# goophi - clustering

2022.08.24.

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## 1 Introduction

1) 본 문서는 goophi 패키지를 Shiny app에서 사용하는 것을 상정해 작성했습니다.

2) 본 문서의 케이스 스타일은 Camel case와 Snake case가 혼용되어 있습니다.

- Camel case : goophi의 함수명 및 파라미터명
- Snake case: 유저로부터 받는 입력, shiny app의 server에서 사용(될 것이라고 예상)하는 object명, snake case로 작성된 dependencies의 함수명 등

## 2 Import sample data

1) 전처리가 완료된 샘플데이터를 불러옵니다.

- NA가 없어야 함
- string value가 있는 열은 factor로 변환

- 한 열이 모두 같은 값으로 채워져 있을 경우 제외해야 함
- Date type column이 없어야 함
- Outcome 변수는 classification의 경우 factor, regression의 경우 numeric이어야 함 (clustering은 outcome변수를 사용하지 않음)

```
library(goophi)

cleaned_data <- read.csv(file = "~/git/goophi/data/boston_c.csv",
                         stringsAsFactors = TRUE
                         )
cleaned_data$Pcrime <- NULL
cleaned_data$chas <- as.numeric(cleaned_data$chas)

str(cleaned_data)
```

```
'data.frame':   506 obs. of  13 variables:
 $ zn     : num  18 0 0 0 0 0 12.5 12.5 12.5 12.5 ...
 $ indus  : num  2.31 7.07 7.07 2.18 2.18 2.18 7.87 7.87 7.87 7.87 ...
 $ chas   : num  1 1 1 1 1 1 1 1 1 1 ...
 $ nox    : num  0.538 0.469 0.469 0.458 0.458 0.458 0.524 0.524 0.524 0.524 ...
 $ rm     : num  6.58 6.42 7.18 7 7.15 ...
 $ age    : num  65.2 78.9 61.1 45.8 54.2 58.7 66.6 96.1 100 85.9 ...
 $ dis    : num  4.09 4.97 4.97 6.06 6.06 ...
 $ rad    : int  1 2 2 3 3 3 5 5 5 5 ...
 $ tax    : int  296 242 242 222 222 222 311 311 311 311 ...
 $ ptratio: num  15.3 17.8 17.8 18.7 18.7 18.7 15.2 15.2 15.2 15.2 ...
 $ black  : num  397 397 393 395 397 ...
 $ lstat  : num  4.98 9.14 4.03 2.94 5.33 ...
 $ medv   : num  24 21.6 34.7 33.4 36.2 28.7 22.9 27.1 16.5 18.9 ...
```

## 3 K-means clustering

```
# user input
max_k <- "15" # k = 2:max_k, <= number of columns
n_start <- "25" # attempts 25 initial configurations, <= 175
iter_max <- "10" # <= 5000
n_boot <- "100" # Used only for determining the number of clusters using gap statistic
algorithm = "Hartigan-Wong" ## "Hartigan-Wong", "Lloyd", "Forgy", "MacQueen"
select_optimal <- "silhouette" # "silhouette", "gap_stat" // there's no mathematical definiti
```

```r
seed = "6471"

# K-means clustering
km_model <- goophi::kMeansClustering(data = cleaned_data,
                                     maxK = max_k,
                                     nStart = n_start,
                                     iterMax = iter_max,
                                     nBoot = n_boot,
                                     algorithm = algorithm,
                                     selectOptimal = select_optimal,
                                     seedNum = seed
                                     )

km_model$result
```

```
K-means clustering with 2 clusters of sizes 137, 369

Cluster means:
        zn     indus     chas       nox       rm      age      dis       rad
1  0.00000 18.451825 1.058394 0.6701022 6.006212 89.96788 2.054470 23.270073
2 15.58266  8.420894 1.073171 0.5118474 6.388005 60.63225 4.441272  4.455285
       tax  ptratio    black    lstat     medv
1 667.6423 20.19635 291.0391 18.67453 16.27226
2 311.9268 17.80921 381.0426 10.41745 24.85718

Clustering vector:
  [1] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
 [38] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
 [75] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
[112] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
[149] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
[186] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
[223] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
[260] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
[297] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
[334] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1
[371] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
[408] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
[445] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
[482] 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2

Within cluster sum of squares by cluster:
```

```
[1] 2873179 2868624
 (between_SS / total_SS =  70.3 %)

Available components:

[1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
[6] "betweenss"    "size"         "iter"         "ifault"
```

## 4 K-means clustering without hyperparameters

```r
# K-means clustering
km_model <- goophi::kMeansClustering(data = cleaned_data)

km_model$result
```

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K-means clustering with 2 clusters of sizes 137, 369

Cluster means:
        zn     indus     chas       nox       rm      age      dis       rad
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[482] 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2

Within cluster sum of squares by cluster:
[1] 2873179 2868624
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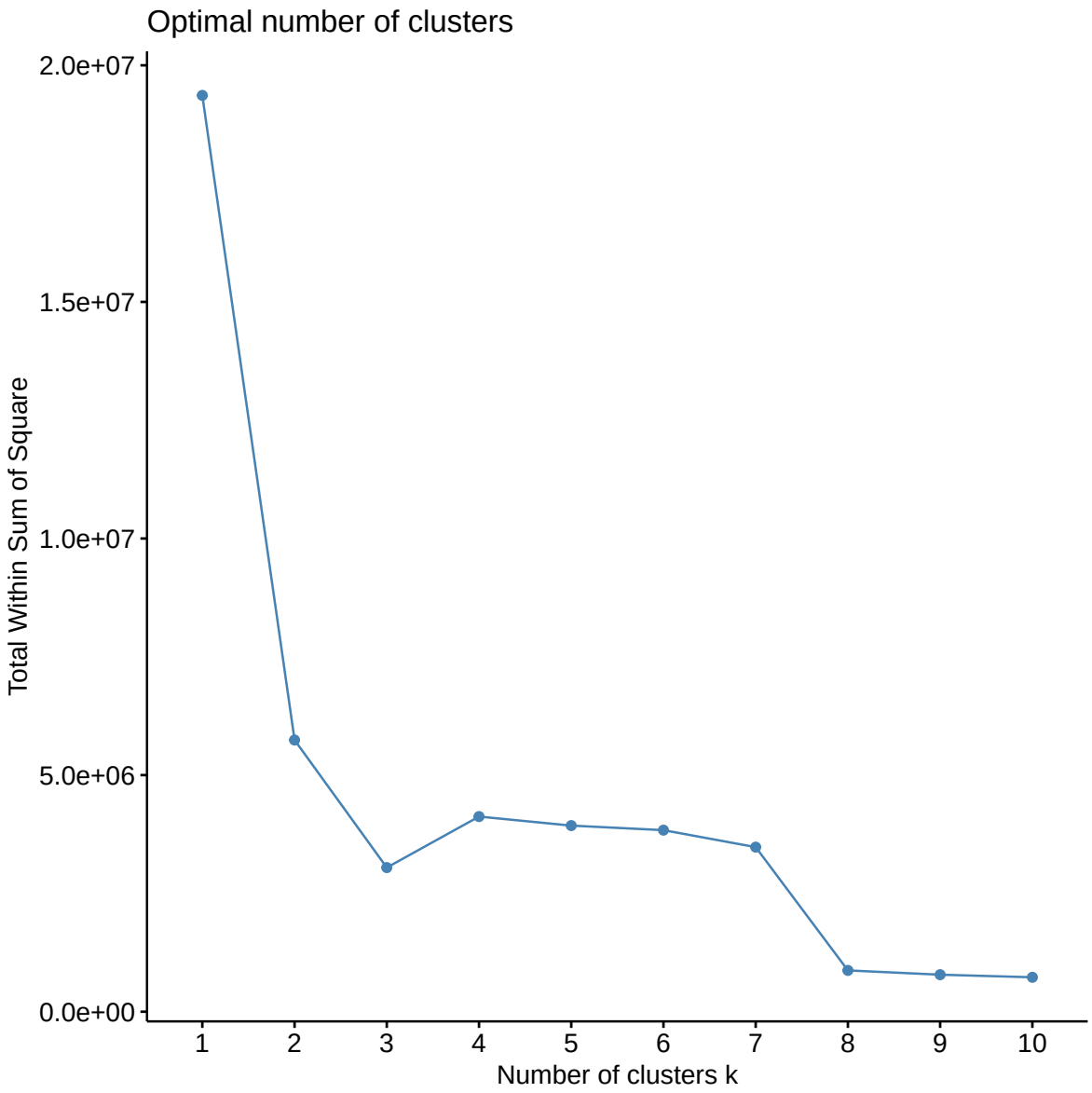
Available components:

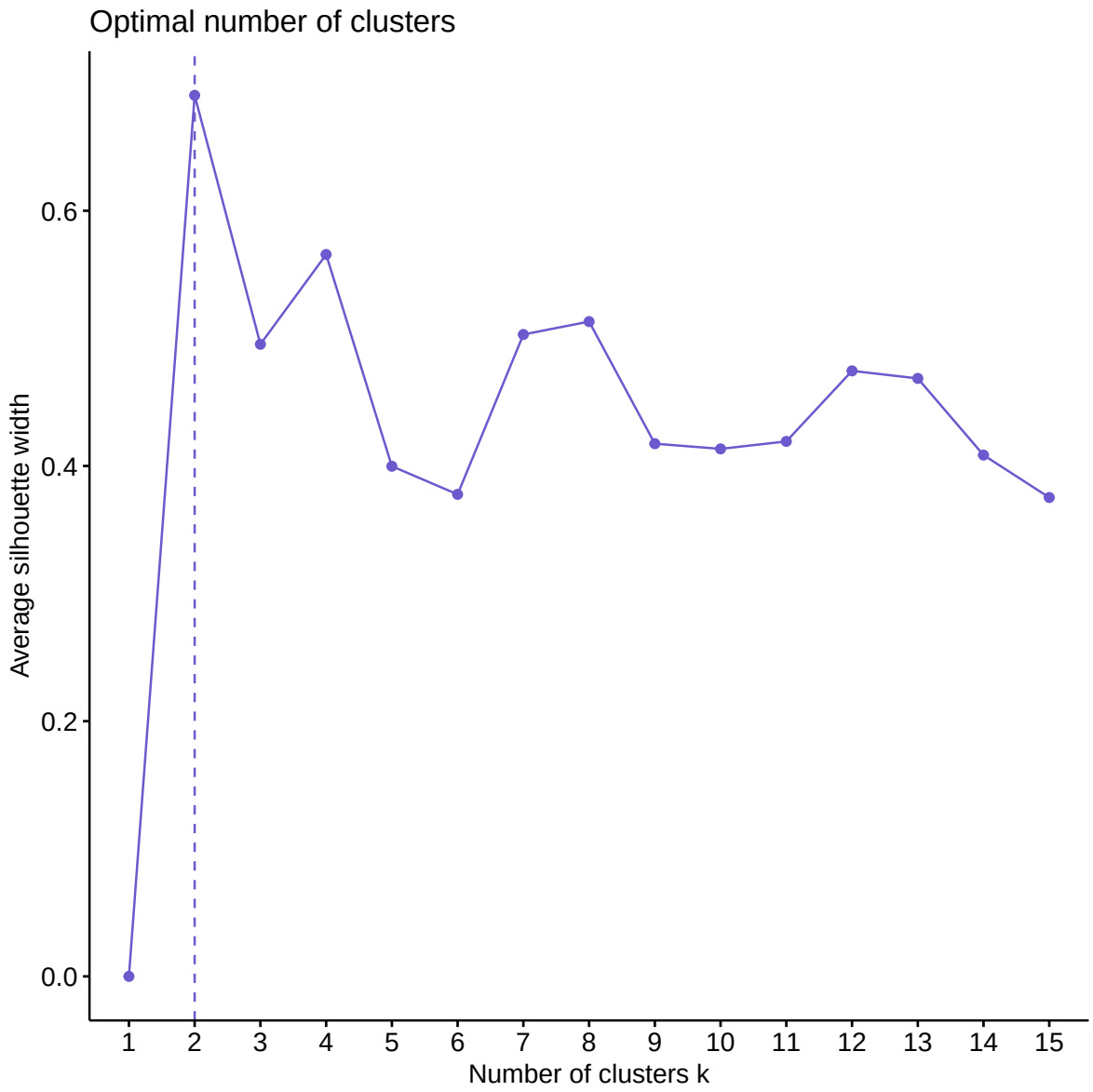
[1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
[6] "betweenss"    "size"         "iter"         "ifault"
```

## 5 Visualize

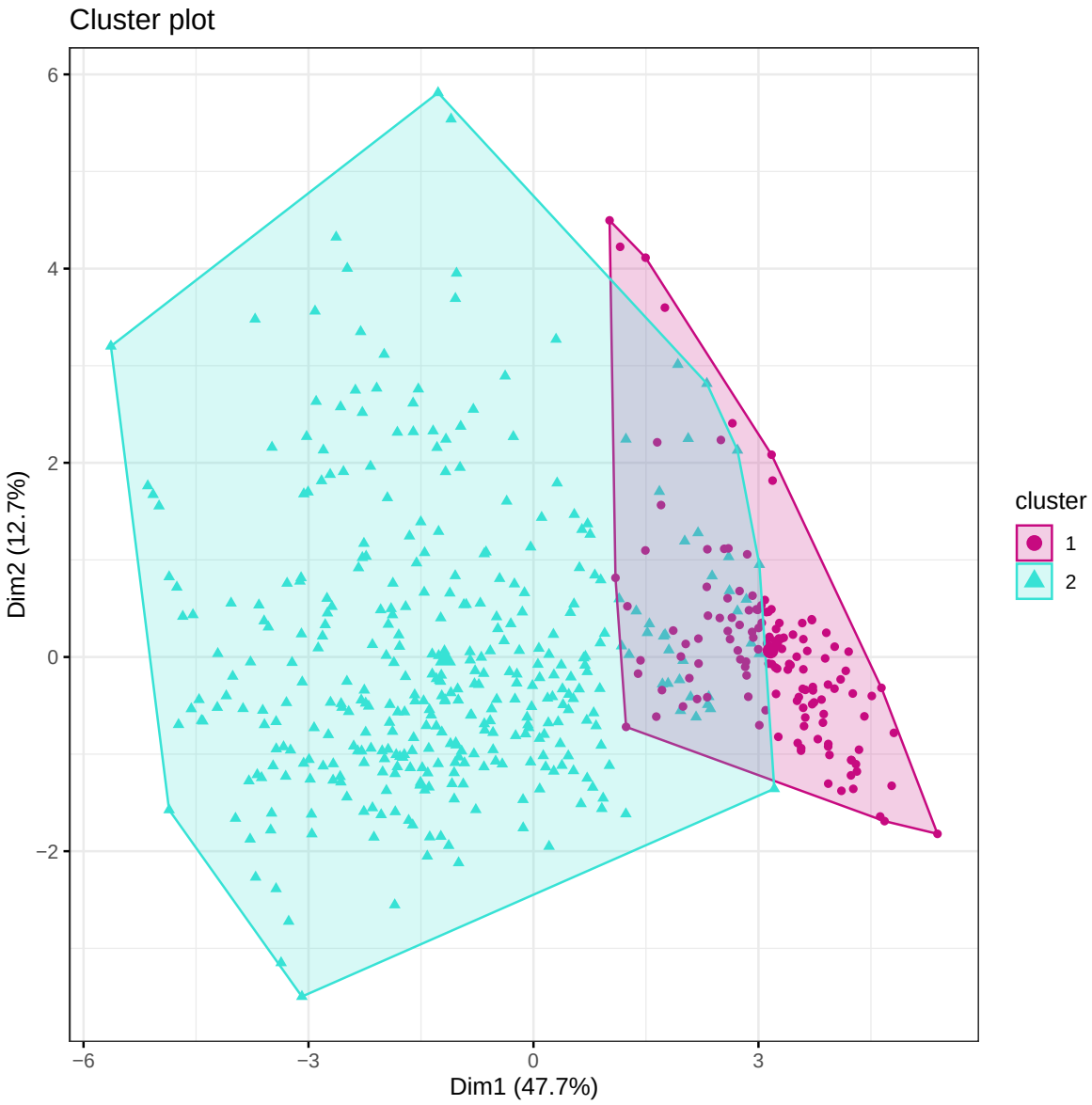
```
km_model$elbowPlot
```




```
km_model$optimalK
```




```
km_model$clustVis
```


Cluster plot
Dim2 (12.7%)
Dim1 (47.7%)
6
4
2
0
−2
−6
−3
0
3
cluster
1
2