STAT547 Graduate Project

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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

```
#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=F) #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,]  0.51389004  0.8241170  0.2382187
## [2,]  0.85777331 -0.4897743 -0.1560322
## [3,] -0.01191537  0.2845210 -0.9585957
```

```
#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 %*% t(W)

  return(M)
}

#Example
```

```r
meanMat(testDataArray)
```

```
##             [,1]        [,2]        [,3]
## [1,] 0.56428972  0.81706055  0.11827583
## [2,] 0.82048379 -0.57091238  0.02941779
## [3,] 0.09156125  0.08044324 -0.99254492
```

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

misorientAngle = function(array, obs=NA){

  if(is.na(obs) == T){

    arrayLength = dim(array)[3]
    sumAngle = 0
    M = meanMat(array)

    for(i in 1:arrayLength){
      oP = t(array[,,i])
      traceOPM = sum(diag(oP %*% M))
      sumAngle = sumAngle + acos((traceOPM-1)/2)
    }

    avgAngle = sumAngle/arrayLength
    cat("Average misorientation angle:\n")
    return(avgAngle)

  }else{

    oP = t(array[,,obs])
    M = meanMat(array)
    traceOPM = sum(diag(oP %*% M))
    angle = acos((traceOPM-1)/2)

    cat(paste0("Misorientaton angle of observation ", as.character(obs), ":\n"))
    return(angle)

  }

}

#Example
misorientAngle(testDataArray) #Average angle
```

```
## Average misorientation angle:
```

```
## [1] 0.3526516
```

```r
misorientAngle(testDataArray, obs=10) #Angle of individual observation
```

```
## Misorientaton angle of observation 10:
```

```
## [1] 0.7883624
```