07-23-2023

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2023-07-23

Simulated Data

```
Cox_Simulation <- function(n,a,beta,lower,upper,
                           lower_cens, upper_cens){
  x = runif(length(beta)*n,lower,upper)
  X = matrix(x,n,length(beta))
  # the exponential part
  b = as.numeric(exp(X%*%beta))
  U = runif(n,0,1)
  time = sqrt(-2*log(1-U)/(a*b))

  cens_time <- runif(n, min=lower_cens, max=upper_cens)
  Y <- pmin(time, cens_time)
  delta <- ifelse(time <= cens_time, 1, 0)
  return(list(Y=Y, delta=delta, Time = time,
              X = X))
}

tst <- Cox_Simulation(100, a=1, beta=c(1,2,3), lower=0, upper=1,
                      lower_cens=0.4, upper_cens=0.8)
## use tst$Y and tst$delta as the survival outcomes
```

```
library(survival)
Cox = summary(coxph(Surv(tst$Y,tst$delta)~tst$X))
Cox
```

```
## Call:
## coxph(formula = Surv(tst$Y, tst$delta) ~ tst$X)
##
##   n= 100, number of events= 87
##
##           coef exp(coef) se(coef)     z Pr(>|z|)
## tst$X1  1.8090    6.1043   0.4231 4.276 1.90e-05 ***
## tst$X2  2.4036   11.0627   0.4496 5.346 8.98e-08 ***
## tst$X3  3.5405   34.4829   0.5076 6.975 3.05e-12 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##        exp(coef) exp(-coef) lower .95 upper .95
```

```
## tst$X1     6.104    0.16382     2.664     13.99
## tst$X2    11.063    0.09039     4.583     26.70
## tst$X3    34.483    0.02900    12.751     93.25
##
## Concordance= 0.759  (se = 0.024 )
## Likelihood ratio test= 73.82  on 3 df,   p=6e-16
## Wald test            = 56.75  on 3 df,   p=3e-12
## Score (logrank) test = 61.49  on 3 df,   p=3e-13
```

Prepare the parameter

```
system.time({

  result1 = MH_Sampling(tti,Y,Y.test,delta,delta.test,tau,
                        A,A.test,beta0,sigma0,var.prop,
                        m,B,eta,
                        Wmat_option=0)

})
```

```
##    user  system elapsed
##   43.36    7.83   67.72
```

```
system.time({

  result2 = MH_GP_Sampling(tti,Y,Y.test,delta,delta.test,tau,
                        A,A.all,beta0,alpha0,v0,kappa,
                        m,B,eta,K.all,n,
                        Wmat_option=0)



})
```

```
##    user  system elapsed
##  311.03   12.36  464.38
```

```
system.time({
  result3 = MH_horseshoe_Sampling(tti,Y,Y.test,delta,delta.test,tau,
                                  A,A.test,beta0,sigma0,var.prop,
                                  m,B,eta,v,
                                  Wmat_option=0)

})
```

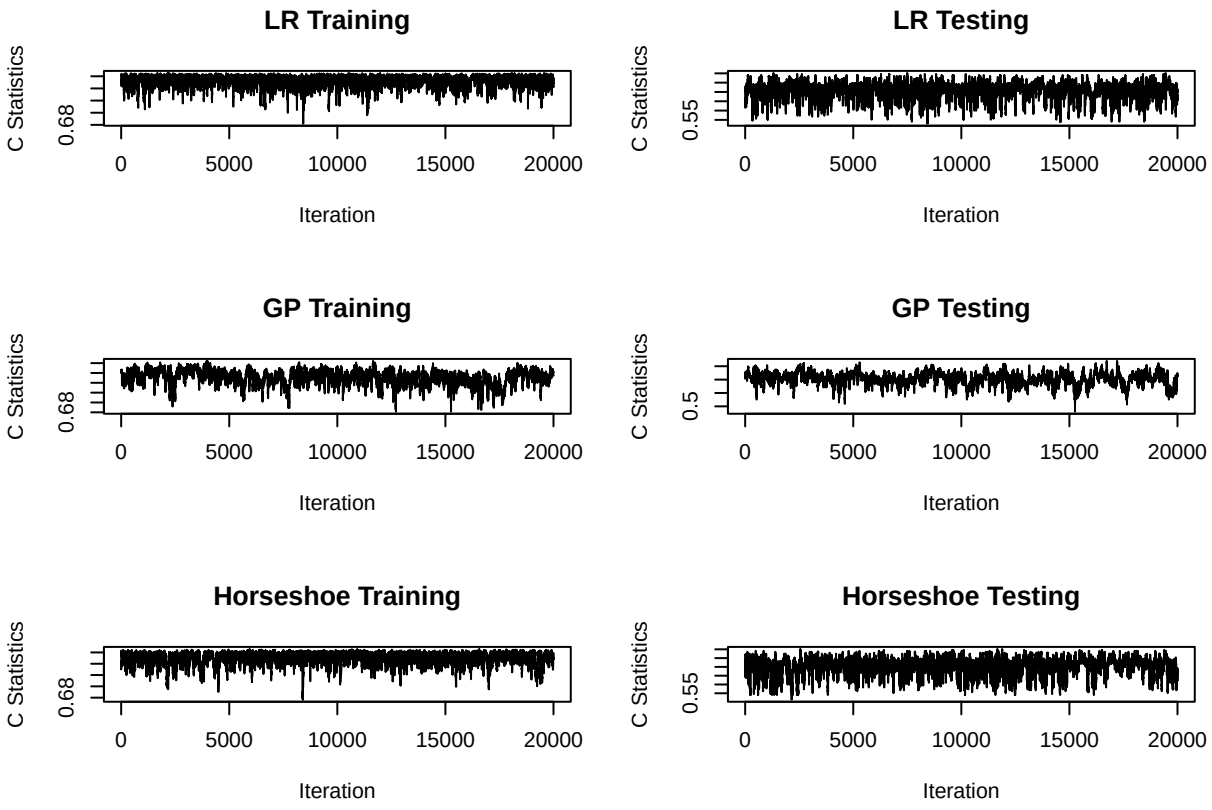
```
##    user  system elapsed
##   50.63    3.52   74.29
```

```
Wmat = HarrellC_Wmat(Y,delta,tau)
Wmat.test = HarrellC_Wmat(Y.test,delta.test,tau)
```

```
all = data.frame(Model = c("Cox","Linear Regression","Gaussian Process",
                           "LR with horseshoe"),
       C_train = c(C_index(THETA(A,Cox$coefficients[,1]),Wmat),
                   C_index(colMeans(result1$THETA),Wmat),
                   C_index(colMeans(result2$BETA),Wmat),
                   C_index(colMeans(result3$THETA),Wmat)),
       C_test = c(C_index(THETA(A.test,Cox$coefficients[,1]),Wmat.test),
                  C_index(colMeans(result1$THETA.test),Wmat.test),
                  C_index(colMeans(result2$BETA_test),Wmat.test),
                  C_index(colMeans(result3$THETA.test),Wmat.test)),
       Spearman = c(cor(THETA(A.test,Cox$coefficients[,1]),
                        THETA(A.test,c(1,2,3)), method="spearman"),
                    cor(colMeans(result1$THETA.test),
                        THETA(A.test,c(1,2,3)), method="spearman"),
                    cor(colMeans(result2$BETA_test),
                        THETA(A.test,c(1,2,3)), method="spearman"),
                    cor(colMeans(result3$THETA.test),
                        THETA(A.test,c(1,2,3)), method="spearman")),
       Kendall = c(cor(THETA(A.test,Cox$coefficients[,1]),
                        THETA(A.test,c(1,2,3)), method="kendall"),
                    cor(colMeans(result1$THETA.test),
                        THETA(A.test,c(1,2,3)), method="kendall"),
                    cor(colMeans(result2$BETA_test),
                        THETA(A.test,c(1,2,3)), method="kendall"),
                   cor(colMeans(result3$THETA.test),
                        THETA(A.test,c(1,2,3)), method="kendall")
                    ))
all
```

```
##               Model   C_train    C_test  Spearman   Kendall
## 1               Cox 0.7622469 0.7326203 0.9939850 0.9684211
## 2 Linear Regression 0.7606140 0.7165775 0.9939850 0.9684211
## 3  Gaussian Process 0.7720444 0.7112299 0.9834586 0.9473684
## 4 LR with horseshoe 0.7602874 0.7219251 0.9924812 0.9578947
```

```
par(mfrow=c(3,2))
plot(1:(m-B),result1$C_stat,type = "l",
     xlab = "Iteration",ylab = "C Statistics",main = "LR Training")
plot(1:(m-B),result1$C_stat.test,type = "l",
     xlab = "Iteration",ylab = "C Statistics",main = "LR Testing")
plot(1:(m-B),result2$C_stat,type = "l",
     xlab = "Iteration",ylab = "C Statistics",main = "GP Training")
plot(1:(m-B),result2$C_stat_test,type = "l",
     xlab = "Iteration",ylab = "C Statistics",main = "GP Testing")
plot(1:(m-B),result3$C_stat,type = "l",
     xlab = "Iteration",ylab = "C Statistics",main = "Horseshoe Training")
plot(1:(m-B),result3$C_stat.test,type = "l",
     xlab = "Iteration",ylab = "C Statistics",main = "Horseshoe Testing")
```


LR Training
C Statistics
0.68
0
5000
10000
15000
20000
Iteration
LR Testing
C Statistics
0.55
0
5000
10000
15000
20000
Iteration
GP Training
C Statistics
0.68
0
5000
10000
15000
20000
Iteration
GP Testing
C Statistics
0.5
0
5000
10000
15000
20000
Iteration
Horseshoe Training
C Statistics
0.68
0
5000
10000
15000
20000
Iteration
Horseshoe Testing
C Statistics
0.55
0
5000
10000
15000
20000
Iteration