

# PCA: Houses

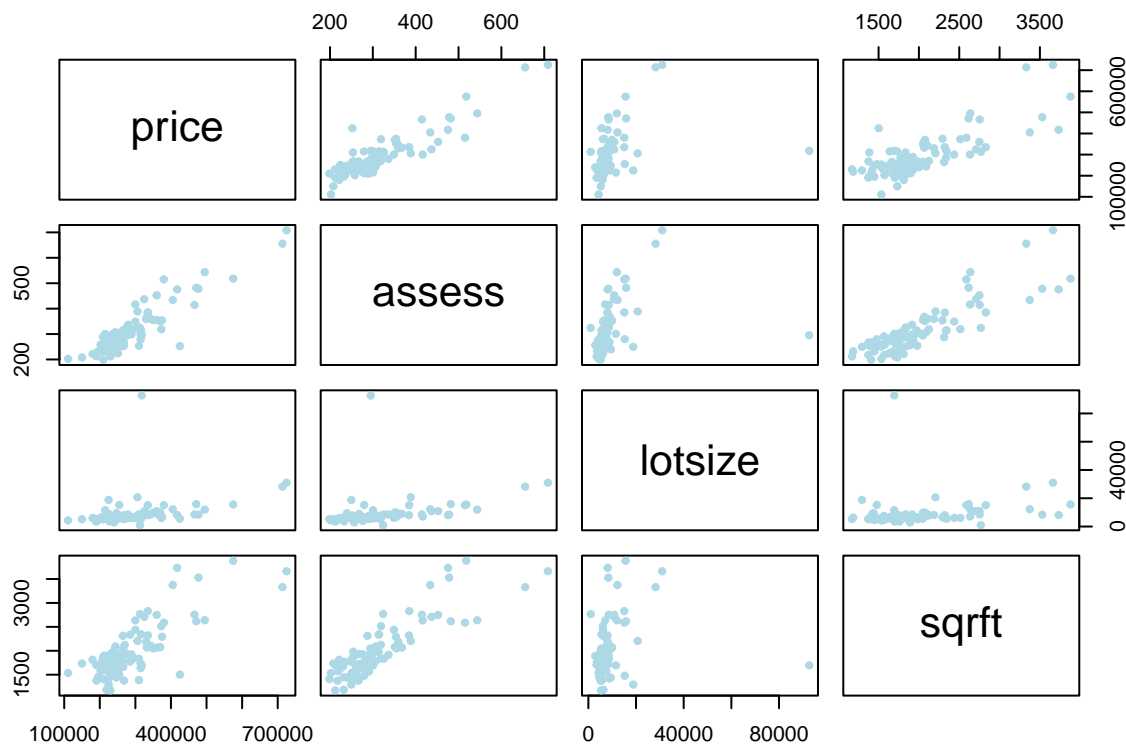
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First, we read in our house data.

```
data=read.csv("housepriceall.csv",header=TRUE)
attach(data)
View(data)
```

Let me do a bit of exploratory data analysis.

```
plot(data, pch=20, col="lightblue")
```



```
cor(data)
```

```
##           price    assess  lotsize   sqrft
## price    1.0000000 0.9052794 0.3471245 0.7879065
## assess   0.9052794 1.0000000 0.3281463 0.8656345
## lotsize  0.3471245 0.3281463 1.0000000 0.1838422
## sqrft    0.7879065 0.8656345 0.1838422 1.0000000
```

Obviously, the scale of the price is different from the scale of the square footage. Also, the assessed price and the price are artificially on a different scale. Let's look at the means and variances.

```
apply(data, 2, mean)
```

```
##           price    assess  lotsize   sqrft
```

```
## 293546.0341    315.7364    9019.8636    2013.6932
```

```
apply(data, 2, sd)
```

```
##           price           assess           lotsize           sqrft  
## 102713.44517      95.31444    10174.15041      577.19158
```

Let's take a look at what the principal component analysis is telling us.

```
pr.out<-prcomp(data, scale=TRUE)
```

Here are the outputs of `prcomp`.

```
pr.out$center
```

```
##           price           assess           lotsize           sqrft  
## 293546.0341      315.7364    9019.8636    2013.6932
```

```
pr.out$scale
```

```
##           price           assess           lotsize           sqrft  
## 102713.44517      95.31444    10174.15041      577.19158
```

```
pr.out$rotation
```

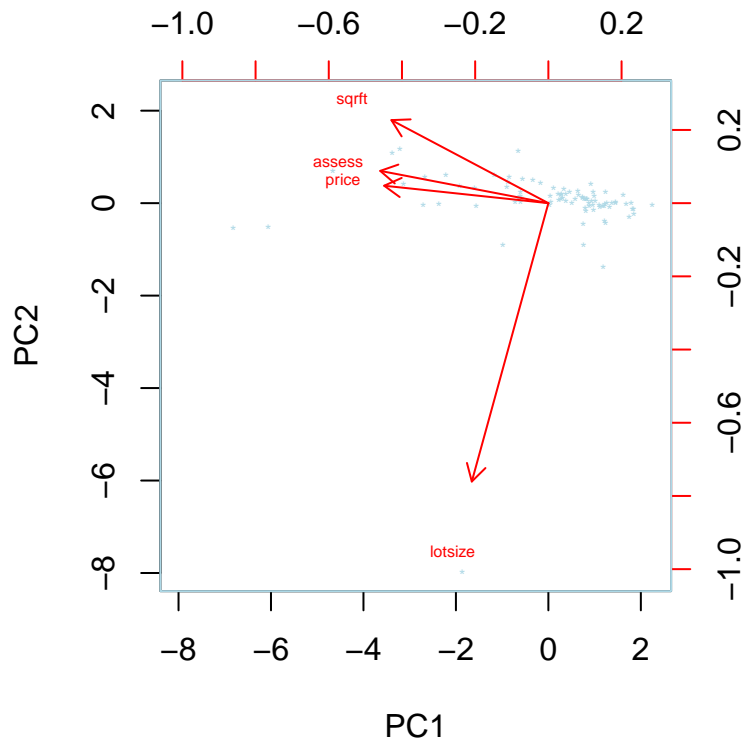
```
##           PC1           PC2           PC3           PC4  
## price  -0.5608750  0.05950919 -0.6507820  0.50829197  
## assess -0.5742342  0.11020662 -0.1214913 -0.80209066  
## lotsize -0.2615396 -0.95073388  0.1633602  0.03186797  
## sqrft  -0.5359770  0.28358110  0.7314616  0.31188825
```

```
dim(pr.out$x)
```

```
## [1] 88  4
```

Of course, it's much better to look at the `biplot`.

```
biplot(pr.out, scale=0, cex=0.5, xlab=rep("*", length(price)),  
       col=c("lightblue", "red"))
```



How many principal components are “sufficient”?

```
#transforming standard deviations to variances
pr.var=pr.out$sdev^2
#pr.var
#proportion of variance explained
pve=pr.var/sum(pr.var)
#pve
#plots
par(mfrow = c(1, 2))
plot(pve,xlab="Principal Component",
     ylab="Proportion of Variance Explained", col="peru",
     pch=20, ylim=c(0,1),type='b')
plot(cumsum(pve),xlab="Principal Component",
     ylab="Cumulative Proportion of Variance Explained",
     col="peru", pch=20, ylim=c(0,1),type='b')
```

