BootStrapping.R

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```
# BootStrapping

library(ISLR)
library(boot)

alpha.fn = function(data,index){

  X = data$X[index]

  Y = data$Y[index]

  return ((var(Y)-cov(X,Y)) / (var(X) + var(Y) - 2 * cov(X,Y)))

}

alpha.fn(Portfolio,1:100)
```

```
## [1] 0.5758321
```

```
set.seed(1)

alpha.fn(Portfolio,sample(100,100,replace = T))
```

```
## [1] 0.7368375
```

```
boot(Portfolio,alpha.fn,R=1000)
```

```
##
## ORDINARY NONPARAMETRIC BOOTSTRAP
##
##
## Call:
## boot(data = Portfolio, statistic = alpha.fn, R = 1000)
##
##
## Bootstrap Statistics :
##      original       bias    std. error
## t1* 0.5758321 -0.001695873  0.09366347
```

```r
# Estimate Accuracy of a Linear Regression Model


boot.fn = function(data,index)
  return (coef(lm(mpg~horsepower,data=data,subset = index)))

boot.fn(Auto,1:392)
```

```
## (Intercept)  horsepower
##  39.9358610  -0.1578447
```

```r
set.seed(1)

boot.fn(Auto,sample(392,392,replace = TRUE))
```

```
## (Intercept)  horsepower
##  40.3404517  -0.1634868
```

```r
boot.fn(Auto,sample(392,392,replace = TRUE))
```

```
## (Intercept)  horsepower
##  40.1186906  -0.1577063
```

```r
boot(Auto,boot.fn,1000)
```

```
##
## ORDINARY NONPARAMETRIC BOOTSTRAP
##
##
## Call:
## boot(data = Auto, statistic = boot.fn, R = 1000)
##
##
## Bootstrap Statistics :
##       original        bias    std. error
## t1* 39.9358610  0.0544513229 0.841289790
## t2* -0.1578447 -0.0006170901 0.007343073
```

```r
summary(lm(mpg~horsepower,data=Auto))$coef
```

```
##               Estimate  Std. Error   t value      Pr(>|t|)
## (Intercept) 39.9358610 0.717498656  55.65984 1.220362e-187
## horsepower  -0.1578447 0.006445501 -24.48914  7.031989e-81
```

```r
# Higher Polynomial Regression

boot.fn = function(data,index)
  coefficients(lm(mpg~horsepower + I(horsepower^2),data=data,subset=index))

set.seed(1)

boot(Auto,boot.fn,1000)
```

```
##
## ORDINARY NONPARAMETRIC BOOTSTRAP
##
##
## Call:
## boot(data = Auto, statistic = boot.fn, R = 1000)
##
##
## Bootstrap Statistics :
##         original        bias     std. error
## t1* 56.900099702  3.511640e-02 2.0300222526
## t2* -0.466189630 -7.080834e-04 0.0324241984
## t3*  0.001230536  2.840324e-06 0.0001172164
```

```
summary(lm(mpg~horsepower + I(horsepower^2),data=Auto))
```

```
##
## Call:
## lm(formula = mpg ~ horsepower + I(horsepower^2), data = Auto)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -14.7135  -2.5943  -0.0859   2.2868  15.8961
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)     56.9000997  1.8004268   31.60   <2e-16 ***
## horsepower      -0.4661896  0.0311246  -14.98   <2e-16 ***
## I(horsepower^2)  0.0012305  0.0001221   10.08   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.374 on 389 degrees of freedom
## Multiple R-squared:  0.6876, Adjusted R-squared:  0.686
## F-statistic:   428 on 2 and 389 DF,  p-value: < 2.2e-16
```