The Bayesian Bootstrap, Estimating Correlation Tuesday, 10 March 2020

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1 Example showing Frequentist and Bayesian bootstrap correlation : Data comparing two methods of measuring blood flow

```
> set.seed(123)
> p3 <- function(x) {formatC(x, format="f", digits=3)}
> sims=19999
> library(LaplacesDemon)
> dye <- c(1.15, 1.7, 1.42, 1.38, 2.8, 4.7, 4.8, 1.41, 3.9)
> efp <- c(1.38, 1.72, 1.59, 1.47, 1.66, 3.45, 3.87, 1.31, 3.75)
> data.set <- data.frame(dye,efp)
```

1.1 Frequentist bootstrap function

```
> sboot <- function() {
   cor(data.set[sample(1:9, replace=T),])[1,2]
 }
```

1.2 Bayesian bootstrap function

```
> bboot <- function() {
   cov.wt(data.set, diff(c(0,sort(runif(8)),1)), cor=T)$cor[1,2]
 }
```

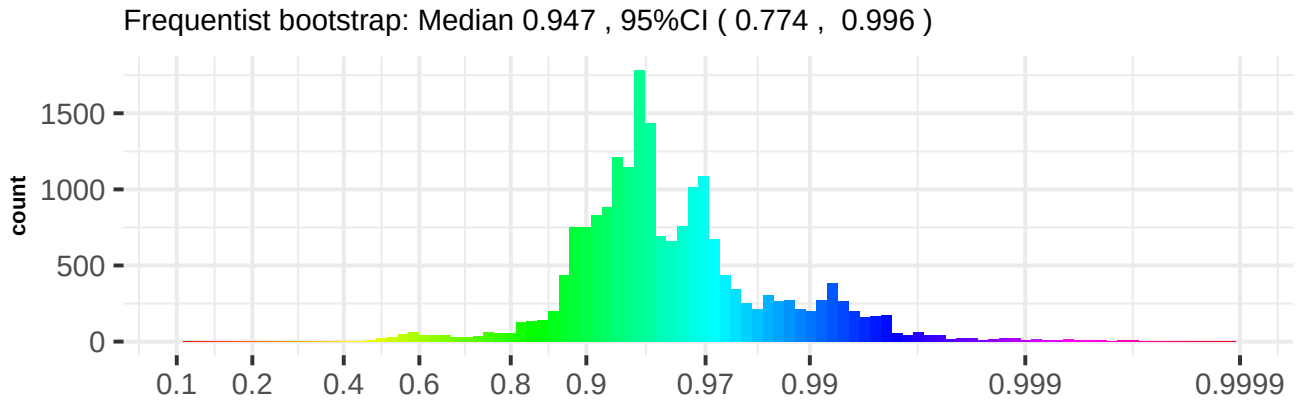
1.3 Bayesian bootstrap using LaplaceDemon function

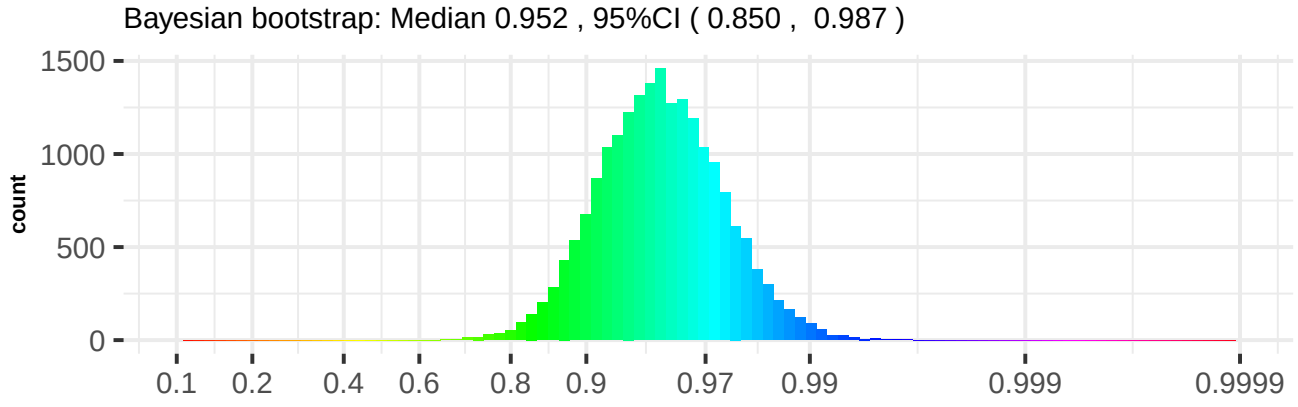
```
> X <- matrix(c(dye,efp), length(dye), 2)
> colnames(X) <- c("dye","efp")
> BB <- BayesianBootstrap(X=X, n=sims,
                          Method=function(x,w) cov.wt(x, w, cor=TRUE)$cor[1,2])
```

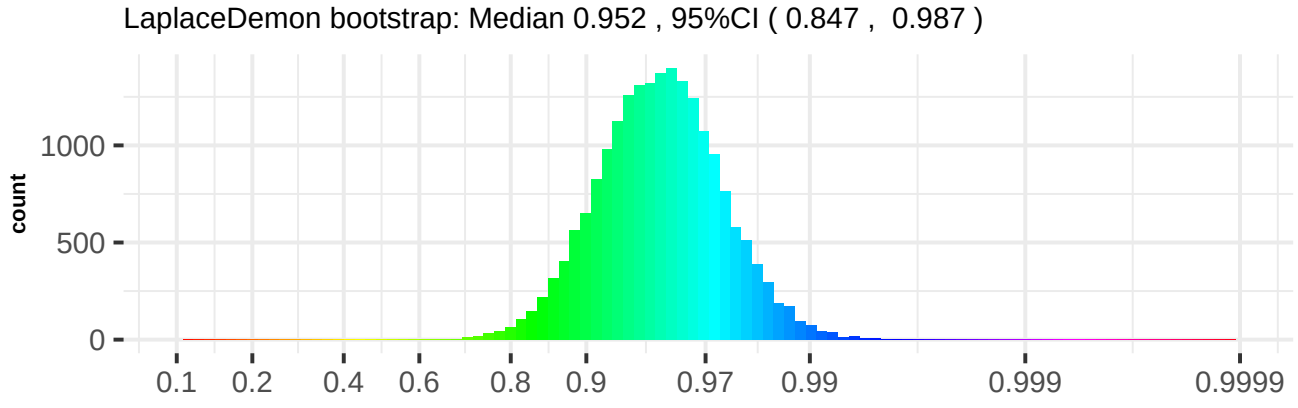
1.4 Bayesian bootstrap using bayesboot function

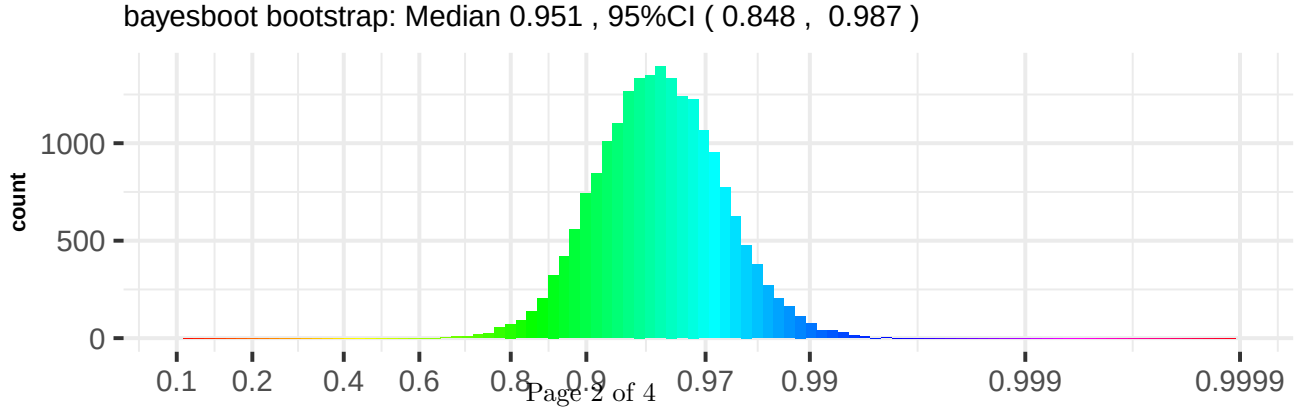
```
> library(bayesboot)
> # Using the weighted correlation (corr) from the boot package.
> library(boot)
> b4 <- bayesboot(data.set, corr, R = sims, use.weights = TRUE)
```

2 Frequentist and Bayesian correlation estimates, plotted using a logistic transformation









3 Standard Correlation Function

```
> cor.test(X[,1],X[,2])
        Pearson's product-moment correlation

data:  X[, 1] and X[, 2]
t = 7.6329, df = 7, p-value = 0.0001229
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.7536150 0.9886178
sample estimates:
      cor
0.9448478
```

4 References

http://rsnippets.blogspot.ie/2012/11/possible-error-bayesian-bootstrap.html
http://rsnippets.blogspot.ie/2012/11/simple-bayesian-bootstrap.html
https://projecteuclid.org/download/pdf_1/euclid.aos/1176345338
polya package in R
http://www.ism.ac.jp/editsec/aism/pdf/048_4_0663.pdf
http://www.people.fas.harvard.edu/~mparzen/published/parzen25.pdf

SOFTWARE AND SCRIPT VERSIONS

```
R version 3.6.1 (2019-07-05)
Platform: x86_64-w64-mingw32/x64 (64-bit)
Running under: Windows 10 x64 (build 18363)

Matrix products: default

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

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

other attached packages:
[1] ggplot2_3.2.1        boot_1.3-22
[3] bayesboot_0.2.2      LaplacesDemon_16.1.4

loaded via a namespace (and not attached):
 [1] Rcpp_1.0.3       magrittr_1.5     tidyselect_0.2.5
 [4] munsell_0.5.0    colorspace_1.4-1 R6_2.4.1
 [7] rlang_0.4.4      plyr_1.8.5       dplyr_0.8.3
[10] tools_3.6.1      parallel_3.6.1   grid_3.6.1
[13] gtable_0.3.0     withr_2.1.2      lazyeval_0.2.2
[16] assertthat_0.2.1 tibble_2.1.3     lifecycle_0.1.0
[19] crayon_1.3.4     gridExtra_2.3    farver_2.0.3
[22] purrr_0.3.3      glue_1.3.1       labeling_0.3
[25] compiler_3.6.1   pillar_1.4.3     scales_1.1.0
[28] pkgconfig_2.0.3
[1] "C:/Users/HP/Documents/Bayesian_bootstrap"
[1] "Time to execute code (minutes) 0.49"
[1] "Executed: 23:29:47, Tue, Mar 10 2020"
C:/Users/HP/Documents/Bayesian_bootstrap
```