STAT547

James Spalding

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Check-in 1

1. Write R code to find the mean matrix and average misorientation angle (AMA) for this generic data set: GenericData.csv. You may want to think about how to put data into an array in R of size 3x3xn. This is a way to store all n 3x3 matrices in one R object

TODO: - [x] Store matrices in array - [x] Find Mean Matrix - [x] Find Average Misorientation Angle

```
#Load libraries
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.3     v readr     2.1.4
## v forcats   1.0.0     v stringr   1.5.0
## v ggplot2   3.4.4     v tibble    3.2.1
## v lubridate 1.9.3     v tidyr     1.3.0
## v purrr     1.0.2
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
library(abind)

#Load data
testData = read.csv(paste0(getwd(),"/files/GenericData.csv"))
```

```
#Function to create array of matrices from dataframe

makeArray = function(df){
  matArray = array(dim = c(3, 3, 0))

  for(i in 1:nrow(df)){
    temp = matrix(testData[i,2:10], ncol = 3, byrow=T) #Will need to adjust for actual data.
    matArray = abind(matArray, temp, along = 3)
  }

  return(matArray)
}

#Example
testDataArray = makeArray(testData)
testDataArray[,,5]
```

```
##           [,1]       [,2]        [,3]
## [1,] 0.5138900  0.8577733 -0.01191537
## [2,] 0.8241170 -0.4897743  0.28452105
## [3,] 0.2382187 -0.1560322 -0.95859574
```

```r
#Function to find mean matrix from matrix array

meanMat = function(array){
  length = dim(array)[3]
  matSum = apply(array, c(1, 2), sum)
  oBar = matSum / length

  V = svd(oBar)$u
  W = svd(oBar)$v
  M = V %*% W #Not sure if %*% or * should be used here...

  return(M)
}

#Example
meanMat(testDataArray)
```

```
##             [,1]        [,2]       [,3]
## [1,] -0.02041148  0.77575946 0.63069853
## [2,] -0.99215646 -0.09352974 0.08293218
## [3,]  0.12332449 -0.62405885 0.77158384
```

```r
# Function to find Average Misorientation Angle given an array and observation

misorientAngle = function(array, obs){
  #acos((sum(diag(t(testDataArray[,,1]) %*% meanMat(testDataArray)))-1)/2) #Split into multiple lines f

  oP = t(array[,,obs])
  M = meanMat(array)
  traceOPM = sum(diag(oP %*% M))

  angle = acos((traceOPM-1)/2)
  return(angle)
}

#Example
misorientAngle(testDataArray, 10)
```

```
## [1] 3.095113
```