

Supplementary materials: source code for survival trees, bagging, and random survival forest

### **(1) Simulation: Model 1b**

```
library(rpart)
library(party)
library(partykit)

# Simulate data for Model 1b
set.seed(20140218)
fact<-1
N<-200
cens<-rep(1,N)
X <- matrix(runif(N * 2), ncol = 2)
  hazard <- rep(NA,N)
  hazard[(X[, 1] <= 0.6 & X[,2]<.4)] <- 0
  hazard[(X[, 1] <= 0.6 & X[,2]>.4)] <- 1
  hazard[(X[, 1] > 0.6)] <- 1
  hazard <- hazard * fact
  haz <- exp(hazard)
  time <- sapply(haz, rexp, n = 1)
simdat<-data.frame(time=time,cens=cens,x1=X[,1],x2=X[,2],haz=haz)
surv<-Surv(time=simdat$time,event=simdat$cens)

# Grow a tree in party
party1<-ctree(surv~x1+x2,data=simdat)
plot(party1)

# Grow a tree in rpart
rpart1<-rpart(surv~x1+x2,data=simdat,method="exp")
plot(as.party(rpart1))
```

### **(1) Simulation: Model 2b**

```
# Simulate data for Model 2b
X <- matrix(runif(N * 2), ncol = 2)
  hazard <- rep(NA,N)
  hazard <- 3*X[,1]+X[,2]+X[,1]*X[,2]
  haz <- exp(hazard)
  time <- sapply(haz, rexp, n = 1)

# Choose gamma value for a desired censoring rate
gamma<-0.55
#gamma<-0.16
#gamma<-0.05

censtime <- runif(N, min = 0, max = gamma)
```

```
event<-as.numeric(time<=censtime)
lasttime<-pmin(time,censtime)
simdat<-data.frame(lasttime=lasttime,event=event,x1=X[,1],x2=X[,2],haz=haz)
surv<-Surv(time=simdat$lasttime,event=simdat$event)
```

```
# Grow a tree in party
party1<-ctree(surv~x1+x2,data=simdat)
plot(party1)
```

```
# Fit a Cox regression model
cox1<-coxph(surv~x1+x2+x1*x2,data=simdat)
summary(cox1)
```

```
# Apply the bagging procedure
library(ipred)
set.seed(20101210)
mod1 <- bagging(surv~x1+x2,data=simdat,coob=T,nbagg=100)
print(mod1)
mod2 <- bagging(surv~x1,data=simdat,coob=T,nbagg=100)
print(mod2)
mod3 <- bagging(surv~x2,data=simdat,coob=T,nbagg=100)
print(mod3)
```

```
# Grow a random survival forest
library(randomSurvivalForest)
set.seed(20101211)
ntree <- 500
v.out <- rsf(Surv(lasttime,event)~x1+x2, simdat, ntree=ntree, forest=T)
print(v.out)
plot(v.out)
```