

DATA 605: Assignment 04

EigenShoes

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15 February 2021

EigenShoes

Starting point: <https://rpubs.com/R-Minator/eigenshoes>

```
# Libraries
library(jpeg)
library(ramify)
```

```
##
## Attaching package: 'ramify'

## The following object is masked from 'package:graphics':
##
## clip
```

Use of Graphics

Add graphics to the data set.

```
# Prepare for Image Processing
num <- 17
files <- list.files("/Users/philiptanofsky/Documents/School/CUNY/MSDS/Courses/DATA605/Week04/jpg/", pat
files
```

```
## [1] "RC_2500x1200_2014_us_53446.jpg" "RC_2500x1200_2014_us_53455.jpg"
## [3] "RC_2500x1200_2014_us_53469.jpg" "RC_2500x1200_2014_us_53626.jpg"
## [5] "RC_2500x1200_2014_us_53632.jpg" "RC_2500x1200_2014_us_53649.jpg"
## [7] "RC_2500x1200_2014_us_53655.jpg" "RC_2500x1200_2014_us_53663.jpg"
## [9] "RC_2500x1200_2014_us_53697.jpg" "RC_2500x1200_2014_us_54018.jpg"
## [11] "RC_2500x1200_2014_us_54067.jpg" "RC_2500x1200_2014_us_54106.jpg"
## [13] "RC_2500x1200_2014_us_54130.jpg" "RC_2500x1200_2014_us_54148.jpg"
## [15] "RC_2500x1200_2014_us_54157.jpg" "RC_2500x1200_2014_us_54165.jpg"
## [17] "RC_2500x1200_2014_us_54172.jpg"
```

View Shoes Function

```

# Set Adjustment Parameters
height <- 1200
width <- 2500
scale <- 20

plot_jpeg <- function(path, add=FALSE) {

  jpg <- readJPEG(path, native=T) # Read the file
  res <- dim(jpg)[2:1] # Get the resolution, [x, y]
  if (!add) { # Initialize any empty plot are if add == False
    plot(1, 1, xlim=c(1, res[1]), ylim=c(1, res[2]), asp=1, type='n',
         xaxs='i', yaxs='i', xaxt='n', yaxt='n', xlab='', bty='n')
    rasterImage(jpg, 1, 1, res[1], res[2])
  }
}

```

Load the Data into an Array

```

im <- array(rep(0, length(files) * height/scale * width/scale * 3), dim=c(length(files), height/scale, width/scale, 3))

for (i in 1:num) {
  temp <- resize(readJPEG(paste0("/Users/philiptanofsky/Documents/School/CUNY/MSDS/Courses/DATA605/Week04/jpg", files[i])), height/scale, width/scale)
  im[i,,] <- array(temp, dim=c(1, height/scale, width/scale, 3))
}

```

Vectorize

```

flat <- matrix(0, num, prod(dim(im)))

for (i in 1:num) {
  newim <- readJPEG(paste0("/Users/philiptanofsky/Documents/School/CUNY/MSDS/Courses/DATA605/Week04/jpg", files[i]))
  r <- as.vector(im[i,,1])
  g <- as.vector(im[i,,2])
  b <- as.vector(im[i,,3])
  flat[i,] <- t(c(r, g, b))
}
shoes <- as.data.frame(t(flat))

```

Actual Plots

NOT SHOWING UP, PLEASE CHECK THIS CODE BELOW

```

# Old Shoes
par(mfrow=c(3,3))
par(mai=c(.3, .3, .3, .3))
for (i in 1:num) { # plot the first images only
  plot_jpeg(writeJPEG(im[i,,]))
}

```


Get Eigen components from correlation structure

```
scaled <- scale(shoes, center=TRUE, scale=TRUE)
mean.shoe <- attr(scaled, "scaled:center") # saving for classification
std.shoe <- attr(scaled, "scaled:scale") # saving for classification ... later
```

Calculate Covariance (Correlation)

```
sigma_ <- cor(scaled)
```

```
sigma_
```

```
##      V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12 V13 V14 V15 V16 V17
## V1   1 NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA
## V2  NA  1 NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA
## V3  NA NA  1 NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA
## V4  NA NA NA  1 NA NA NA NA NA NA NA NA NA NA NA NA NA NA
## V5  NA NA NA NA  1 NA NA NA NA NA NA NA NA NA NA NA NA NA
## V6  NA NA NA NA NA  1 NA NA NA NA NA NA NA NA NA NA NA NA
## V7  NA NA NA NA NA NA  1 NA NA NA NA NA NA NA NA NA NA NA
## V8  NA NA NA NA NA NA NA  1 NA NA NA NA NA NA NA NA NA NA
```

```
## V9  NA NA NA NA NA NA NA NA NA 1  NA NA NA NA NA NA NA NA
## V10 NA NA NA NA NA NA NA NA NA NA 1  NA NA NA NA NA NA NA NA
## V11 NA NA NA NA NA NA NA NA NA NA NA 1  NA NA NA NA NA NA NA NA
## V12 NA NA NA NA NA NA NA NA NA NA NA NA 1  NA NA NA NA NA NA NA NA
## V13 NA NA NA NA NA NA NA NA NA NA NA NA NA 1  NA NA NA NA NA NA NA NA
## V14 NA NA NA NA NA NA NA NA NA NA NA NA NA NA 1  NA NA NA NA NA NA NA NA
## V15 NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA 1  NA NA NA NA NA NA NA NA
## V16 NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA 1  NA NA NA NA NA NA NA NA
## V17 NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA 1  NA NA NA NA NA NA NA NA
```

Get the eigencomponents

```
myeigen <- eigen(sigma_)
cumsum(myeigen$values) / sum(myeigen$values)
```

Eigen shoes

```
scaling <- diag(myeigen$values[1:5]^(-1/2)) / (sqrt(nrow(scaled)-1))
eigen shoes <- scaled %*% myeigen$vectors[,1:5] %*% scaling
imageShow(array(eigen shoes[,1], c(60, 125, 3)))
```

Generate Principal Components

Transform the images

```
# Generate variables
height <- 1200
width <- 2500
scale <- 20
newdata <- im
dim(newdata) <- c(length(files), height*width*3/scale^2)
mypca <- princomp(t(as.matrix(newdata)), scores=TRUE, cor=TRUE)
```

Eigen shoes

Generate Eigen shoes

```
mypca2 <- t(mypca$scores)
dim(mypca2) <- c(length(files), height/scale, width/scale, 3)
par(mfrow=c(5,5))
par(mai=c(.001, .001, .001, .001))
# Plot the first 20 eigen shoes only
for (i in 1:20) {
  plot_jpeg(writeJPEG(mypca2[i,,], bg="white")) # Complete without reduction
}
```

Variance Capture

```
a <- round(mypca$sdev[1:num]^2 / sum(mypca$sdev^2), 3)
cumsum(a)
```