Boosting

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Boosting

Boosting builds lots of smaller trees. Unlike random forests, each new tree in boosting tries to patch up the deficiencies of the current ensemble.

```
library(gbm)
```

```
## Warning: package 'gbm' was built under R version 3.3.3
```

```
## Loading required package: survival
```

```
## Loading required package: lattice
```

```
## Loading required package: splines
```

```
## Loading required package: parallel
```

```
## Loaded gbm 2.1.3
```

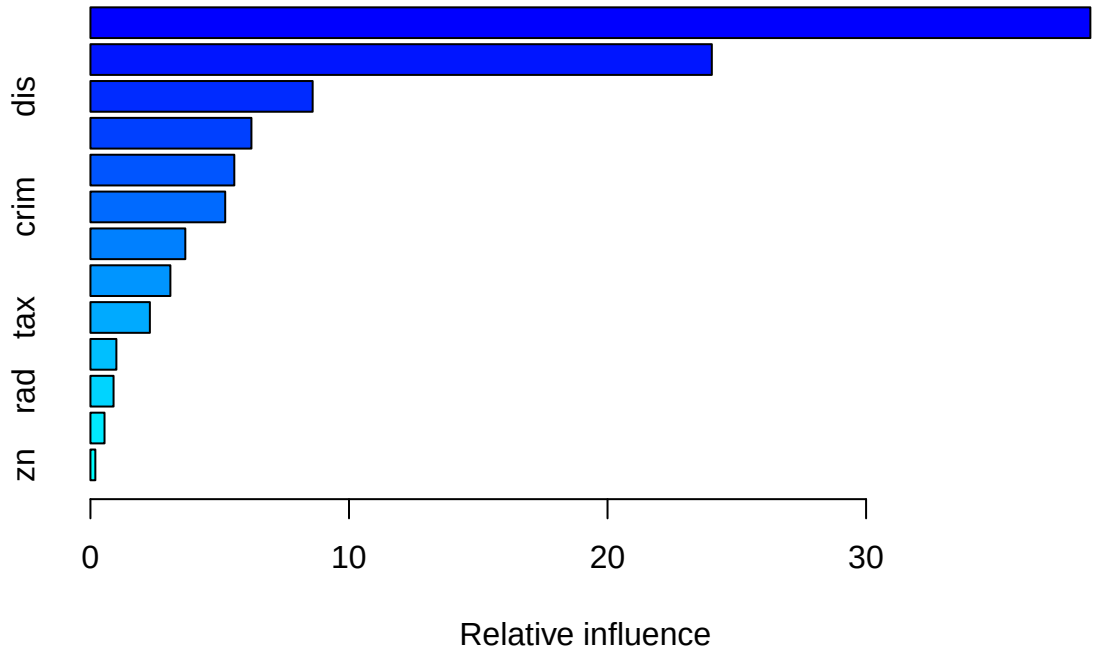
```
library(ISLR)
```

```
## Warning: package 'ISLR' was built under R version 3.3.3
```

```
library(MASS)
```

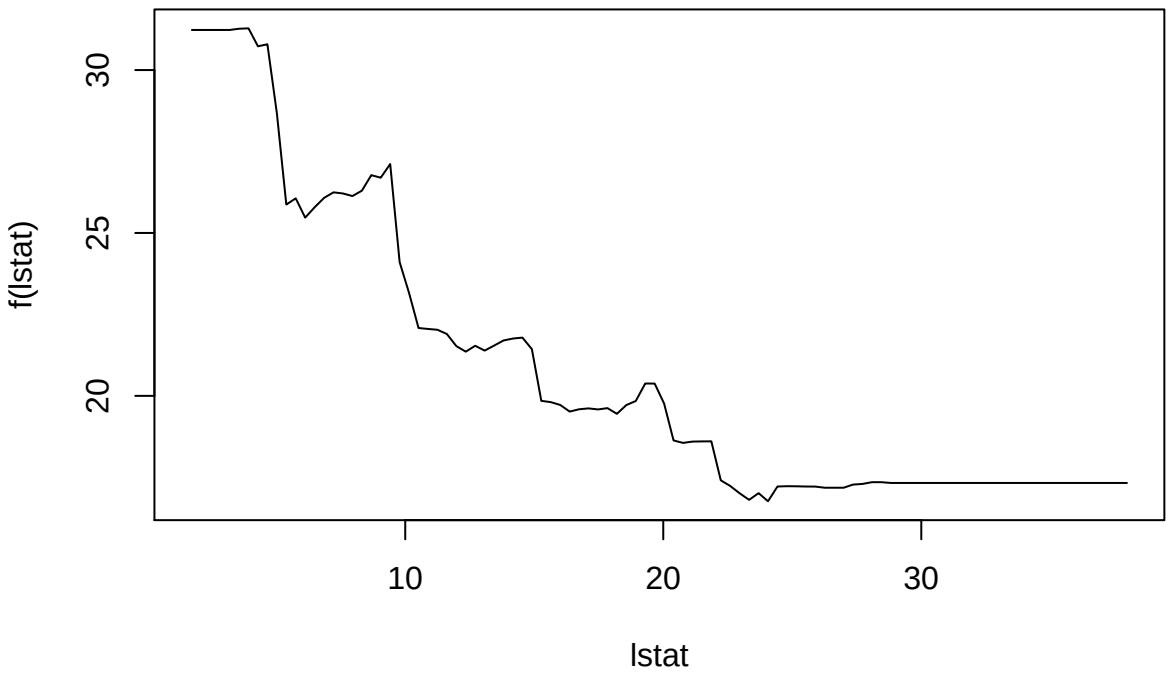
```
## Warning: package 'MASS' was built under R version 3.3.3
```

```
#View(Boston)
train=sample(1:nrow(Boston),300)
boost.boston=gbm(medv~.,data=Boston[train,],distribution="gaussian",n.trees=10000,shrinkage=0.01,intera
summary(boost.boston)
```

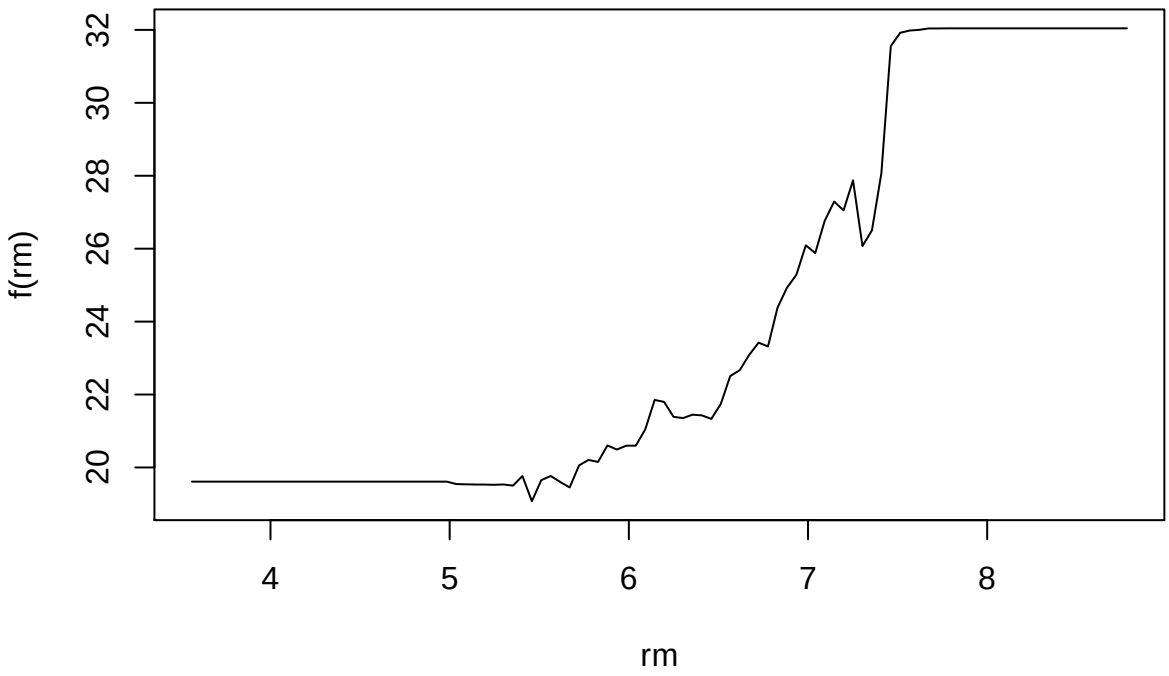



```
##             var    rel.inf
## lstat     lstat 38.6743820
## rm           rm 24.0341064
## dis         dis  8.5945754
## nox         nox  6.2267140
## age         age  5.5646177
## crim       crim  5.2125267
## black     black  3.6692445
## ptratio ptratio  3.0925433
## tax         tax  2.2994252
## indus     indus  1.0031019
## rad         rad  0.8944638
## chas       chas  0.5448754
## zn           zn  0.1894238
```

```
plot(boost.boston,i="lstat")
```




```
plot(boost.boston,i="rm")
```

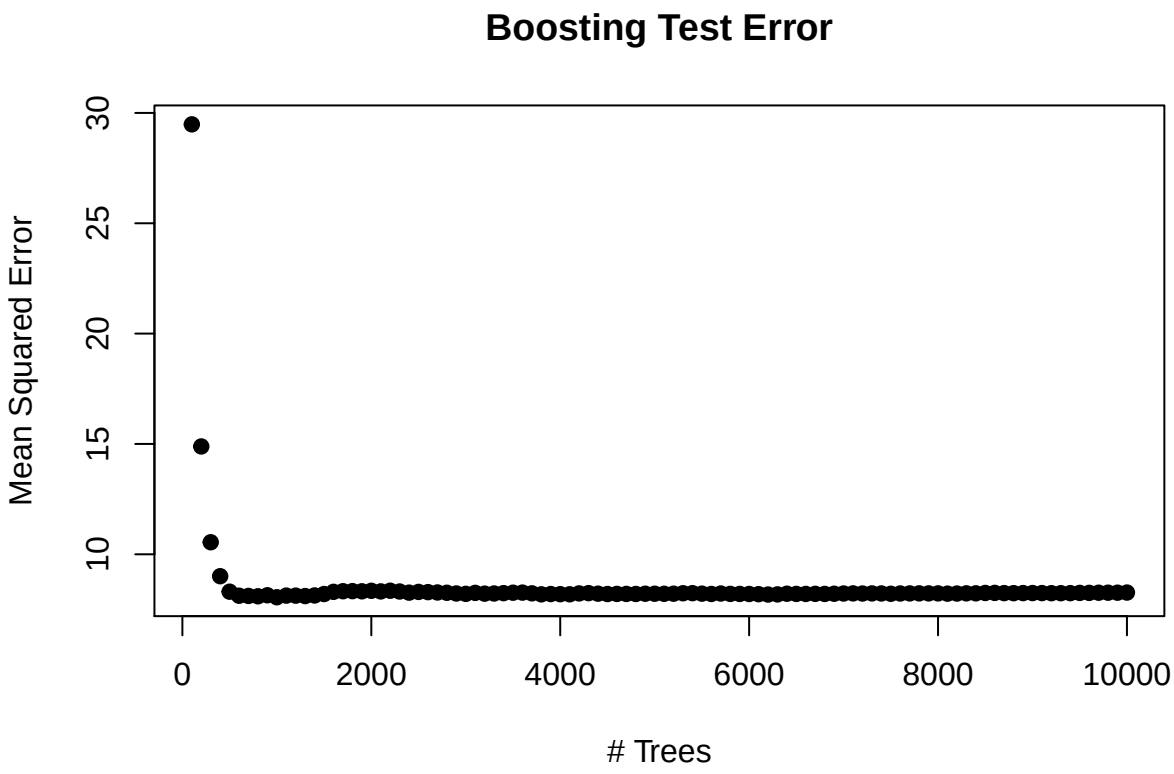


Lets make a prediction on the test set. With boosting, the number of trees is a tuning parameter, and if we have too many we can overfit. So we should use cross-validation to select the number of trees. We will leave this as an exercise. Instead, we will compute the test error as a function of the number of trees, and make a plot.

```
test.err=double(13)
n.trees=seq(from=100,to=10000,by=100)
predmat=predict(boost.boston,newdata=Boston[-train,],n.trees=n.trees)
dim(predmat)
```

```
## [1] 206 100
```

```
berr=with(Boston[-train,],apply( (predmat-medv)^2,2,mean))
plot(n.trees,berr,pch=19,ylab="Mean Squared Error", xlab="# Trees",main="Boosting Test Error")
abline(h=min(test.err),col="red")
```


Boosting Test Error
Mean Squared Error
10
15
20
25
30
0
2000
4000
6000
8000
10000
Trees