500

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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(500, 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$X)
##
##   n= 500, number of events= 428
##
##           coef exp(coef) se(coef)      z Pr(>|z|)
## tst$X1  1.0719    2.9211   0.1656  6.474 9.52e-11 ***
## tst$X2  1.8956    6.6566   0.1856 10.215  < 2e-16 ***
## tst$X3  2.8155   16.7017   0.2011 14.002  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##        exp(coef) exp(-coef) lower .95 upper .95
```

```
## tst$X1     2.921    0.34234     2.112     4.041
## tst$X2     6.657    0.15023     4.627     9.577
## tst$X3    16.702    0.05987    11.262    24.769
##
## Concordance= 0.736  (se = 0.012 )
## Likelihood ratio test= 310.9  on 3 df,   p=<2e-16
## Wald test            = 283.9  on 3 df,   p=<2e-16
## Score (logrank) test = 304.5  on 3 df,   p=<2e-16
```

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
##  156.22   47.42  218.66
```

```
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
## 7428.27  245.25 8134.92
```

```
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)

})
```

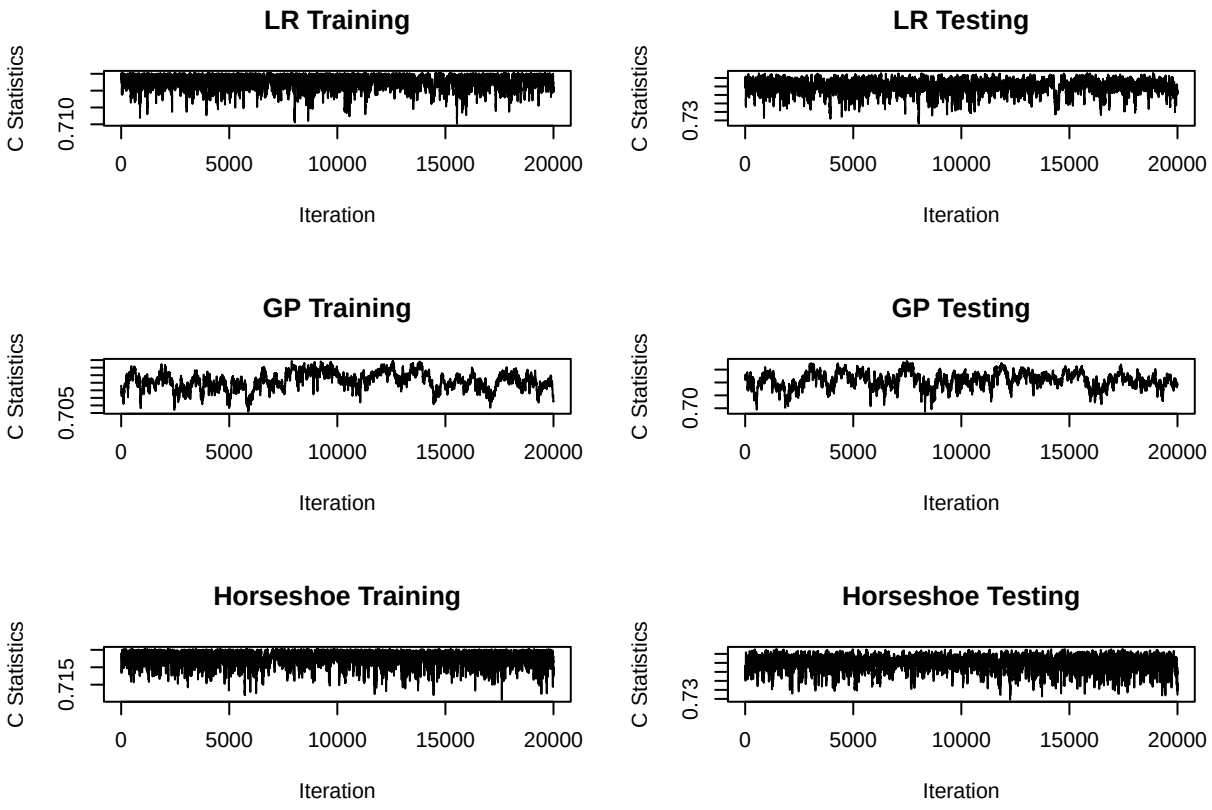
```
##    user  system elapsed
##  149.34   50.31  209.90
```

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

```r
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 0.7232943 0.7802198 0.9989679 0.9806061
## 2 Linear Regression 0.7251037 0.7704987 0.9925473 0.9353535
## 3  Gaussian Process 0.7410916 0.7592984 0.9621482 0.8266667
## 4 LR with horseshoe 0.7249874 0.7696534 0.9920672 0.9333333
```

```r
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
0.710
0
5000
10000
15000
20000
Iteration
LR Testing
C Statistics
0.73
0
5000
10000
15000
20000
Iteration
GP Training
C Statistics
0.705
0
5000
10000
15000
20000
Iteration
GP Testing
C Statistics
0.70
0
5000
10000
15000
20000
Iteration
Horseshoe Training
C Statistics
0.715
0
5000
10000
15000
20000
Iteration
Horseshoe Testing
C Statistics
0.73
0
5000
10000
15000
20000
Iteration