Confidence Intervals for Percentiles

Eamonn

02 December, 2016

Quantiles of the binomial distribution approach

```
set.seed(321)
x <- rexp(120, rate=0.10) # create continuous data, no ties

conf2 <- 0.95             # confidence level
low <- (1- conf2)/2 ; up <- 1-low

# What percentile is the value of 10?
(p <- sum(x <= 1/0.10 )/length(x))
```

```
[1] 0.625
```

```
# confidence intervals for the percentile estimate 'p'
sort(x)[qbinom(c(low, up), size=length(x), prob=p)]
```

```
[1]  7.415326 12.551951
```

Bootstrap method (BCa), an approximation to the quantiles of the binomial distribution approach

```
f.quantile <- function(x, ind, ...){
  quantile(x[ind], ...)
}

# the percentile p is bootstrapped, ensure No of bootstraps is > than sample size
quant.boot <- boot(x, f.quantile, R = 10000, probs = p)

# apply the boo.ci function, note BCa option
boot.ci(quant.boot, c(conf2), type = c("bca") )
```

```
BOOTSTRAP CONFIDENCE INTERVAL CALCULATIONS
Based on 10000 bootstrap replicates

CALL :
boot.ci(boot.out = quant.boot, conf = c(conf2), type = c("bca"))

Intervals :
Level       BCa
95%   ( 7.415, 12.552 )
Calculations and Intervals on Original Scale
```

CONCLUSION

REFERENCES

http://stats.stackexchange.com/questions/186957/ is-there-a-reliable-nonparametric-confidence-interval-for-the-mean-of-a-skewed-d

http://stats.stackexchange.com/questions/21103/confidence-interval-for-median/21116#21116

COMPUTING ENVIRONMENT

```
R version 3.2.2 (2015-08-14)
Platform: x86_64-w64-mingw32/x64 (64-bit)
Running under: Windows 8 x64 (build 9200)

locale:
[1] LC_COLLATE=English_United Kingdom.1252
[2] LC_CTYPE=English_United Kingdom.1252
[3] LC_MONETARY=English_United Kingdom.1252
[4] LC_NUMERIC=C
[5] LC_TIME=English_United Kingdom.1252

attached base packages:
[1] stats     graphics  grDevices utils     datasets  methods
[7] base

other attached packages:
[1] boot_1.3-17       DescTools_0.99.18 knitr_1.15

loaded via a namespace (and not attached):
 [1] Rcpp_0.12.8      mvtnorm_1.0-5    digest_0.6.10
 [4] assertthat_0.1   MASS_7.3-45      magrittr_1.5
 [7] evaluate_0.10    stringi_1.1.2    rmarkdown_1.1
[10] tools_3.2.2      stringr_1.1.0    foreign_0.8-65
[13] yaml_2.1.14      manipulate_1.0.1 htmltools_0.3.5
[16] tibble_1.2


[1] "C:/Users\\User\\Documents\\GIT\\confidence-intervals-for-percentilers"
```

This took 3.38 seconds to execute.