Tree Model Examples

Some remarks on rpart()

$cp = \alpha / SS_0$.

xerror is (relative) sum-of-squared errors in tenfold cross-validation.

xstd represents variation in prediction across the ten validation samples.

Simulate some data for tree-fitting examples

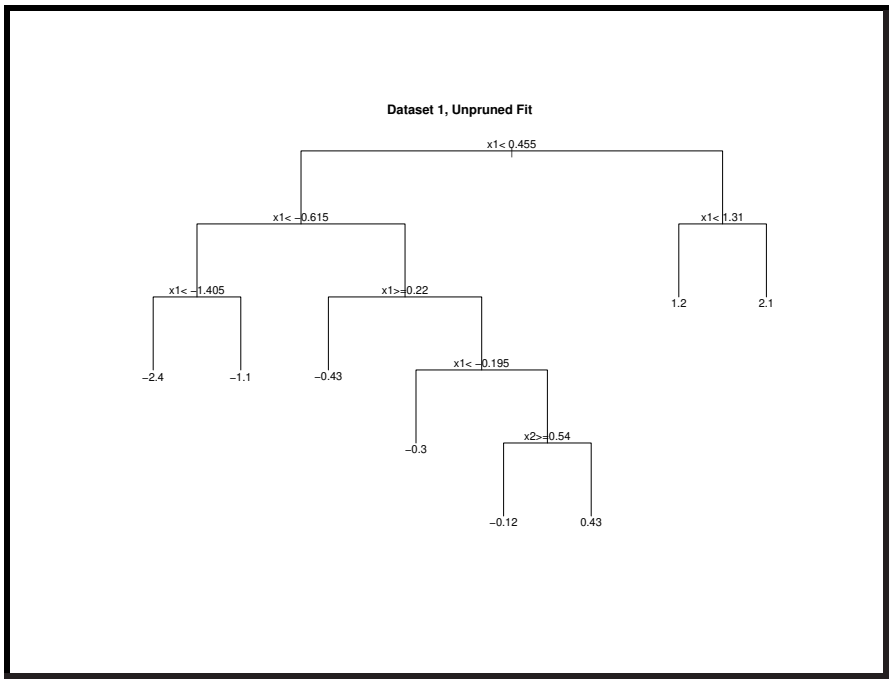
```
> set.seed(150)
> x1 <- round(rnorm(100),2); x2 <- round(rnorm(100),2)
> noise <- round(rnorm(100),2)

> y <- x1+noise; dt <- data.frame(cbind(y,x1,x2))

> set.seed(794)
> fit1.a <- rpart(y~x1+x2,data=dt, cp=.001)
> fit1.b <- rpart(y~x1+x2,data=dt, cp=.001)
```

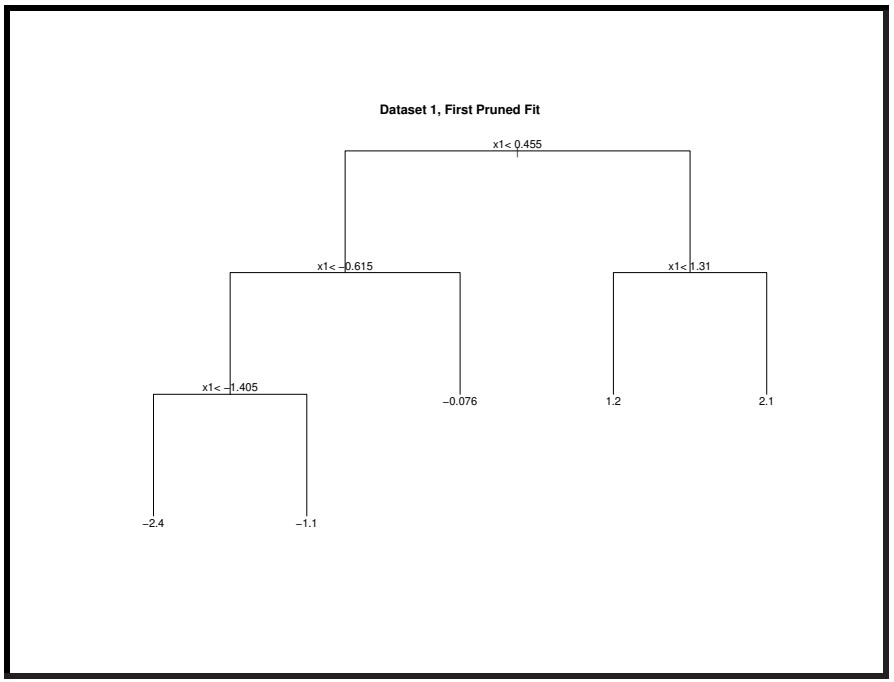


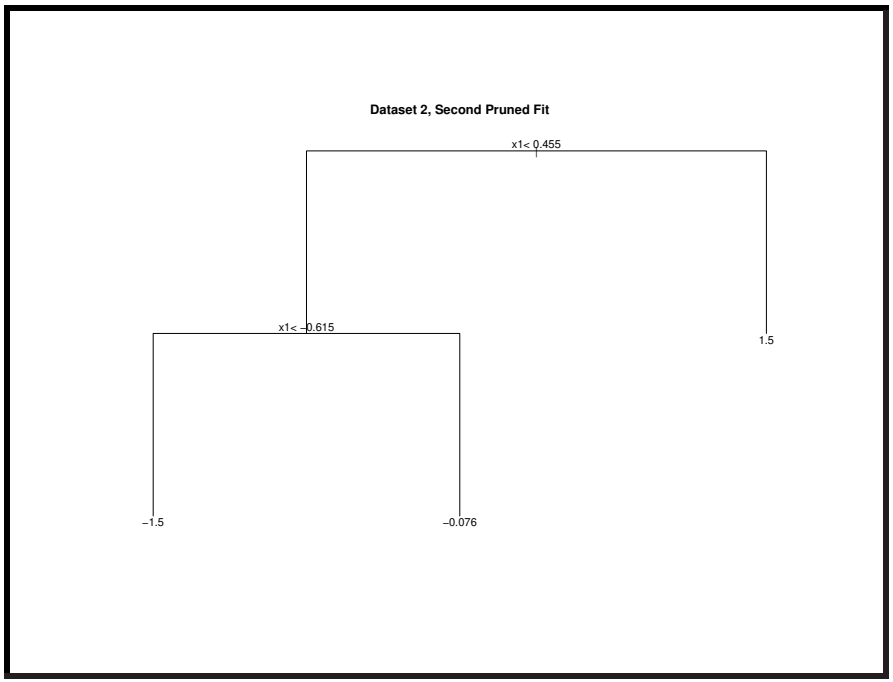
```
> printcp(fit1a)
Regression tree:
rpart(formula = y ~ x1 + x2, data = dt, cp = 0.001)
Root node error: 233.31/100 = 2.3331

         CP nsplit rel error  xerror     xstd
1 0.3982870      0   1.00000 1.01170 0.136653
2 0.1541180      1   0.60171 0.70437 0.103025
3 0.0384161      2   0.44760 0.49255 0.076145
4 0.0226927      3   0.40918 0.46238 0.069819
5 0.0090841      4   0.38649 0.45191 0.068230
6 0.0060035      6   0.36832 0.49262 0.074234
7 0.0010000      7   0.36231 0.48833 0.072860

> fit1.a.pruned <- prune(fit1.a, cp=.02)
```



```
> printcp(fit1.b)
Regression tree:
rpart(formula = y ~ x1 + x2, data = dt, cp = 0.001)
Root node error: 233.31/100 = 2.3331

         CP nsplit rel error  xerror     xstd
1 0.3982870      0   1.00000 1.01227 0.137338
2 0.1541180      1   0.60171 0.76735 0.112788
3 0.0384161      2   0.44760 0.49054 0.075356
4 0.0226927      3   0.40918 0.49428 0.076309
5 0.0090841      4   0.38649 0.50970 0.077870
6 0.0060035      6   0.36832 0.53877 0.079370
7 0.0010000      7   0.36231 0.53700 0.079119

> fit1.b.pruned <- prune(fit1.b, cp=.04)
```

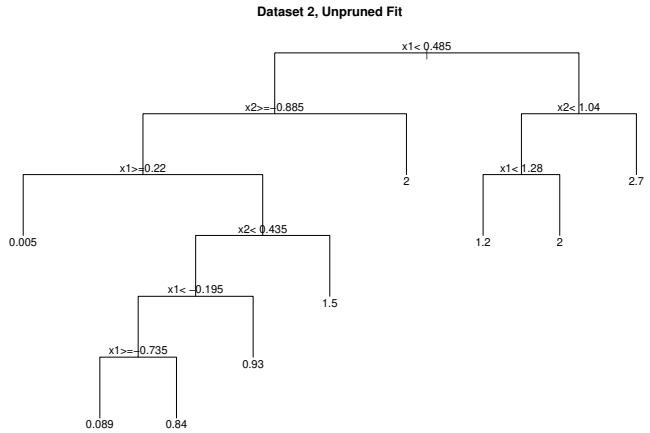


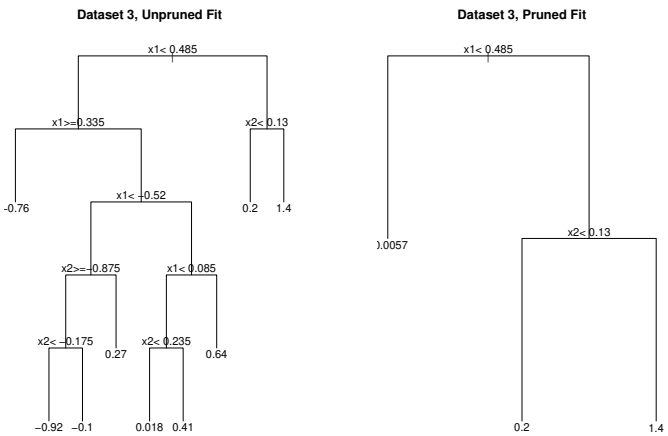




Second example

```
> y <- round(sqrt(x1^2+x2^2)+noise,digits=2)

> fit2 <- rpart(y~x1+x2,data=dt, cp=.001)

        CP nsplit rel error xerror    xstd
1 0.112013      0   1.00000 1.0394 0.15894
2 0.105763      1   0.88799 1.1493 0.16595
3 0.054138      2   0.78222 1.0258 0.14791
4 0.044665      4   0.67395 1.0714 0.14507
5 0.021122      5   0.62928 1.0340 0.15335
6 0.015787      6   0.60816 1.0113 0.14765
7 0.000001      8   0.57659 1.0155 0.15094
```



Third Example

```
> y <- round( as.numeric((x1>0)&(x2>0)) + noise,digits=2)

> fit3 <- rpart(y~x1+x2,data=dt, cp=.001)

         CP nsplit rel error  xerror    xstd
1 0.1042658      0   1.00000 1.04412 0.14304
2 0.0799562      1   0.89573 1.08600 0.14176
3 0.0407288      2   0.81578 0.99553 0.14747
4 0.0266698      4   0.73432 1.11006 0.15831
5 0.0148459      6   0.68098 1.13835 0.16006
6 0.0067386      7   0.66614 1.11390 0.15893
7 0.0010000      8   0.65940 1.11464 0.15804

> fit3.pruned <- prune(fit3, cp=.05)
```