Lab 3: PCR and PLS Regression

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6.7.1 Components Regression

```
library(ISLR)
library(pls)
```

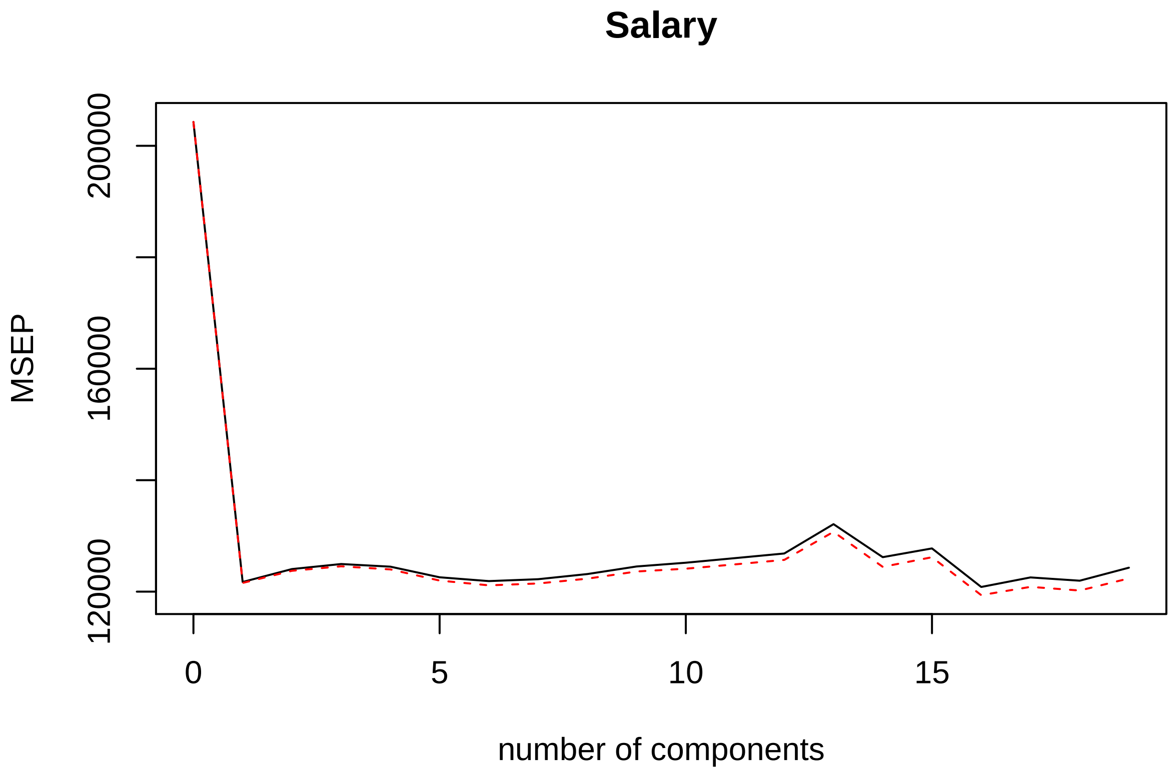
```
## Warning: package 'pls' was built under R version 3.4.4
```

```
#remove observations with missing data
Hitters = na.omit(Hitters)

#PCR regression and k-fold cross-validation
set.seed(2)
pcr.fit=pcr(Salary ~ ., data=Hitters, scale = TRUE, validation ="CV")
summary(pcr.fit)
```

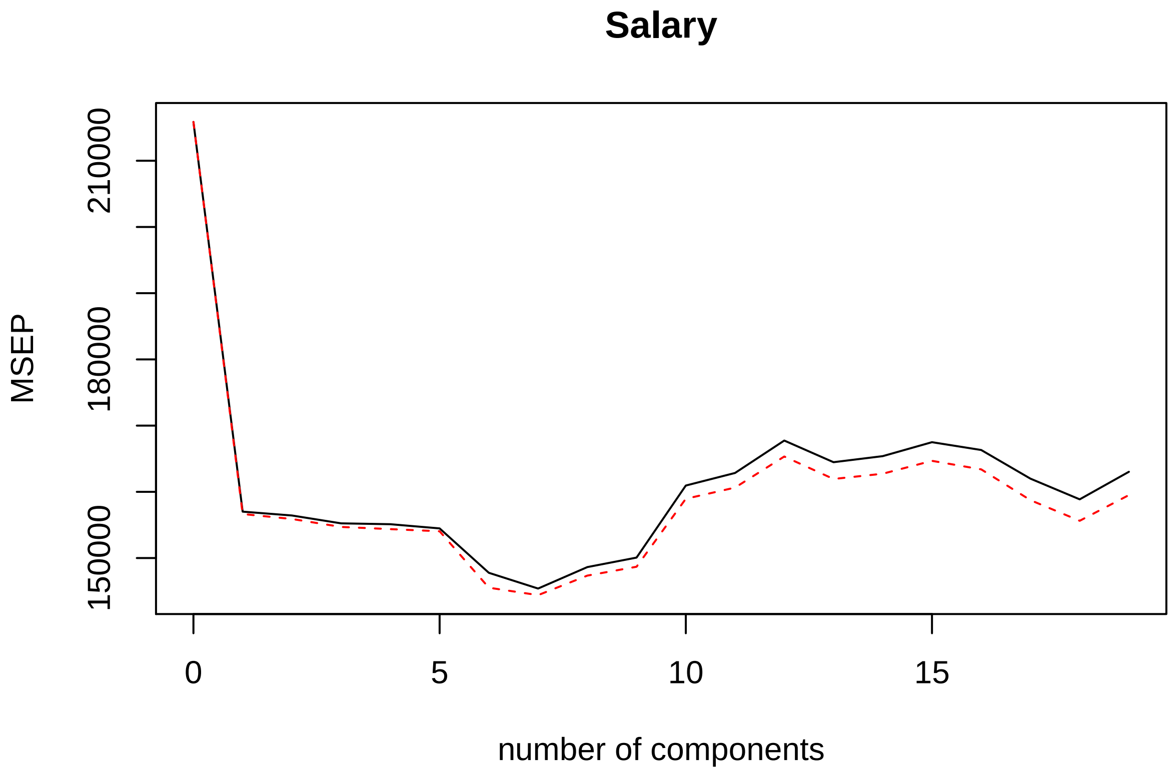
```
## Data:    X dimension: 263 19
##  Y dimension: 263 1
## Fit method: svdpc
## Number of components considered: 19
##
## VALIDATION: RMSEP
## Cross-validated using 10 random segments.
##        (Intercept)  1 comps  2 comps  3 comps  4 comps  5 comps  6 comps
## CV             452    348.9    352.2    353.5    352.8    350.1    349.1
## adjCV          452    348.7    351.8    352.9    352.1    349.3    348.0
##        7 comps  8 comps  9 comps  10 comps  11 comps  12 comps  13 comps
## CV       349.6    350.9    352.9     353.8     355.0     356.2     363.5
## adjCV    348.5    349.8    351.6     352.3     353.4     354.5     361.6
##        14 comps  15 comps  16 comps  17 comps  18 comps  19 comps
## CV        355.2     357.4     347.6     350.1     349.2     352.6
## adjCV     352.8     355.2     345.5     347.6     346.7     349.8
##
## TRAINING: % variance explained
##         1 comps  2 comps  3 comps  4 comps  5 comps  6 comps  7 comps
## X         38.31    60.16    70.84    79.03    84.29    88.63    92.26
## Salary    40.63    41.58    42.17    43.22    44.90    46.48    46.69
##         8 comps  9 comps  10 comps  11 comps  12 comps  13 comps  14 comps
## X         94.96    96.28     97.26     97.98     98.65     99.15     99.47
## Salary    46.75    46.86     47.76     47.82     47.85     48.10     50.40
##         15 comps  16 comps  17 comps  18 comps  19 comps
## X          99.75     99.89     99.97     99.99    100.00
## Salary     50.55     53.01     53.85     54.61     54.61
```

```
validationplot(pcr.fit,val.type="MSEP")
```



```
#set up training and test sets
set.seed(1)
x=model.matrix (Salary~.,Hitters )[,-1]
y=Hitters$Salary
train = sample(1:nrow(Hitters), size = nrow(Hitters)/2)
test = (-train)
y.test = y[test]

#PCR validation on test set
pcr.fit = pcr(Salary~., data=Hitters,
                        subset = train,
                        scale = TRUE,
                        validation = "CV")
validationplot(pcr.fit,val.type="MSEP")
```



```
pcr.pred=predict(pcr.fit,x[test,], ncomp=7)
mean((pcr.pred-y.test)^2)
```

```
## [1] 96556.22
```

```
#PCR regression on full dataset
pcr.fit = pcr(y~x, scale = TRUE, ncomp =7)
summary(pcr.fit)
```

```
## Data:    X dimension: 263 19
##  Y dimension: 263 1
## Fit method: svdpc
## Number of components considered: 7
## TRAINING: % variance explained
##    1 comps  2 comps  3 comps  4 comps  5 comps  6 comps  7 comps
## X    38.31    60.16    70.84    79.03    84.29    88.63    92.26
## y    40.63    41.58    42.17    43.22    44.90    46.48    46.69
```

6.7.2 Partial Least Squares

```
#cross-validated PLS regression
set.seed(1)
pls.fit = plsr(Salary ~., data = Hitters,
                          subset = train,
                          scale = TRUE,
                          validation = "CV")
```

```r
summary(pls.fit)
```

```
## Data:    X dimension: 131 19
##  Y dimension: 131 1
## Fit method: kernelpls
## Number of components considered: 19
##
## VALIDATION: RMSEP
## Cross-validated using 10 random segments.
##        (Intercept)  1 comps  2 comps  3 comps  4 comps  5 comps  6 comps
## CV           464.6    394.2    391.5    393.1    395.0    415.0    424.0
## adjCV        464.6    393.4    390.2    391.1    392.9    411.5    418.8
##        7 comps  8 comps  9 comps  10 comps  11 comps  12 comps  13 comps
## CV       424.5    415.8    404.6     407.1     412.0     414.4     410.3
## adjCV    418.9    411.4    400.7     402.2     407.2     409.3     405.6
##        14 comps  15 comps  16 comps  17 comps  18 comps  19 comps
## CV        406.2     408.6     410.5     408.8     407.8     410.2
## adjCV     401.8     403.9     405.6     404.1     403.2     405.5
##
## TRAINING: % variance explained
##         1 comps  2 comps  3 comps  4 comps  5 comps  6 comps  7 comps
## X         38.12    53.46    66.05    74.49    79.33    84.56    87.09
## Salary    33.58    38.96    41.57    42.43    44.04    45.59    47.05
##         8 comps  9 comps  10 comps  11 comps  12 comps  13 comps  14 comps
## X         90.74    92.55     93.94     97.23     97.88     98.35     98.85
## Salary    47.53    48.42     49.68     50.04     50.54     50.78     50.92
##         15 comps  16 comps  17 comps  18 comps  19 comps
## X          99.11     99.43     99.78     99.99    100.00
## Salary     51.04     51.11     51.15     51.16     51.18
```

```r
#PLS regression using only two components
pls.pred = predict(pls.fit,x[test,], ncomp=2)
mean((pls.pred-y.test)^2)
```

```
## [1] 101417.5
```

```r
pls.fit = plsr(Salary ~., data=Hitters, scale=TRUE, ncomp=2)
summary(pls.fit)
```

```
## Data:    X dimension: 263 19
##  Y dimension: 263 1
## Fit method: kernelpls
## Number of components considered: 2
## TRAINING: % variance explained
##         1 comps  2 comps
## X         38.08    51.03
## Salary    43.05    46.40
```