hall's confidence limits  
2*CV(x) - quantile(bootstrap,0.975)  
2*CV(x) - quantile(bootstrap,0.025)
```

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#####
# Alternative 3. Resampling using Jackknife estimation #
#####

jackknife <- numeric(length(x)-1)
pseudovalues <- numeric(length(x))
for (i in 1:length(x))
{ for (j in 1:length(x))
{ if(j < i) jackknife[j] <- x[j] else if(j > i) jackknife[j-1] <- x[j]}
pseudovalues[i] <- length(x)*CV(x) -(length(x)-1)*CV(jackknife)}

# Jackknife CV estimate
mean(pseudovalues)

# Approximate Jackknife confidence intervals
mean(pseudovalues) - qt(0.975,length(x)-1)*sqrt(var(pseudovalues)/length(x))
mean(pseudovalues) + qt(0.975,length(x)-1)*sqrt(var(pseudovalues)/length(x))
```