Assignment 3

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2018-01-26

Exploratory questions

First we load the data and packages.

```
library(msgl)
```

```
## Loading required package: Matrix
```

```
## Loading required package: sglOptim
```

```
## Loading required package: foreach
```

```
## Loading required package: doParallel
```

```
## Loading required package: iterators
```

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

```
library(ggplot2)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

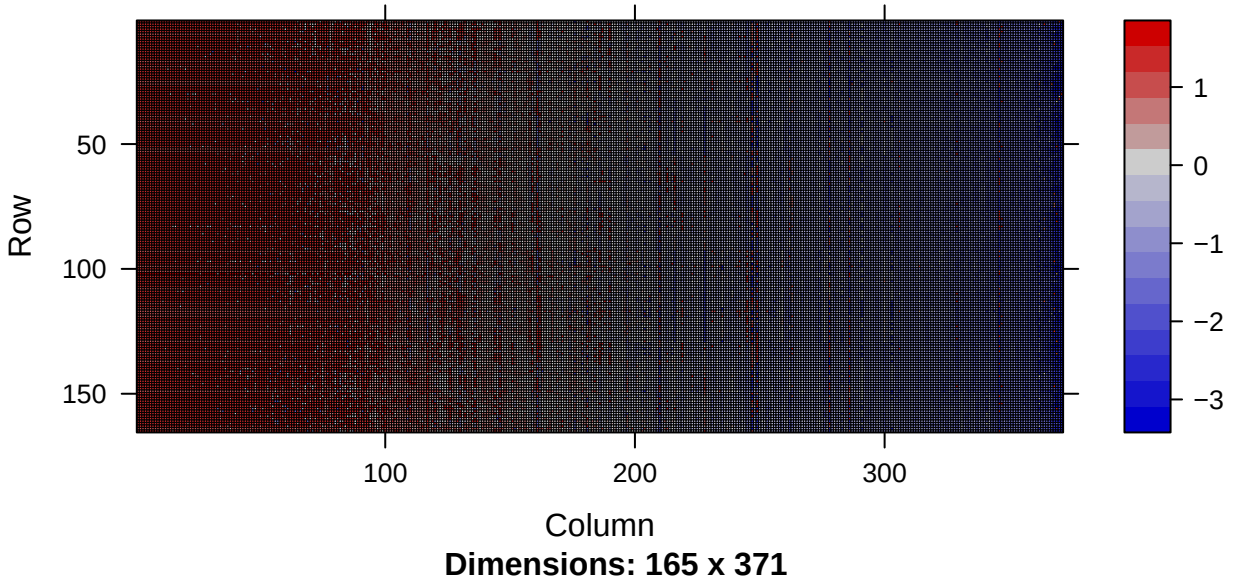
```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(tidyr)
```

```
##
## Attaching package: 'tidyr'
```

```
## The following object is masked from 'package:Matrix':
##
##     expand
```

```
data(PrimaryCancers)
ord_class <- order(classes)
ord_mir <- order(colMeans(x), decreasing = TRUE)
x <- x[ord_class, ord_mir]
classes <- classes[ord_class]
image(Matrix(x))
```



And plot the matrix.

Class means

First we calculate the class means for each column

```
class.col.means <- data.frame(class = classes) %>%
  bind_cols(as.data.frame(x)) %>%
  group_by(class) %>%
  summarise_all(mean)
```

and plots the column means for each class

```
plot.cols <- class.col.means %>%
  gather(col,means,-class) %>%
  group_by(class) %>%
  mutate(col.num = row_number()) %>%
  arrange(class,col.num)

ggplot(plot.cols,aes(x=col.num,y=means)) +
  geom_line() + facet_wrap(~class)
```

We see generally declining means over the columns for each class with some noise, which is expected since column of X are ordered by declining means.

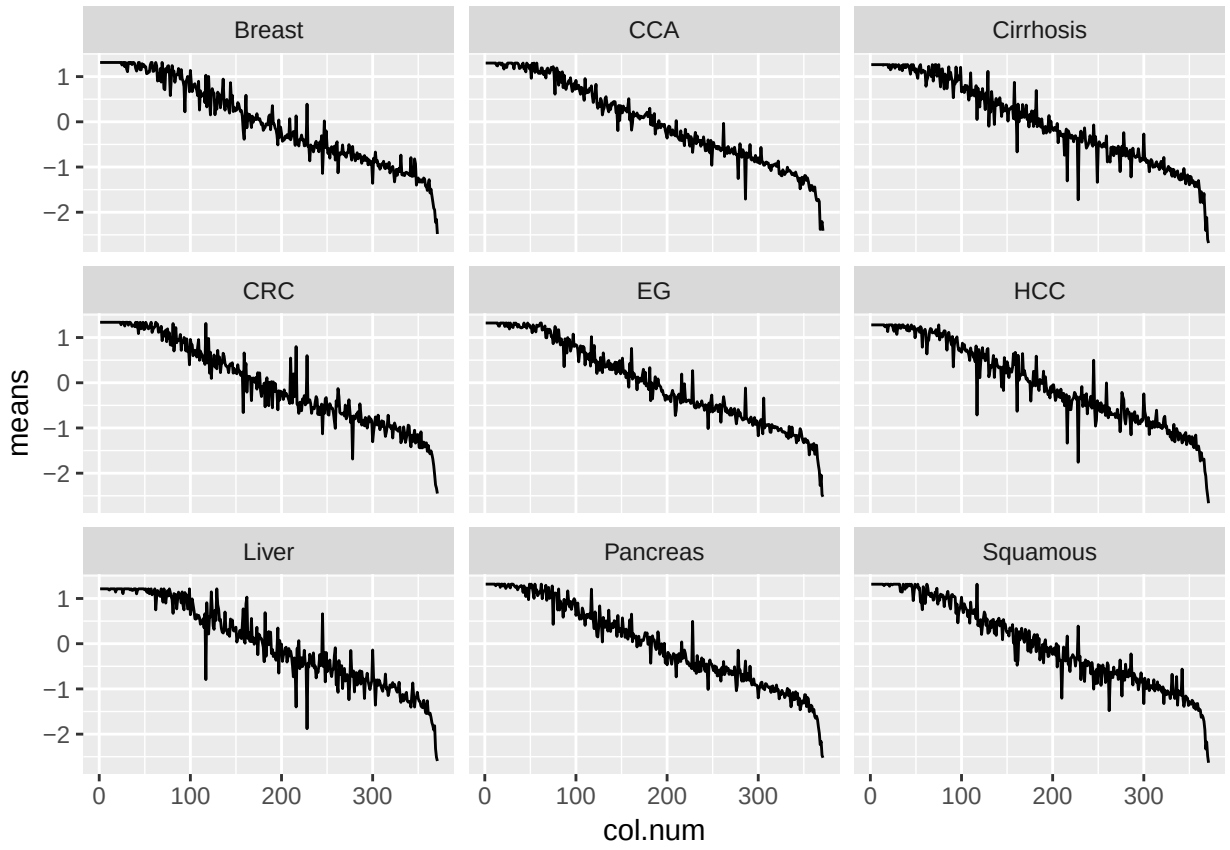


Figure 1: Columns means by class and column

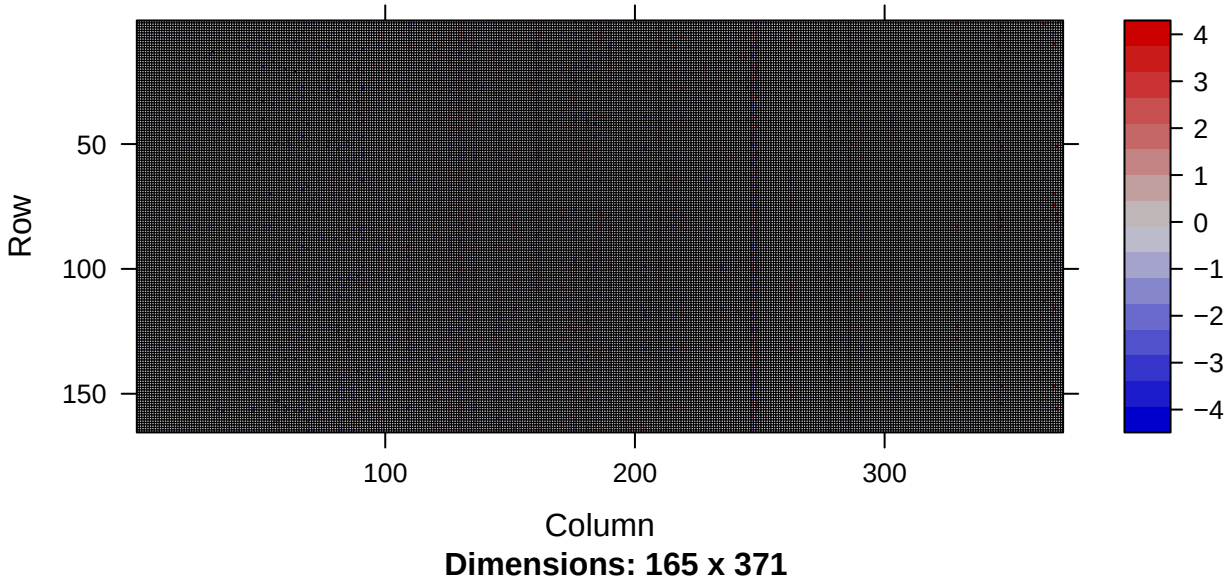


Figure 2: Image of residual matrix

PCA on the residual matrix

We now do PCA on the residual matrix by first subtracting the class means per columns from X and then using the singular value decomposition of the residual matrix so calculate the principal components.

```
X.mean.matrix <- data.frame(class = classes) %>%
  left_join(class.col.means) %>%
  select(-class)
```

```
## Joining, by = "class"
```

```
X.residuals <- x-X.mean.matrix
X.residuals.svd <- svd(X.residuals)
pc <- t(X.residuals.svd$d * t(X.residuals.svd$u)) %>%
  as.data.frame() %>%
  bind_cols(data.frame(class = classes))
image(Matrix(as.matrix(X.residuals)))
```

We now plot the first and second principal component against eachother with each observation colored according to class.

```
ggplot(pc, aes(V1,V2,col=class)) +
  geom_point() +
  ylab("2nd PC") +
  xlab("1st PC")
```

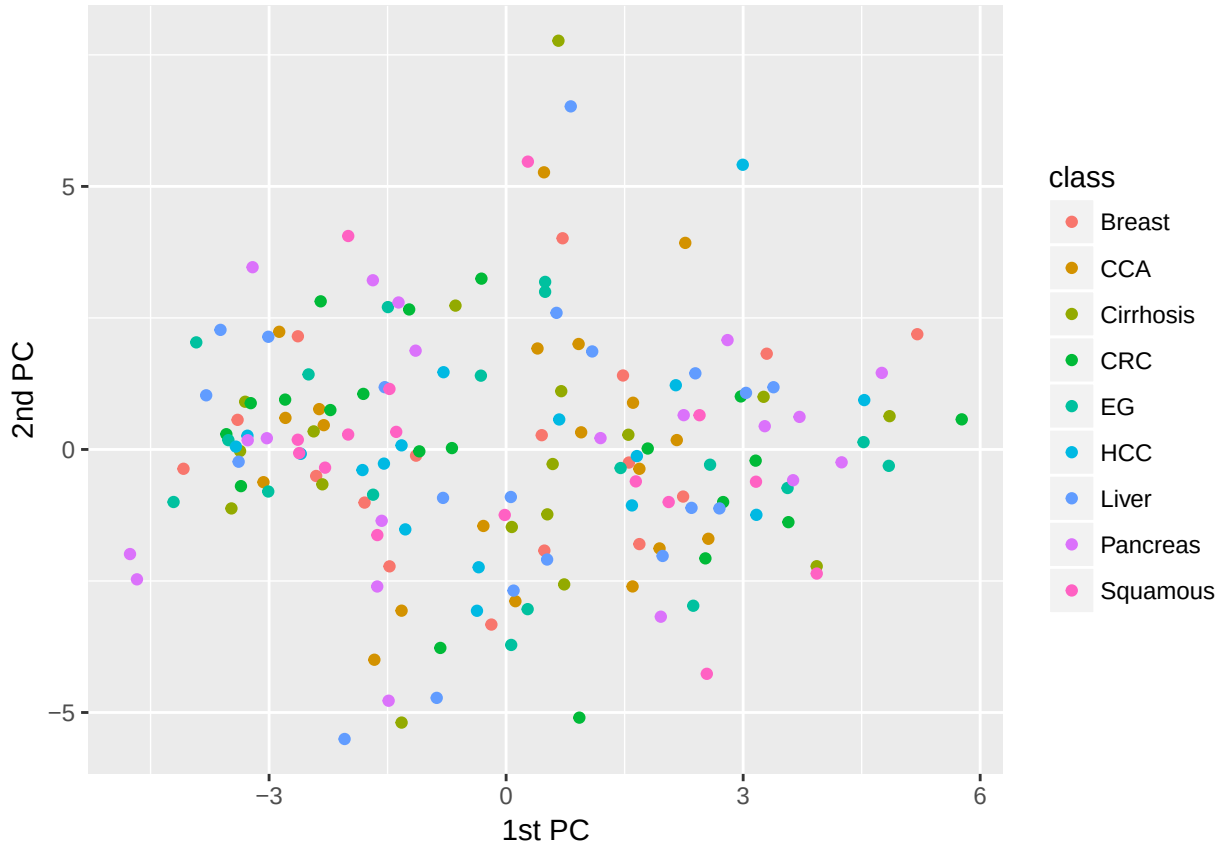


Figure 3: First and second PC