Nov 17, 2019 Matrix Operation Basic

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Matrix Operation in R

- Ref: http://www.philender.com/courses/multivariate/notes/matr.html (http://www.philender.com/courses/multivariate/notes/matr.html)
- ctrl + Enter : run this line
- ctrl + shift + Enter : run this chuck
- Ctrl + Shift + K : Knit
- Ctrl + Alt + I : Insert a chuck

Making matrix by using matrix

```
A <- matrix(c(seq(1:6)), 2,3)
A
```

```
##      [,1] [,2] [,3]
## [1,]    1    3    5
## [2,]    2    4    6
```

```
is.matrix(A)
```

```
## [1] TRUE
```

```
is.vector(A)
```

```
## [1] FALSE
```

```
B <- matrix(c(seq(1:6)), 2,3)
C <- A+B
C
```

```
##      [,1] [,2] [,3]
## [1,]    2    6   10
## [2,]    4    8   12
```

Transpose t(matrix)

```
t(C)
```

```
##      [,1] [,2]
## [1,]    2    4
## [2,]    6    8
## [3,]   10   12
```

Matrix Multiplication

```
A # 2 x 3
```

```
##      [,1] [,2] [,3]
## [1,]    1    3    5
## [2,]    2    4    6
```

```
t(C) # traspose 3 X 2
```

```
##      [,1] [,2]
## [1,]    2    4
## [2,]    6    8
## [3,]   10   12
```

```
A%*%t(C) # 2 x x
```

```
##      [,1] [,2]
## [1,]   70   88
## [2,]   88  112
```

Unit Vector

```
(U <- matrix(1,2,2))
```

```
##      [,1] [,2]
## [1,]    1    1
## [2,]    1    1
```

Zero Vector

```
(Z <- matrix(0,2,2))
```

```
##      [,1] [,2]
## [1,]    0    0
## [2,]    0    0
```

Diagonal component

```
C
```

```
##      [,1] [,2] [,3]
## [1,]    2    6   10
## [2,]    4    8   12
```

```
diag(C)
```

```
## [1] 2 8
```

```
diag(diag(C))
```

```
##      [,1] [,2]
## [1,]    2    0
## [2,]    0    8
```

Identity Matrix

```
c(1,1,1)
```

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

```
(I <-diag(c(1,1,1)))
```

```
##      [,1] [,2] [,3]
## [1,]    1    0    0
## [2,]    0    1    0
## [3,]    0    0    1
```

Inverse of a Matrix

```
(A <- matrix(c(4,4,-2,2,6,2,2,8,4),3,3))
```

```
##      [,1] [,2] [,3]
## [1,]    4    2    2
## [2,]    4    6    8
## [3,]   -2    2    4
```

```
(inv.A <- solve(A))
```

```
##      [,1] [,2] [,3]
## [1,]  1.0 -0.5  0.5
## [2,] -4.0  2.5 -3.0
## [3,]  2.5 -1.5  2.0
```

```
A%*%inv.A
```

```
##      [,1] [,2] [,3]
## [1,]    1    0    0
## [2,]    0    1    0
## [3,]    0    0    1
```

```
inv.A %*%A
```

```
##      [,1] [,2] [,3]
## [1,]    1    0    0
## [2,]    0    1    0
## [3,]    0    0    1
```

Inverse & Determinant of a Matrix (=det(A))

```
A
```

```
##      [,1] [,2] [,3]
## [1,]    4    2    2
## [2,]    4    6    8
## [3,]   -2    2    4
```

```
solve(A)
```

```
##      [,1] [,2] [,3]
## [1,]  1.0 -0.5  0.5
## [2,] -4.0  2.5 -3.0
## [3,]  2.5 -1.5  2.0
```

```
det(A)
```

```
## [1] 8
```

Rank of a Matrix

- Full rank condition

```
A <- matrix(c(2,3,-2,1,2,2,4,7,0),3,3)
matA <- qr(A)
matA$rank
```

```
## [1] 3
```

- Under justification
- column 3 is 2 times column 1

```
A <- matrix(c(2,3,-2,1,2,2,4,6,-4),3,3)
A
```

```
##      [,1] [,2] [,3]
## [1,]    2    1    4
## [2,]    3    2    6
## [3,]   -2    2   -4
```

```
matA <- qr(A)
matA$rank
```

```
## [1] 2
```

Number of Rows & Columns

```
X <- matrix(c(3,2,4,3,2,-2,6,1),4,2)
X
```

```
##      [,1] [,2]
## [1,]    3    2
## [2,]    2   -2
## [3,]    4    6
## [4,]    3    1
```

```
dim(X)
```

```
## [1] 4 2
```

```
(r <-nrow(X))
```

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

```
(c<-ncol(X))
```

```
## [1] 2
```

Computing Column & Row Sums

```
(A <- matrix(c(2,3,-2,1,2,2),3,2))
```

```
##      [,1] [,2]
## [1,]    2    1
## [2,]    3    2
## [3,]   -2    2
```

```
(c<- colSums(A))
```

```
## [1] 3 5
```

```
(r<- rowSums(A))
```

```
## [1] 3 5 0
```

```
(a<- sum(A))
```

```
## [1] 8
```

Computing Column & Row Means

```
A
```

```
##      [,1] [,2]
## [1,]    2    1
## [2,]    3    2
## [3,]   -2    2
```

```
(cm <- colMeans(A))
```

```
## [1] 1.000000 1.666667
```

```
(rm <- rowMeans(A))
```

```
## [1] 1.5 2.5 0.0
```

```
(m  <- mean(A))
```

```
## [1] 1.333333
```

Horizontal Concatenation: A+B **cbind**

```
A
```

```
##      [,1] [,2]
## [1,]    2    1
## [2,]    3    2
## [3,]   -2    2
```

```
(B <- matrix(c(1,3,2,1,4,2),3,2))
```

```
##      [,1] [,2]
## [1,]    1    1
## [2,]    3    4
## [3,]    2    2
```

```
(C <-cbind(A,B))
```

```
##      [,1] [,2] [,3] [,4]
## [1,]    2    1    1    1
## [2,]    3    2    3    4
## [3,]   -2    2    2    2
```

Vertical Concatenation (Appending): A + B(next row) **rbind**

```
(c<-rbind(A,B))
```

```
##      [,1] [,2]
## [1,]    2    1
## [2,]    3    2
## [3,]   -2    2
## [4,]    1    1
## [5,]    3    4
## [6,]    2    2
```