

project model 3 k-mean clustering

Jingjing Li

2022-12-16

I cannot knit all 3 clustering models at once, so I did them separately.

Helper packages

```
library(tidyverse)

## -- Attaching packages ----- tidyverse 1.3.2 --
## v ggplot2 3.4.0      v purrr  0.3.4
## v tibble  3.1.7      v dplyr  1.0.10
## v tidyr   1.2.1      v stringr 1.4.1
## v readr   2.1.2      v forcats 0.5.2
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()

library(dplyr)
library(stringr)
library(gridExtra)

##
## Attaching package: 'gridExtra'
##
## The following object is masked from 'package:dplyr':
##
##   combine

library(cluster)
library(factoextra)

## Welcome! Want to learn more? See two factoextra-related books at https://goo.gl/ve3WBa

library(mclust)

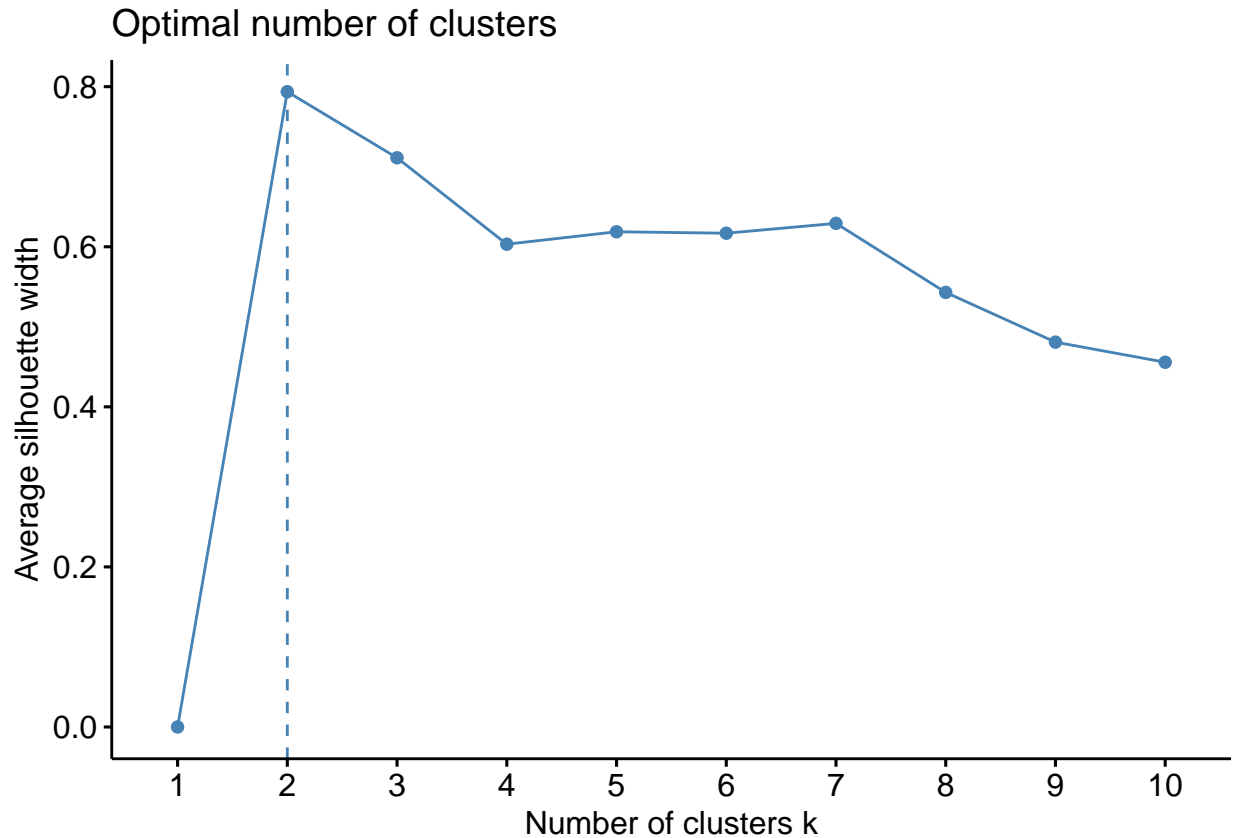
## Package 'mclust' version 6.0.0
## Type 'citation("mclust")' for citing this R package in publications.
##
## Attaching package: 'mclust'
##
## The following object is masked from 'package:purrr':
##
##   map
```

process the data

```
df <- read.csv("radiomics_completedata.csv")  
  
df <- na.omit(df)  
  
df <- select(df, -c(Institution, Failure.binary))  
  
set.seed(123)
```

K-mean clustering

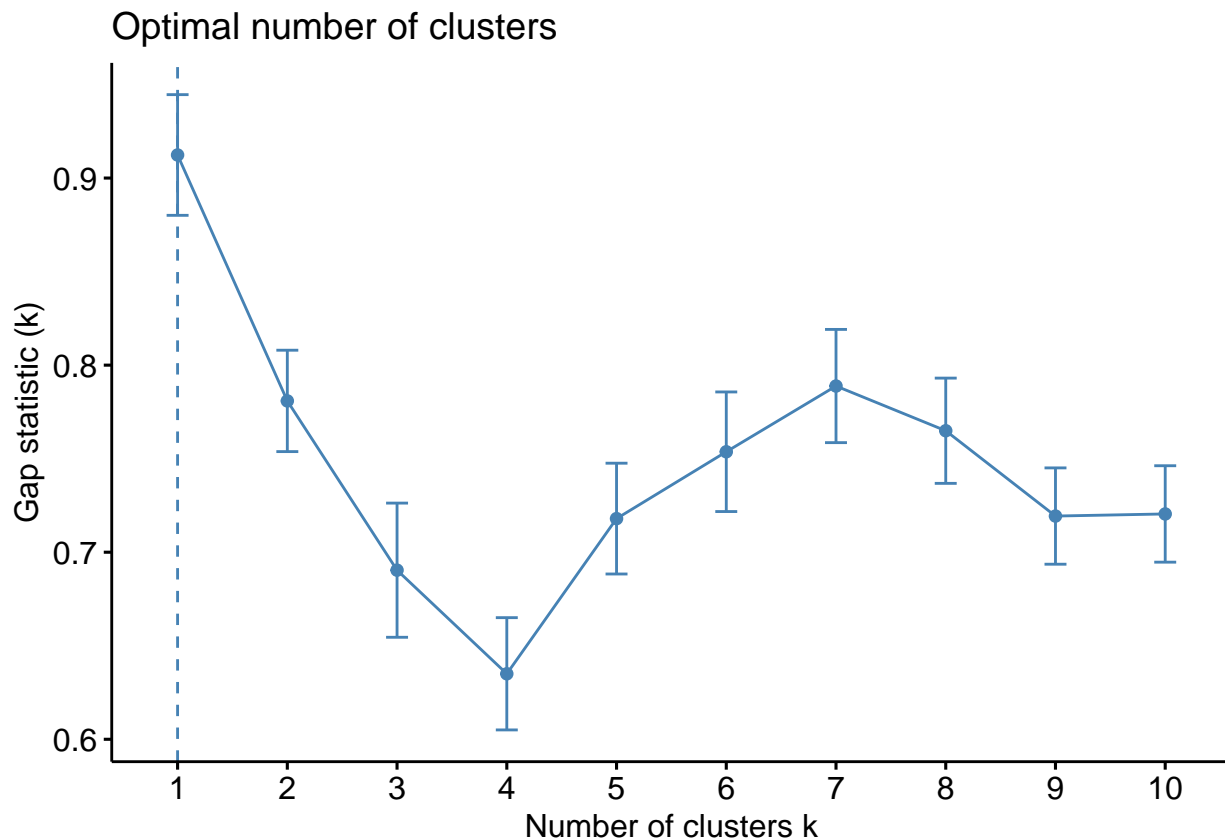
```
#function to compute total within-cluster sum of square  
wss <- function(k) {  
  kmeans(df, k, nstart = 10)$tot.withinss  
}  
  
# Compute and plot wss for k = 1 to k = 15  
k.values <- 1:15  
  
# extract wss for 2-15 clusters  
wss_values <- map_dbl(k.values, wss)  
  
#optimal number of cluster  
fviz_nbclust(df, kmeans, method = "silhouette")
```



```
# compute gap statistic
set.seed(123)
gap_stat <- clusGap(df, FUN = kmeans, nstart = 25,
                   K.max = 10, B = 50)
# Print the result
print(gap_stat, method = "firstmax")
```

```
## Clustering Gap statistic ["clusGap"] from call:
## clusGap(x = df, FUNcluster = kmeans, K.max = 10, B = 50, nstart = 25)
## B=50 simulated reference sets, k = 1..10; spaceH0="scaledPCA"
## --> Number of clusters (method 'firstmax'): 1
##      logW      E.logW      gap      SE.sim
## [1,] 21.41819 22.33052 0.9123332 0.03226158
## [2,] 20.86039 21.64127 0.7808819 0.02709159
## [3,] 20.53676 21.22716 0.6903992 0.03586341
## [4,] 20.30402 20.93903 0.6350126 0.03000272
## [5,] 19.98790 20.70587 0.7179659 0.02961470
## [6,] 19.76350 20.51720 0.7537013 0.03196371
## [7,] 19.58030 20.36914 0.7888372 0.03025893
## [8,] 19.47531 20.24024 0.7649309 0.02813081
## [9,] 19.40694 20.12627 0.7193261 0.02574257
## [10,] 19.30556 20.02602 0.7204577 0.02576691
```

```
fviz_gap_stat(gap_stat)
```



```
# Compute k-means clustering with k = 2
set.seed(123)
final <- kmeans(df, 2, nstart = 25)
print(final)
```

```
## K-means clustering with 2 clusters of sizes 173, 24
##
## Cluster means:
##      Failure Entropy_cooc.W.ADC GLNU_align.H.PET Min_hist.PET Max_hist.PET
## 1 27.19531      12.13725      88.24858      8.574928      24.07513
## 2 20.39444      13.29748      146.80159      8.068699      25.68628
##      Mean_hist.PET Variance_hist.PET Standard_Deviation_hist.PET Skewness_hist.PET
## 1      13.09267      9.335057      3.059548      0.853593
## 2      12.39877      8.698047      2.974779      1.332854
##      Kurtosis_hist.PET Energy_hist.PET Entropy_hist.PET AUC_hist.PET H_suv.PET
## 1      0.1631983      0.002729231      10.91287      0.6284775      1.229888
## 2      2.8533429      0.010263583      13.60531      0.7206375      1.106253
##      Volume.PET X3D_surface.PET ratio_3ds_vol.PET ratio_3ds_vol_norm.PET
## 1      46852.86      19171.66      3.766180      20.01679
## 2      59709.70      39084.40      3.941951      28.72834
##      irregularity.PET tumor_length.PET Compactness_v1.PET Compactness_v2.PET
## 1      2.559331      58.79731      0.004003896      0.03813479
## 2      2.832633      89.88848      0.012357917      0.04264846
##      Spherical_disproportion.PET Sphericity.PET Asphericity.PET Center_of_mass.PET
## 1      20.01679      0.1768912      18.77979      0.7724709
## 2      28.72834      0.1622369      27.35334      1.2784380
##      Max_3D_diam.PET Major_axis_length.PET Minor_axis_length.PET
## 1      76.46230      63.80532      42.94481
## 2      97.44916      88.45074      56.18579
##      Least_axis_length.PET Elongation.PET Flatness.PET Max_cooc.L.PET
## 1      35.23119      0.8916770      0.7124643      0.003176301
## 2      44.45337      0.9132477      0.7122144      0.013864417
##      Average_cooc.L.PET Variance_cooc.L.PET Entropy_cooc.L.PET DAVE_cooc.L.PET
## 1      27.27457      220.5009      12.80576      14.06341
## 2      25.82968      192.0645      13.96954      12.60382
##      DVAR_cooc.L.PET DENT_cooc.L.PET SAVE_cooc.L.PET SVAR_cooc.L.PET
## 1      112.9807      6.022669      54.55072      601.0240
## 2      101.5525      6.299086      51.65169      553.1985
##      SENT_cooc.L.PET ASM_cooc.L.PET Contrast_cooc.L.PET Dissimilarity_cooc.L.PET
## 1      7.659092 -0.0002362659      280.9828      14.06341
## 2      8.171604      0.0096532083      215.0440      12.60382
##      Inv_diff_cooc.L.PET Inv_diff_norm_cooc.L.PET IDM_cooc.L.PET
## 1      0.2180262      1.064832      0.1224332
## 2      0.2939719      1.224672      0.1806690
##      IDM_norm_cooc.L.PET Inv_var_cooc.L.PET Correlation_cooc.L.PET
## 1      1.177716      0.1256006      0.4724254
## 2      1.337300      0.1871535      0.6214577
##      Autocorrelation_cooc.L.PET Tendency_cooc.L.PET Shade_cooc.L.PET
## 1      705.2930      601.0240      5905.232
## 2      612.5504      553.1985      6579.245
##      Prominence_cooc.L.PET IC1_.L.PET IC2_.L.PET Coarseness_vdif_.L.PET
## 1      866428.8 -0.10324885      0.9031448      0.01356043
## 2      763830.8 -0.08441738      0.9609073      0.01798992
```

```

## Contrast_vdif_.L.PET Busyness_vdif_.L.PET Complexity_vdif_.L.PET
## 1 1.4939977 0.2443384 19867.32
## 2 0.8454666 0.4028733 18190.10
## Strength_vdif_.L.PET SRE_align.L.PET LRE_align.L.PET GLNU_align.L.PET
## 1 41.21487 1.210679 1.341023 40.01804
## 2 30.47412 1.348911 1.528494 72.06779
## RLNU_align.L.PET RP_align.L.PET LGRE_align.L.PET HGRE_align.L.PET
## 1 1313.104 1.203206 0.06756546 704.1971
## 2 2077.915 1.337714 0.10428417 606.8444
## LGSRE_align.L.PET HGSRE_align.L.PET LGHRE_align.L.PET HGLRE_align.L.PET
## 1 0.06598425 692.1731 0.0744040 754.6296
## 2 0.10146500 594.9735 0.1165969 657.5437
## GLNU_norm_align.L.PET RLNU_norm_align.L.PET GLVAR_align.L.PET
## 1 0.03436273 1.174528 214.8743
## 2 0.05474975 1.296868 190.7910
## RLVAR_align.L.PET Entropy_align.L.PET SZSE.L.PET LZSE.L.PET LGLZE.L.PET
## 1 0.03292797 6.754279 1.145333 1.725359 0.06732364
## 2 0.05759483 7.362201 1.280591 1.995911 0.10236808
## HGLZE.L.PET SZLGE.L.PET SZHGE.L.PET LZLGE.L.PET LZHGE.L.PET GLNU_area.L.PET
## 1 707.6394 0.06198279 662.7980 0.0964361 943.1499 36.08390
## 2 610.1254 0.09324500 574.4866 0.1636745 806.5035 64.47354
## ZSNU.L.PET ZSP.L.PET GLNU_norm.L.PET ZSNU_norm.L.PET GLVAR_area.L.PET
## 1 1054.400 1.119189 0.03382026 1.048482 216.7869
## 2 1642.033 1.237634 0.05400933 1.143778 192.5575
## ZSVAR.L.PET Entropy_area.L.PET Max_cooc.H.PET Average_cooc.H.PET
## 1 0.1680346 7.047919 0.09255945 50.21542
## 2 0.2627388 7.757871 0.17103925 57.45115
## Variance_cooc.H.PET Entropy_cooc.H.PET DAVE_cooc.H.PET DVAR_cooc.H.PET
## 1 306.0617 7.843908 16.37951 169.8540
## 2 298.7518 7.813227 15.85627 165.9872
## DENT_cooc.H.PET SAVE_cooc.H.PET SVAR_cooc.H.PET SENT_cooc.H.PET
## 1 4.270239 97.77348 825.2937 5.063490
## 2 5.180607 113.22797 951.5808 5.300703
## ASM_cooc.H.PET Contrast_cooc.H.PET Dissimilarity_cooc.H.PET
## 1 0.04691703 394.2743 16.37951
## 2 0.09326533 356.3277 15.85627
## Inv_diff_cooc.H.PET Inv_diff_norm_cooc.H.PET IDM_cooc.H.PET
## 1 0.3538649 1.046094 0.2888990
## 2 0.4903434 1.196658 0.4231678
## IDM_norm_cooc.H.PET Inv_var_cooc_.H.PET Correlation_cooc.H.PET
## 1 1.157018 0.02468823 0.4365657
## 2 1.309896 0.03835796 0.5520141
## Autocorrelation_cooc.H.PET Tendency_cooc.H.PET Shade_cooc.H.PET
## 1 2159.623 829.9758 -4221.759
## 2 2538.785 838.6642 -3125.698
## Prominence_cooc.H.PET IC1_d.H.PET IC2_d.H.PET Coarseness_vdif.H.PET
## 1 1224492 -0.06550312 0.5881136 0.0006573584
## 2 1142676 -0.08646883 0.7134900 0.0086805000
## Contrast_vdif.H.PET Busyness_vdif.H.PET Complexity_vdif.H.PET
## 1 110.8314 2.408175 27246.59
## 2 127.6310 1.451310 27869.71
## Strength_vdif.H.PET SRE_align.H.PET LRE_align.H.PET RLNU_align.H.PET
## 1 43.19090 1.085973 2.124865 932.774
## 2 15.36795 1.155212 3.146853 1514.505

```

```

## RP_align.H.PET LGRE_align.H.PET HGRE_align.H.PET LGSRE_align.H.PET
## 1 1.044711 0.001496451 2074.188 0.001254462
## 2 1.097826 0.010547792 2434.324 0.010271208
## HGSRE_align.H.PET LGHRE_align.H.PET HGLRE_align.H.PET GLNU_norm_align.H.PET
## 1 1802.664 0.002927803 3725.712 0.2110703
## 2 1996.493 0.012415000 5797.780 0.3072955
## RLNU_norm_align.H.PET GLVAR_align.H.PET RLVAR_align.H.PET Entropy_align.H.PET
## 1 0.9202978 324.9165 0.3320692 4.422073
## 2 0.9359130 318.2815 0.6572044 4.829799
## SZSE.H.PET LZSE.H.PET LGLZE.H.PET HGLZE.H.PET SZLGE.H.PET SZHGE.H.PET
## 1 0.8532961 39.68414 0.001626584 2111.352 0.0009069769 1406.550
## 2 0.9001930 360.29938 0.010663542 2699.699 0.0099682917 1579.607
## LZLGE.H.PET LZHGE.H.PET GLNU_area.H.PET ZSNU.H.PET ZSP.H.PET GLNU_norm.H.PET
## 1 0.04682398 92471.15 89.51968 423.0430 0.6518192 0.2052475
## 2 0.28611504 662565.27 132.32471 712.2865 0.5995874 0.2886872
## ZSNU_norm.H.PET GLVAR_area.H.PET ZSVAR.H.PET Entropy_area.H.PET
## 1 0.5870633 324.6276 36.09802 5.465243
## 2 0.5770080 321.2669 329.65824 6.148553
## Max_cooc.W.PET Average_cooc.W.PET Variance_cooc.W.PET Entropy_cooc.W.PET
## 1 0.02994108 10.82511 37.83992 9.595584
## 2 0.05755779 10.37906 33.92479 9.921937
## DAVE_cooc.W.PET DVAR_cooc.W.PET DENT_cooc.W.PET SAVE_cooc.W.PET
## 1 5.235428 19.05542 4.215414 21.65182
## 2 4.612980 15.49589 4.254693 20.75046
## SVAR_cooc.W.PET SENT_cooc.W.PET ASM_cooc.W.PET Contrast_cooc.W.PET
## 1 105.0826 5.781932 0.01203285 46.28024
## 2 100.1570 6.068148 0.03042513 35.52683
## Dissimilarity_cooc.W.PET Inv_diff_cooc.W.PET Inv_diff_norm_cooc.W.PET
## 1 5.235428 0.4257723 1.067407
## 2 4.612980 0.5573089 1.228453
## IDM_cooc.W.PET IDM_norm_cooc.W.PET Inv_var_cooc.W.PET Correlation_cooc.W.PET
## 1 0.3231161 1.178434 0.3131820 0.4687133
## 2 0.4530904 1.338094 0.4262685 0.6152566
## Autocorrelation_cooc.W.PET Tendency_cooc.W.PET Shade_cooc.W.PET
## 1 130.7735 105.0826 700.7295
## 2 127.3971 100.1570 634.6559
## Prominence_cooc.W.PET IC1_d.W.PET IC2_d.W.PET Coarseness_vdif.W.PET
## 1 56147.43 -0.06237749 0.6693906 0.01702759
## 2 51745.84 -0.07188562 0.7734765 0.01848404
## Contrast_vdif.W.PET Busyness_vdif.W.PET Complexity_vdif.W.PET
## 1 0.3556881 1.987926 2026.460
## 2 0.2493583 3.435807 2322.632
## Strength_vdif.W.PET SRE_align.W.PET LRE_align.W.PET GLNU_align.W.PET
## 1 5.151902 1.160001 1.611274 86.55956
## 2 4.307706 1.269973 2.024183 139.54229
## RLNU_align.W.PET RP_align.W.PET LGRE_align.W.PET HGRE_align.W.PET
## 1 1160.987 1.137281 0.2031411 131.1623
## 2 1871.883 1.234035 0.3094088 127.1438
## LGSRE_align.W.PET HGSRE_align.W.PET LGHRE_align.W.PET HGLRE_align.W.PET
## 1 0.1872361 126.1531 0.2896089 153.8089
## 2 0.2781837 121.4785 0.5138725 153.2439
## GLNU_norm_align.W.PET RLNU_norm_align.W.PET GLVAR_align.W.PET
## 1 0.1086834 1.060479 37.68446
## 2 0.1613787 1.128567 35.19323

```

```

##  RLVAR_align.W.PET Entropy_align.W.PET SZSE.W.PET LZSE.W.PET LGLZE.W.PET
## 1      0.1295874      5.282088      1.012923      4.855277      0.1959613
## 2      0.2461529      5.687970      1.093720      10.822512      0.2978860
##  HGLZE.W.PET SZLGE.W.PET SZHGE.W.PET LZLGE.W.PET LZHGE.W.PET GLNU_area.W.PET
## 1      133.1964      0.1510940      117.7391      1.266505      276.1583      65.94387
## 2      127.9542      0.2222621      110.9065      4.733948      304.2829      102.52189
##  ZSNU.W.PET ZSP.W.PET GLNU_norm.W.PET ZSNU_norm.W.PET GLVAR_area.W.PET
## 1      747.8483 0.9066497      0.1054177      0.8069485      38.57483
## 2      1239.6650 0.9285180      0.1567325      0.8244713      36.04790
##  ZSVAR.W.PET Entropy_area.W.PET Min_hist.ADC Max_hist.ADC Mean_hist.ADC
## 1      2.098416      5.970963      410.6227      2742.045      1453.536
## 2      6.813225      6.641511      95.0910      3880.341      1601.553
##  Variance_hist.ADC Standard_Deviation_hist.ADC Skewness_hist.ADC
## 1      90731.36      326.0607      0.4927327
## 2      254629.26      588.0478      0.4682881
##  Kurtosis_hist.ADC Energy_hist.ADC Entropy_hist.ADC AUC_hist.ADC Volume.ADC
## 1      0.9319835      0.001870705      11.04222      0.6485667      47900.54
## 2      0.7702392      0.009188667      13.78615      0.7242862      59609.21
##  X3D_surface.ADC ratio_3ds_vol.ADC ratio_3ds_vol_norm.ADC irregularity.ADC
## 1      10421.33      0.3260677      1.861363      2.183904
## 2      22489.34      0.2474014      2.112219      2.252143
##  Compactness_v1.ADC Compactness_v2.ADC Spherical_disproportion.ADC
## 1      0.03479107      0.3877654      1.861363
## 2      0.04675013      0.4091303      2.112219
##  Sphericity.ADC Asphericity.ADC Center_of_mass.ADC Max_3D_diam.ADC
## 1      0.8307687      0.6243692      0.9607342      93.88587
## 2      0.9130048      0.7372197      2.4988489      154.41926
##  Major_axis_length.ADC Minor_axis_length.ADC Least_axis_length.ADC
## 1      63.09772      46.57526      34.35319
## 2      102.02853      74.34899      54.41410
##  Elongation.ADC Flatness.ADC Max_cooc.L.ADC Average_cooc.L.ADC
## 1      0.9008132      0.6584532      0.007621578      34.83373
## 2      1.0282568      0.7491329      0.016265958      34.56939
##  Variance_cooc.L.ADC Entropy_cooc.L.ADC DAVE_cooc.L.ADC DVAR_cooc.L.ADC
## 1      98.64666      11.86180      8.816352      51.15299
## 2      133.30226      13.73934      9.577251      61.97875
##  DENT_cooc.L.ADC SAVE_cooc.L.ADC SVAR_cooc.L.ADC SENT_cooc.L.ADC
## 1      5.253611      69.66905      275.5658      4.809445
## 2      5.869620      69.13111      402.0206      6.309578
##  ASM_cooc.L.ADC Contrast_cooc.L.ADC Dissimilarity_cooc.L.ADC
## 1      0.001217723      119.0240      8.816352
## 2      0.010186958      131.1731      9.577251
##  Inv_diff_cooc.L.ADC Inv_diff_norm_cooc.L.ADC IDM_cooc.L.ADC
## 1      0.3008213      1.120226      0.1942965
## 2      0.3534331      1.257843      0.2342755
##  IDM_norm_cooc.L.ADC Inv_var_cooc.L.ADC Correlation_cooc.L.ADC
## 1      1.209166      0.2002545      0.4918407
## 2      1.353981      0.2382549      0.7037778
##  Autocorrelation_.L.ADC Tendency_cooc.L.ADC Shade_.L.ADC Prominence_cooc.L.ADC
## 1      1062.318      275.5658      1919.119      248470.9
## 2      956.795      402.0206      1967.897      435054.6
##  IC1_.L.ADC IC2_.L.ADC Coarseness_vdif_.L.ADC Contrast_vdif_.L.ADC
## 1 -0.08244699 0.8154471      0.01042934      0.439143
## 2 -0.07957671 0.9407728      0.01146833      0.400936

```

```

## Busyness_vdif_.L.ADC Complexity_vdif_.L.ADC Strength_vdif_.L.ADC
## 1 0.2385924 7685.305 12.670204
## 2 0.6419912 10177.157 5.290495
## SRE_align.L.ADC LRE_align.L.ADC GLNU_align.L.ADC RLNU_align.L.ADC
## 1 1.194590 1.419590 118.8192 2643.641
## 2 1.330737 1.617946 287.0006 7185.464
## RP_align.L.ADC LGRE_align.L.ADC HGRE_align.L.ADC LGSRE_align.L.ADC
## 1 1.180850 0.004707728 1161.988 0.004563237
## 2 1.313201 0.025264708 1073.334 0.024110292
## HGSRE_align.L.ADC LGHRE_align.L.ADC HGLRE_align.L.ADC GLNU_norm_align.L.ADC
## 1 1128.810 0.005399468 1311.029 0.04378442
## 2 1040.737 0.031375667 1218.073 0.05274183
## RLNU_norm_align.L.ADC GLVAR_align.L.ADC RLVAR_align.L.ADC Entropy_align.L.ADC
## 1 1.133746 109.5375 0.06267791 6.537033
## 2 1.253608 140.6706 0.08995775 7.568515
## SZSE.L.ADC LZSE.L.ADC LGLZE.L.ADC HGLZE.L.ADC SZLGE.L.ADC SZHGE.L.ADC
## 1 1.126745 2.013071 0.00481411 1173.051 0.004448676 1080.332
## 2 1.247303 2.337648 0.02329021 1089.051 0.020621333 1000.180
## LZLGE.L.ADC LZHGE.L.ADC GLNU_area.L.ADC ZSNU.L.ADC ZSP.L.ADC GLNU_norm.L.ADC
## 1 0.007571052 1788.869 100.2888 2003.307 1.074886 0.04212442
## 2 0.051710792 1633.578 244.1058 5502.259 1.183687 0.05112104
## ZSNU_norm.L.ADC GLVAR_area.L.ADC ZSVAR.L.ADC Entropy_area.L.ADC
## 1 0.9864824 112.4048 0.3590032 6.951598
## 2 1.0758275 142.6720 0.4395865 8.091669
## Max_cooc.H.ADC Average_cooc.H.ADC Variance_cooc.H.ADC Entropy_cooc.H.ADC
## 1 0.000980341 38.60966 391.4535 14.03906
## 2 0.012350375 42.69047 441.1526 15.83445
## DAVE_cooc.H.ADC DVAR_cooc.H.ADC DENT_cooc.H.ADC SAVE_cooc.H.ADC
## 1 18.58459 188.8052 6.568723 77.22091
## 2 18.24931 192.8448 7.124766 85.37328
## SVAR_cooc.H.ADC SENT_cooc.H.ADC ASM_cooc.H.ADC Contrast_cooc.H.ADC
## 1 1092.741 4.534486 -0.001061879 473.0767
## 2 1326.403 5.091628 0.008216333 438.1925
## Dissimilarity_cooc.H.ADC Inv_diff_cooc.H.ADC Inv_diff_norm_cooc.H.ADC
## 1 18.58459 0.1804861 1.022840
## 2 18.24931 0.2416567 1.170427
## IDM_cooc.H.ADC IDM_norm_cooc.H.ADC Inv_var_cooc.H.ADC Correlation_cooc.H.ADC
## 1 0.09513712 1.144557 0.09940879 0.4872475
## 2 0.14225488 1.297829 0.14227879 0.6992277
## Autocorrelation_cooc.H.ADC Tendency_cooc.H.ADC Shade_cooc.H.ADC
## 1 1362.323 1092.741 2939.447
## 2 1548.252 1326.403 3031.549
## Prominence_cooc.H.ADC IC1_d.H.ADC IC2_d.H.ADC Coarseness_vdif.H.ADC
## 1 2054834 -0.09359702 0.8747766 0.008854532
## 2 2642531 -0.07204613 0.9544842 0.010873833
## Contrast_vdif.H.ADC Busyness_vdif.H.ADC Complexity_vdif.H.ADC
## 1 2.208533 0.3633655 19967.44
## 2 2.155887 0.9424872 19145.03
## Strength_vdif.H.ADC SRE_align.H.ADC LRE_align.H.ADC GLNU_align.H.ADC
## 1 14.739718 1.216863 1.315870 48.72108
## 2 4.391189 1.352434 1.518544 131.57286
## RLNU_align.H.ADC RP_align.H.ADC LGRE_align.H.ADC HGRE_align.H.ADC
## 1 2906.872 1.210381 0.02798183 1682.455
## 2 7744.281 1.341472 0.03840579 1863.055

```



```

## LGSRE_align.H.ADC HGSRE_align.H.ADC LGHRE_align.H.ADC HGLRE_align.H.ADC
## 1 0.02686303 1657.236 0.03395375 1794.174
## 2 0.03615242 1820.837 0.05068813 2058.424
## GLNU_norm_align.H.ADC RLNU_norm_align.H.ADC GLVAR_align.H.ADC
## 1 0.01830694 1.187637 406.0562
## 2 0.02960542 1.305634 447.8178
## RLVAR_align.H.ADC Entropy_align.H.ADC SZSE.H.ADC LZSE.H.ADC LGLZE.H.ADC
## 1 0.02656647 7.513578 1.182616 1.517131 0.02565727
## 2 0.05624287 8.451461 1.299670 1.908625 0.03342946
## HGLZE.H.ADC SZLGE.H.ADC SZHGE.H.ADC LZLGE.H.ADC LZHGE.H.ADC GLNU_area.H.ADC
## 1 1671.367 0.02280493 1594.198 0.04972676 2119.019 46.40594
## 2 1848.192 0.02876888 1727.653 0.09084979 2669.463 124.31487
## ZSNU.H.ADC ZSP.H.ADC GLNU_norm.H.ADC ZSNU_norm.H.ADC GLVAR_area.H.ADC
## 1 2530.859 1.160724 0.01838613 1.105574 398.8986
## 2 6630.837 1.259621 0.02971837 1.183594 432.4503
## ZSVAR.H.ADC Entropy_area.H.ADC Max_cooc.W.ADC Average_cooc.W.ADC
## 1 0.1134877 7.708548 0.0003199538 106.8261
## 2 0.2476833 8.768355 0.0096262500 150.3573
## Variance_cooc.W.ADC DAVE_cooc.W.ADC DVAR_cooc.W.ADC DENT_cooc.W.ADC
## 1 825.1489 24.95128 415.7549 7.098370
## 2 2435.2393 41.10589 1112.9785 8.711247
## SAVE_cooc.W.ADC SVAR_cooc.W.ADC SENT_cooc.W.ADC ASM_cooc.W.ADC
## 1 211.7758 2357.391 5.930917 -0.001110121
## 2 296.5015 7379.638 8.425598 0.007832250
## Contrast_cooc.W.ADC Dissimilarity_cooc.W.ADC Inv_diff_cooc.W.ADC
## 1 943.2077 24.95128 0.1408553
## 2 2361.3033 41.10589 0.1379546
## Inv_diff_norm_cooc.W.ADC IDM_cooc.W.ADC IDM_norm_cooc.W.ADC
## 1 1.119003 0.07212651 1.208634
## 2 1.256195 0.06735029 1.353231
## Inv_var_cooc.W.ADC Correlation_cooc.W.ADC Autocorrelation_cooc.W.ADC
## 1 0.07562266 0.4924185 10236.01
## 2 0.06767446 0.7042127 17696.41
## Tendency_cooc.W.ADC Shade_cooc.W.ADC Prominence_cooc.W.ADC IC1_d.W.ADC
## 1 2357.391 45917.16 19250418 -0.1325692
## 2 7379.638 151385.98 139586384 -0.1299187
## IC2_d.W.ADC Coarseness_vdif.W.ADC Contrast_vdif.W.ADC Busyness_vdif.W.ADC
## 1 1.016528 0.00874289 1.656155 0.03092039
## 2 1.163815 0.01105854 2.160217 0.04919350
## Complexity_vdif.W.ADC Strength_vdif.W.ADC SRE_align.W.ADC LRE_align.W.ADC
## 1 174090.3 53.94542 1.221763 1.291908
## 2 636164.9 64.07633 1.369946 1.435837
## GLNU_align.W.ADC RLNU_align.W.ADC RP_align.W.ADC LGRE_align.W.ADC
## 1 38.50920 2980.982 1.217229 0.001736884
## 2 67.02436 8197.988 1.365563 0.018922500
## HGRE_align.W.ADC LGSRE_align.W.ADC HGSRE_align.W.ADC LGHRE_align.W.ADC
## 1 10787.08 0.001696052 10685.68 0.001949832
## 2 19705.39 0.018111167 19561.62 0.023239708
## HGLRE_align.W.ADC GLNU_norm_align.W.ADC RLNU_norm_align.W.ADC
## 1 11207.42 0.01526780 1.199866
## 2 20292.76 0.01861142 1.349384
## GLVAR_align.W.ADC RLVAR_align.W.ADC Entropy_align.W.ADC SZSE.W.ADC LZSE.W.ADC
## 1 911.1183 0.01746290 8.031972 1.193705 1.416800
## 2 2541.8411 0.02586771 9.670828 1.347225 1.552834

```

```

##   LGLZE.W.ADC HGLZE.W.ADC SZLGE.W.ADC SZHGE.W.ADC LZLGE.W.ADC LZHGE.W.ADC
## 1  0.00172937   10813.09 0.001637289   10518.24 0.002350318   12189.75
## 2  0.01677883   19802.26 0.015024542   19393.56 0.035635750   21578.68
##   GLNU_area.W.ADC ZSNU.W.ADC ZSP.W.ADC GLNU_norm.W.ADC ZSNU_norm.W.ADC
## 1    36.74396    2732.236  1.175270    0.01584184    1.138890
## 2    64.73788    7672.339  1.327663    0.02183338    1.292747
##   GLVAR_area.W.ADC ZSVAR.W.ADC Entropy_area.W.ADC
## 1    917.9021    0.06449373    8.264979
## 2   2533.3803    0.07272758   10.252530
##
## Clustering vector:
##   1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20
##   1  1  2  1  1  2  1  1  1  2  1  1  1  1  1  1  1  1  1  1
## 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
##   1  1  1  1  1  1  1  1  1  1  1  1  2  1  1  1  2  1  1  1
## 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
##   1  1  2  1  1  1  2  1  1  1  1  1  2  1  1  1  1  1  1  1
## 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
##   1  1  2  1  1  1  1  2  1  1  1  2  1  1  1  1  1  1  1  1
## 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100
##   1  1  1  1  1  1  1  1  1  1  1  1  1  1  2  1  1  1  1  1
## 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120
##   1  1  1  1  1  2  1  1  1  1  1  1  1  1  1  1  1  1  1  1
## 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140
##   1  1  1  1  2  1  1  1  1  1  1  1  1  1  1  2  1  1  1  1
## 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160
##   1  1  1  1  1  1  1  1  1  1  1  2  1  1  1  1  2  1  2  2
## 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180
##   1  2  1  1  1  1  2  1  1  1  2  1  1  1  1  1  1  1  1  1
## 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
##   2  1  1  1  1  1  1  1  1  1  1  1  1  2  1  1  1
##
## Within cluster sum of squares by cluster:
## [1] 5.014654e+16 7.680429e+16
## (between_SS / total_SS =  70.6 %)
##
## Available components:
##
## [1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
## [6] "betweenss"    "size"         "iter"         "ifault"

```

```

#final data
fviz_cluster(final, data = df)

```

