

Model 3

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K-Means

Helper packages

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##   filter, lag

## The following objects are masked from 'package:base':
##
##   intersect, setdiff, setequal, union
```

```
library(ggplot2)
library(stringr)
library(gridExtra)
```

```
##
## Attaching package: 'gridExtra'

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

```
# Modeling packages
library(tidyverse)
```

```
## -- Attaching packages ----- tidyverse 1.3.2 --

## v tibble  3.1.8      v purrr  0.3.4
## v tidyr   1.2.1      v forcats 0.5.2
## v readr   2.1.2

## -- Conflicts ----- tidyverse_conflicts() --
## x gridExtra::combine() masks dplyr::combine()
## x dplyr::filter()      masks stats::filter()
## x dplyr::lag()          masks stats::lag()
```

```
library(cluster)
library(factoextra)
```

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

Load the dataset

```
library(readr)
df = read.csv("radiomics_completedata.csv")
```

Investigate the statistics of the dataset

```
summary(df)
```

```
## Institution      Failure.binary      Failure      Entropy_cooc.W.ADC
## Length:197      Min.      :0.0000      Min.      : 4.767      Min.      : 9.533
## Class :character 1st Qu.:0.0000      1st Qu.:11.267      1st Qu.:11.559
## Mode  :character Median :0.0000      Median :20.500      Median :12.279
##              Mean  :0.3401      Mean  :26.367      Mean   :12.279
##              3rd Qu.:1.0000      3rd Qu.:37.900      3rd Qu.:12.977
##              Max.   :1.0000      Max.   :97.633      Max.    :14.510
## GLNU_align.H.PET Min_hist.PET      Max_hist.PET      Mean_hist.PET
## Min.      : 9.445      Min.      : 1.485      Min.      : 4.164      Min.      : 2.425
## 1st Qu.: 37.518      1st Qu.: 5.152      1st Qu.:13.072      1st Qu.: 7.498
## Median : 80.035      Median : 7.389      Median :21.014      Median :11.449
## Mean   : 95.382      Mean   : 8.513      Mean   :24.271      Mean   :13.008
## 3rd Qu.:112.145      3rd Qu.:11.005      3rd Qu.:33.761      3rd Qu.:17.387
## Max.   :559.352      Max.   :28.404      Max.   :79.986      Max.    :44.043
## Variance_hist.PET Standard_Deviation_hist.PET Skewness_hist.PET
## Min.      : 0.1787      Min.      :0.4194      Min.      : -0.001136
## 1st Qu.: 2.2583      1st Qu.:1.6391      1st Qu.: 0.444828
## Median : 6.4504      Median :2.7341      Median : 0.734796
## Mean   : 9.2575      Mean   :3.0492      Mean   : 0.911980
## 3rd Qu.:12.6824      3rd Qu.:4.2095      3rd Qu.: 1.199956
## Max.   :49.0121      Max.   :9.9293      Max.    : 4.901172
## Kurtosis_hist.PET Energy_hist.PET      Entropy_hist.PET      AUC_hist.PET
## Min.      : -2.2661      Min.      : -0.063283      Min.      : 5.296      Min.      :0.4403
## 1st Qu.: -0.5259      1st Qu.: -0.012100      1st Qu.: 8.281      1st Qu.:0.5039
## Median : -0.1672      Median : 0.007731      Median : 9.922      Median :0.5170
## Mean   : 0.4909      Mean   : 0.003647      Mean   :11.241      Mean   :0.6397
## 3rd Qu.: 0.5017      3rd Qu.: 0.020205      3rd Qu.:12.528      3rd Qu.:0.9764
## Max.   :33.7421      Max.   : 0.089760      Max.   :25.055      Max.    :1.1242
## H_suv.PET      Volume.PET      X3D_surface.PET      ratio_3ds_vol.PET
## Min.      :0.1557      Min.      : 3584      Min.      : 926.2      Min.      : 0.1171
## 1st Qu.:0.6073      1st Qu.:16846      1st Qu.: 7680.0      1st Qu.: 2.3726
## Median :1.0579      Median :34286      Median :13705.0      Median : 3.5661
## Mean   :1.2148      Mean   :48419      Mean   :21597.6      Mean   : 3.7876
## 3rd Qu.:1.5739      3rd Qu.:69138      3rd Qu.:22901.7      3rd Qu.: 4.9584
## Max.   :4.1235      Max.   :283502      Max.   :290926.3      Max.    :11.4815
## ratio_3ds_vol_norm.PET irregularity.PET tumor_length.PET Compactness_v1.PET
## Min.      : 1.487      Min.      :1.730      Min.      :13.84      Min.      : -0.061021
## 1st Qu.:14.899      1st Qu.:1.963      1st Qu.:39.34      1st Qu.: 0.003078
```

## Median :18.320	Median :2.123	Median : 51.36	Median : 0.005560
## Mean :21.078	Mean :2.593	Mean : 62.59	Mean : 0.005022
## 3rd Qu.:27.985	3rd Qu.:3.553	3rd Qu.: 75.90	3rd Qu.: 0.016708
## Max. :75.896	Max. :5.105	Max. :306.76	Max. : 0.040820
## Compactness_v2.PET	Spherical_disproportion.PET	Sphericity.PET	
## Min. : -0.061536	Min. : 1.487	Min. : -0.008712	
## 1st Qu.: 0.002703	1st Qu.:14.899	1st Qu.: 0.053418	
## Median : 0.015918	Median :18.320	Median : 0.070447	
## Mean : 0.038685	Mean :21.078	Mean : 0.175106	
## 3rd Qu.: 0.032250	3rd Qu.:27.985	3rd Qu.: 0.141500	
## Max. : 0.509032	Max. :75.896	Max. : 1.261968	
## Asphericity.PET	Center_of_mass.PET	Max_3D_diam.PET	Major_axis_length.PET
## Min. : 0.4868	Min. :0.02145	Min. : 13.84	Min. : 14.11
## 1st Qu.:13.8993	1st Qu.:0.39969	1st Qu.: 41.92	1st Qu.: 37.32
## Median :17.3200	Median :0.62581	Median : 62.74	Median : 54.19
## Mean :19.8243	Mean :0.83411	Mean : 79.02	Mean : 66.81
## 3rd Qu.:26.9567	3rd Qu.:1.04679	3rd Qu.: 98.06	3rd Qu.: 83.98
## Max. :73.8960	Max. :5.95651	Max. :306.76	Max. :288.01
## Minor_axis_length.PET	Least_axis_length.PET	Elongation.PET	Flatness.PET
## Min. : 10.98	Min. : 6.961	Min. :0.2847	Min. :0.2061
## 1st Qu.: 27.29	1st Qu.: 22.247	1st Qu.:0.6649	1st Qu.:0.5117
## Median : 41.35	Median : 31.747	Median :0.7906	Median :0.6508
## Mean : 44.56	Mean : 36.355	Mean :0.8943	Mean :0.7124
## 3rd Qu.: 53.41	3rd Qu.: 42.708	3rd Qu.:0.9866	3rd Qu.:0.7964
## Max. :148.69	Max. :137.273	Max. :1.9731	Max. :1.6248
## Max_cooc.L.PET	Average_cooc.L.PET	Variance_cooc.L.PET	Entropy_cooc.L.PET
## Min. : -0.061012	Min. : 7.286	Min. : 24.0	Min. : 8.077
## 1st Qu.: -0.010176	1st Qu.:20.927	1st Qu.:137.9	1st Qu.:10.376
## Median : 0.007806	Median :23.525	Median :201.1	Median :10.630
## Mean : 0.004478	Mean :27.099	Mean :217.0	Mean :12.948
## 3rd Qu.: 0.020696	3rd Qu.:28.993	3rd Qu.:255.3	3rd Qu.:16.154
## Max. : 0.057722	Max. :64.058	Max. :575.6	Max. :22.440
## DAVE_cooc.L.PET	DVAR_cooc.L.PET	DENT_cooc.L.PET	SAVE_cooc.L.PET
## Min. : 4.325	Min. : 21.97	Min. : 3.635	Min. : 14.56
## 1st Qu.: 8.901	1st Qu.: 64.46	1st Qu.: 4.657	1st Qu.: 41.85
## Median :12.670	Median : 99.01	Median : 5.062	Median : 47.04
## Mean :13.886	Mean :111.59	Mean : 6.056	Mean : 54.20
## 3rd Qu.:15.530	3rd Qu.:130.75	3rd Qu.: 7.270	3rd Qu.: 57.95
## Max. :38.939	Max. :395.31	Max. :10.965	Max. :128.08
## SVAR_cooc.L.PET	SENT_cooc.L.PET	ASM_cooc.L.PET	Contrast_cooc.L.PET
## Min. : 63.6	Min. : 4.832	Min. : -0.0627950	Min. : 32.37
## 1st Qu.: 399.7	1st Qu.: 6.211	1st Qu.: -0.0121930	1st Qu.: 137.93
## Median : 558.2	Median : 6.469	Median : 0.0040010	Median : 239.14
## Mean : 595.2	Mean : 7.722	Mean : 0.0009685	Mean : 272.95
## 3rd Qu.: 696.7	3rd Qu.: 9.759	3rd Qu.: 0.0169560	3rd Qu.: 326.69
## Max. :1671.9	Max. :13.423	Max. : 0.0442660	Max. :1151.93
## Dissimilarity_cooc.L.PET	Inv_diff_cooc.L.PET	Inv_diff_norm_cooc.L.PET	
## Min. : 4.325	Min. :0.07774	Min. :0.7734	
## 1st Qu.: 8.901	1st Qu.:0.15401	1st Qu.:0.8409	
## Median :12.670	Median :0.18711	Median :0.8752	
## Mean :13.886	Mean :0.22728	Mean :1.0843	
## 3rd Qu.:15.530	3rd Qu.:0.28121	3rd Qu.:1.6137	
## Max. :38.939	Max. :0.65958	Max. :1.9108	
## IDM_cooc.L.PET	IDM_norm_cooc.L.PET	Inv_var_cooc.L.PET	

```

## Min. :0.006727 Min. :0.8766 Min. :0.01145
## 1st Qu.:0.080322 1st Qu.:0.9419 1st Qu.:0.08407
## Median :0.105318 Median :0.9625 Median :0.10969
## Mean :0.129528 Mean :1.1972 Mean :0.13310
## 3rd Qu.:0.166520 3rd Qu.:1.8260 3rd Qu.:0.17249
## Max. :0.478270 Max. :2.0165 Max. :0.47857
## Correlation_cooc.L.PET Autocorrelation_cooc.L.PET Tendency_cooc.L.PET
## Min. : -0.01336 Min. : 60.68 Min. : 63.6
## 1st Qu.: 0.34436 1st Qu.: 492.39 1st Qu.: 399.7
## Median : 0.42414 Median : 614.95 Median : 558.2
## Mean : 0.49058 Mean : 693.99 Mean : 595.2
## 3rd Qu.: 0.62925 3rd Qu.: 811.25 3rd Qu.: 696.7
## Max. : 1.28668 Max. :2225.86 Max. :1671.9
## Shade_cooc.L.PET Prominence_cooc.L.PET IC1_.L.PET IC2_.L.PET
## Min. : -7233 Min. : 28425 Min. : -0.360734 Min. : 0.4430
## 1st Qu.: 2180 1st Qu.: 456518 1st Qu.: -0.126535 1st Qu.: 0.6654
## Median : 4857 Median : 768547 Median : -0.089284 Median : 0.7938
## Mean : 5987 Mean : 853930 Mean : -0.100955 Mean : 0.9102
## 3rd Qu.: 8315 3rd Qu.:1091790 3rd Qu.: -0.056803 3rd Qu.: 0.9552
## Max. :24034 Max. :3269996 Max. : -0.008777 Max. :1.9104
## Coarseness_vdif_.L.PET Contrast_vdif_.L.PET Busyness_vdif_.L.PET
## Min. : -0.061468 Min. : 0.1886 Min. : -0.03228
## 1st Qu.: -0.006006 1st Qu.: 0.5195 1st Qu.: 0.06736
## Median : 0.017239 Median : 0.9731 Median : 0.15893
## Mean : 0.014100 Mean : 1.4150 Mean : 0.26365
## 3rd Qu.: 0.033488 3rd Qu.: 1.4553 3rd Qu.: 0.32494
## Max. : 0.141802 Max. :18.6449 Max. : 2.44794
## Complexity_vdif_.L.PET Strength_vdif_.L.PET SRE_align.L.PET LRE_align.L.PET
## Min. : 7268 Min. : 2.002 Min. : 0.8629 Min. : 0.9847
## 1st Qu.:12641 1st Qu.: 8.460 1st Qu.:0.9715 1st Qu.:1.0571
## Median :17160 Median : 23.324 Median :0.9893 Median :1.0890
## Mean :19663 Mean : 39.906 Mean :1.2275 Mean :1.3639
## 3rd Qu.:21957 3rd Qu.: 55.792 3rd Qu.:1.9080 3rd Qu.:2.0723
## Max. :69560 Max. :295.545 Max. :2.0211 Max. :2.4167
## GLNU_align.L.PET RLNU_align.L.PET RP_align.L.PET LGRE_align.L.PET
## Min. : 1.647 Min. : 39.43 Min. : 0.8740 Min. : -0.03560
## 1st Qu.: 8.230 1st Qu.: 300.12 1st Qu.:0.9627 1st Qu.: 0.03366
## Median : 21.227 Median : 713.34 Median :0.9843 Median : 0.06100
## Mean : 43.923 Mean : 1406.28 Mean :1.2196 Mean : 0.07204
## 3rd Qu.: 62.183 3rd Qu.: 1803.07 3rd Qu.:1.8882 3rd Qu.: 0.10134
## Max. :441.820 Max. :15312.68 Max. :2.0161 Max. : 0.36303
## HGRE_align.L.PET LGSRE_align.L.PET HGSRE_align.L.PET LGHRE_align.L.PET
## Min. : 67.61 Min. : -0.03590 Min. : 65.67 Min. : -0.03429
## 1st Qu.: 499.26 1st Qu.: 0.03241 1st Qu.: 487.32 1st Qu.: 0.03791
## Median : 602.00 Median : 0.06090 Median : 584.44 Median : 0.06539
## Mean : 692.34 Mean : 0.07031 Mean : 680.33 Mean : 0.07954
## 3rd Qu.: 820.69 3rd Qu.: 0.10037 3rd Qu.: 801.22 3rd Qu.: 0.11015
## Max. :2080.05 Max. : 0.34822 Max. :2047.60 Max. : 0.43073
## HGLRE_align.L.PET GLNU_norm_align.L.PET RLNU_norm_align.L.PET
## Min. : 76.1 Min. : -0.03837 Min. : 0.8611
## 1st Qu.: 535.8 1st Qu.: 0.02299 1st Qu.:0.9333
## Median : 665.0 Median : 0.03344 Median :0.9634
## Mean : 742.8 Mean : 0.03685 Mean :1.1894
## 3rd Qu.: 884.2 3rd Qu.: 0.05188 3rd Qu.:1.7947

```

## Max. :2209.9	Max. : 0.18495	Max. :1.9936	
## GLVAR_align.L.PET	RLVAR_align.L.PET	Entropy_align.L.PET	SZSE.L.PET
## Min. : 25.37	Min. :-0.04672	Min. : 4.280	Min. :0.1768
## 1st Qu.:140.87	1st Qu.: 0.01945	1st Qu.: 5.450	1st Qu.:0.9142
## Median :196.49	Median : 0.03054	Median : 5.577	Median :0.9499
## Mean :211.94	Mean : 0.03593	Mean : 6.828	Mean :1.1618
## 3rd Qu.:248.98	3rd Qu.: 0.05440	3rd Qu.: 8.560	3rd Qu.:1.7686
## Max. :542.91	Max. : 0.16722	Max. :11.667	Max. :1.9617
## LZSE.L.PET	LGLZE.L.PET	HGLZE.L.PET	SZLGE.L.PET
## Min. :1.003	Min. :-0.03560	Min. : 71.77	Min. :-0.04675
## 1st Qu.:1.248	1st Qu.: 0.03474	1st Qu.: 502.88	1st Qu.: 0.03069
## Median :1.354	Median : 0.06054	Median : 603.02	Median : 0.05654
## Mean :1.758	Mean : 0.07159	Mean : 695.76	Mean : 0.06579
## 3rd Qu.:2.358	3rd Qu.: 0.10166	3rd Qu.: 819.19	3rd Qu.: 0.09873
## Max. :5.785	Max. : 0.35820	Max. :1988.06	Max. : 0.30999
## SZHGE.L.PET	LZLGE.L.PET	LZHGE.L.PET	GLNU_area.L.PET
## Min. : 65.32	Min. :-0.02915	Min. : 115.8	Min. : 1.551
## 1st Qu.: 467.58	1st Qu.: 0.04621	1st Qu.: 623.2	1st Qu.: 7.695
## Median : 561.06	Median : 0.08144	Median : 783.7	Median : 19.019
## Mean : 652.04	Mean : 0.10463	Mean : 926.5	Mean : 39.542
## 3rd Qu.: 772.90	3rd Qu.: 0.13560	3rd Qu.:1075.6	3rd Qu.: 57.064
## Max. :1911.50	Max. : 0.71824	Max. :3030.5	Max. :408.095
## ZSNU.L.PET	ZSP.L.PET	GLNU_norm.L.PET	ZSNU_norm.L.PET
## Min. : 35.19	Min. :0.3864	Min. :-0.03836	Min. :0.7155
## 1st Qu.: 254.69	1st Qu.:0.8886	1st Qu.: 0.02259	1st Qu.:0.8153
## Median : 594.33	Median :0.9286	Median : 0.03365	Median :0.8713
## Mean : 1125.99	Mean :1.1336	Mean : 0.03628	Mean :1.0601
## 3rd Qu.: 1322.79	3rd Qu.:1.6321	3rd Qu.: 0.05133	3rd Qu.:1.4555
## Max. :12249.90	Max. :1.9410	Max. : 0.18003	Max. :1.8450
## GLVAR_area.L.PET	ZSVAR.L.PET	Entropy_area.L.PET	Max_cooc.H.PET
## Min. : 27.01	Min. :0.00253	Min. : 4.512	Min. :-0.04902
## 1st Qu.:144.01	1st Qu.:0.08041	1st Qu.: 5.689	1st Qu.: 0.02770
## Median :196.99	Median :0.12536	Median : 5.858	Median : 0.06533
## Mean :213.84	Mean :0.17957	Mean : 7.134	Mean : 0.10212
## 3rd Qu.:250.79	3rd Qu.:0.20093	3rd Qu.: 9.648	3rd Qu.: 0.14406
## Max. :534.49	Max. :1.05837	Max. :12.150	Max. : 0.81117
## Average_cooc.H.PET	Variance_cooc.H.PET	Entropy_cooc.H.PET	DAVE_cooc.H.PET
## Min. :36.47	Min. : 1.866	Min. : 2.473	Min. : 0.6999
## 1st Qu.:38.49	1st Qu.:226.943	1st Qu.: 5.687	1st Qu.:11.9980
## Median :42.01	Median :276.466	Median : 7.103	Median :14.1391
## Mean :51.10	Mean :305.171	Mean : 7.840	Mean :16.3158
## 3rd Qu.:72.93	3rd Qu.:297.145	3rd Qu.: 7.871	3rd Qu.:18.1939
## Max. :93.09	Max. :611.179	Max. :16.101	Max. :36.3879
## DVAR_cooc.H.PET	DENT_cooc.H.PET	SAVE_cooc.H.PET	SVAR_cooc.H.PET
## Min. : 2.353	Min. : 0.8283	Min. : 72.92	Min. : 4.611
## 1st Qu.:121.528	1st Qu.: 3.0993	1st Qu.: 76.41	1st Qu.: 656.858
## Median :151.762	Median : 4.1300	Median : 79.88	Median : 753.357
## Mean :169.383	Mean : 4.3811	Mean : 99.66	Mean : 840.679
## 3rd Qu.:191.314	3rd Qu.: 4.9869	3rd Qu.:145.84	3rd Qu.: 886.786
## Max. :394.861	Max. :10.0676	Max. :186.16	Max. :1776.231
## SENT_cooc.H.PET	ASM_cooc.H.PET	Contrast_cooc.H.PET	
## Min. : 0.302	Min. :-0.05834	Min. : 2.821	
## 1st Qu.: 2.981	1st Qu.: 0.01188	1st Qu.: 266.667	
## Median : 4.955	Median : 0.03473	Median : 349.442	

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## Mean      : 5.092      Mean      : 0.05256      Mean      : 389.651
## 3rd Qu.: 5.976      3rd Qu.: 0.07810      3rd Qu.: 457.092
## Max.      :12.565      Max.      : 0.65981      Max.      :1055.743
## Dissimilarity_cooc.H.PET Inv_diff_cooc.H.PET Inv_diff_norm_cooc.H.PET
## Min.      : 0.6999      Min.      :0.1124      Min.      :0.7478
## 1st Qu.:11.9980      1st Qu.:0.2252      1st Qu.:0.8304
## Median :14.1391      Median :0.3182      Median :0.8601
## Mean      :16.3158      Mean      :0.3705      Mean      :1.0644
## 3rd Qu.:18.1939      3rd Qu.:0.4680      3rd Qu.:1.5894
## Max.      :36.3879      Max.      :1.2243      Max.      :1.8274
## IDM_cooc.H.PET      IDM_norm_cooc.H.PET Inv_var_cooc_.H.PET
## Min.      :0.05396      Min.      :0.8484      Min.      : -0.055882
## 1st Qu.:0.16043      1st Qu.:0.9278      1st Qu.: 0.009132
## Median :0.25827      Median :0.9475      Median : 0.027178
## Mean      :0.30526      Mean      :1.1756      Mean      : 0.026354
## 3rd Qu.:0.38620      3rd Qu.:1.7906      3rd Qu.: 0.044357
## Max.      :1.17324      Max.      :1.9649      Max.      : 0.123834
## Correlation_cooc.H.PET Autocorrelation_cooc.H.PET Tendency_cooc.H.PET
## Min.      : -0.000138      Min.      :1474      Min.      : 4.611
## 1st Qu.: 0.315680      1st Qu.:1599      1st Qu.: 629.846
## Median : 0.392730      Median :1849      Median : 753.311
## Mean      : 0.450630      Mean      :2206      Mean      : 831.034
## 3rd Qu.: 0.558411      3rd Qu.:2950      3rd Qu.: 888.115
## Max.      : 1.225154      Max.      :4427      Max.      :1776.231
## Shade_cooc.H.PET Prominence_cooc.H.PET IC1_d.H.PET      IC2_d.H.PET
## Min.      : -15874      Min.      : 134      Min.      : -0.26739      Min.      :0.2221
## 1st Qu.: -5732      1st Qu.: 729696      1st Qu.: -0.09830      1st Qu.:0.4330
## Median : -3931      Median :1173937      Median : -0.05559      Median :0.5250
## Mean      : -4088      Mean      :1214525      Mean      : -0.06806      Mean      :0.6034
## 3rd Qu.: -2025      3rd Qu.:1469772      3rd Qu.: -0.03012      3rd Qu.:0.7239
## Max.      : 3449      Max.      :3219875      Max.      : 0.01637      Max.      :1.4532
## Coarseness_vdif.H.PET Contrast_vdif.H.PET Busyness_vdif.H.PET
## Min.      : -0.063165      Min.      : 0.2156      Min.      : -0.02149
## 1st Qu.: -0.012344      1st Qu.: 38.2720      1st Qu.: 0.12606
## Median : 0.005432      Median : 62.4850      Median : 0.31395
## Mean      : 0.001635      Mean      :112.8780      Mean      : 2.29160
## 3rd Qu.: 0.018121      3rd Qu.:134.1018      3rd Qu.: 0.83327
## Max.      : 0.052168      Max.      :1099.8953      Max.      :40.35804
## Complexity_vdif.H.PET Strength_vdif.H.PET SRE_align.H.PET LRE_align.H.PET
## Min.      : 1806      Min.      : 0.2884      Min.      :0.4984      Min.      :1.163
## 1st Qu.:17897      1st Qu.: 4.5072      1st Qu.:0.8453      1st Qu.:1.393
## Median :25517      Median : 13.9361      Median :0.9161      Median :1.828
## Mean      :27323      Mean      : 39.8013      Mean      :1.0944      Mean      :2.249
## 3rd Qu.:33113      3rd Qu.: 39.7754      3rd Qu.:1.4601      3rd Qu.:2.706
## Max.      :77554      Max.      :2126.3694      Max.      :1.9425      Max.      :6.679
## RLNU_align.H.PET RP_align.H.PET LGRE_align.H.PET HGRE_align.H.PET
## Min.      : 29.06      Min.      :0.4429      Min.      : -0.061932      Min.      :1443
## 1st Qu.: 166.08      1st Qu.:0.8112      1st Qu.: -0.010726      1st Qu.:1551
## Median : 493.35      Median :0.8881      Median : 0.005428      Median :1765
## Mean      :1003.64      Mean      :1.0512      Mean      : 0.002599      Mean      :2118
## 3rd Qu.:1232.19      3rd Qu.:1.3806      3rd Qu.: 0.018529      3rd Qu.:2920
## Max.      :12515.43      Max.      :1.9135      Max.      : 0.058436      Max.      :4928
## LGSRE_align.H.PET HGSRE_align.H.PET LGHRE_align.H.PET HGLRE_align.H.PET
## Min.      : -0.062119      Min.      :1105      Min.      : -0.060688      Min.      : 1739

```

## 1st Qu.:-0.010919	1st Qu.:1389	1st Qu.:-0.009758	1st Qu.: 2166
## Median : 0.005302	Median :1475	Median : 0.006693	Median : 3318
## Mean : 0.002353	Mean :1826	Mean : 0.004084	Mean : 3978
## 3rd Qu.: 0.018418	3rd Qu.:2615	3rd Qu.: 0.020079	3rd Qu.: 4836
## Max. : 0.057712	Max. :3746	Max. : 0.061592	Max. :15092
## GLNU_norm_align.H.PET	RLNU_norm_align.H.PET	GLVAR_align.H.PET	
## Min. :0.000795	Min. :0.2702	Min. : 1.666	
## 1st Qu.:0.107847	1st Qu.:0.6952	1st Qu.:232.056	
## Median :0.174514	Median :0.8057	Median :295.015	
## Mean :0.222793	Mean :0.9222	Mean :324.108	
## 3rd Qu.:0.295122	3rd Qu.:1.0280	3rd Qu.:329.111	
## Max. :0.883282	Max. :1.8171	Max. :695.249	
## RLVAR_align.H.PET	Entropy_align.H.PET	SZSE.H.PET	LZSE.H.PET
## Min. :0.02306	Min. :2.128	Min. :0.1136	Min. : 1.946
## 1st Qu.:0.13992	1st Qu.:3.381	1st Qu.:0.6298	1st Qu.: 3.659
## Median :0.25736	Median :3.839	Median :0.7709	Median : 7.177
## Mean :0.37168	Mean :4.472	Mean :0.8590	Mean : 78.744
## 3rd Qu.:0.49132	3rd Qu.:4.953	3rd Qu.:0.8672	3rd Qu.: 21.995
## Max. :2.02894	Max. :9.332	Max. :1.7258	Max. :3263.559
## LGLZE.H.PET	HGLZE.H.PET	SZLGE.H.PET	SZHGE.H.PET
## Min. : -0.062002	Min. :1213	Min. : -0.062397	Min. : 244.1
## 1st Qu.: -0.010533	1st Qu.:1534	1st Qu.: -0.011847	1st Qu.:1084.3
## Median : 0.005468	Median :1870	Median : 0.005118	Median :1212.6
## Mean : 0.002728	Mean :2183	Mean : 0.002011	Mean :1427.6
## 3rd Qu.: 0.018478	3rd Qu.:2748	3rd Qu.: 0.017706	3rd Qu.:1618.4
## Max. : 0.063216	Max. :4732	Max. : 0.062112	Max. :3237.0
## LZLGE.H.PET	LZHGE.H.PET	GLNU_area.H.PET	ZSNU.H.PET
## Min. : -0.054985	Min. : 2645	Min. : 3.737	Min. : 2.096
## 1st Qu.: 0.008822	1st Qu.: 5590	1st Qu.: 23.451	1st Qu.: 52.451
## Median : 0.027093	Median : 15647	Median : 51.916	Median : 174.378
## Mean : 0.075976	Mean : 161924	Mean : 94.734	Mean : 458.281
## 3rd Qu.: 0.064368	3rd Qu.: 44703	3rd Qu.:132.613	3rd Qu.: 511.028
## Max. : 2.074899	Max. :5859252	Max. :872.124	Max. :6851.599
## ZSP.H.PET	GLNU_norm.H.PET	ZSNU_norm.H.PET	GLVAR_area.H.PET
## Min. :0.00288	Min. :0.000309	Min. :0.1394	Min. : 4.462
## 1st Qu.:0.40544	1st Qu.:0.106671	1st Qu.:0.3770	1st Qu.:229.704
## Median :0.62856	Median :0.172544	Median :0.5521	Median :297.243
## Mean :0.64546	Mean :0.215413	Mean :0.5858	Mean :324.218
## 3rd Qu.:0.76959	3rd Qu.:0.287310	3rd Qu.:0.6712	3rd Qu.:340.901
## Max. :1.59616	Max. :0.855168	Max. :1.3792	Max. :719.046
## ZSVAR_H.PET	Entropy_area.H.PET	Max_cooc.W.PET	Average_cooc.W.PET
## Min. : 0.3741	Min. : 2.980	Min. : -0.059812	Min. : 1.598
## 1st Qu.: 1.3509	1st Qu.: 4.319	1st Qu.: 0.006934	1st Qu.: 5.456
## Median : 5.0446	Median : 4.662	Median : 0.025257	Median : 9.169
## Mean : 71.8617	Mean : 5.548	Mean : 0.033306	Mean :10.771
## 3rd Qu.: 16.7681	3rd Qu.: 6.824	3rd Qu.: 0.051286	3rd Qu.:14.611
## Max. :2860.0216	Max. :10.652	Max. : 0.449036	Max. :36.018
## Variance_cooc.W.PET	Entropy_cooc.W.PET	DAVE_cooc.W.PET	DVAR_cooc.W.PET
## Min. : 0.8107	Min. : 2.897	Min. : 0.6561	Min. : 0.5749
## 1st Qu.: 9.3123	1st Qu.: 6.861	1st Qu.: 2.6785	1st Qu.: 4.7001
## Median : 27.0179	Median : 8.627	Median : 4.6500	Median :12.8543
## Mean : 37.3629	Mean : 9.635	Mean : 5.1596	Mean :18.6218
## 3rd Qu.: 53.1635	3rd Qu.:10.508	3rd Qu.: 7.0237	3rd Qu.:28.4017
## Max. :201.4968	Max. :20.210	Max. :15.3052	Max. :86.3098

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## DENT_cooc.W.PET SAVE_cooc.W.PET SVAR_cooc.W.PET SENT_cooc.W.PET
## Min. :1.532 Min. : 3.179 Min. : 2.122 Min. : 2.149
## 1st Qu.:2.966 1st Qu.:10.896 1st Qu.: 25.538 1st Qu.: 4.207
## Median :3.812 Median :18.391 Median : 72.682 Median : 5.079
## Mean :4.220 Mean :21.542 Mean :104.483 Mean : 5.817
## 3rd Qu.:4.501 3rd Qu.:29.255 3rd Qu.:139.053 3rd Qu.: 6.449
## Max. :8.815 Max. :72.004 Max. :665.393 Max. :12.170
## ASM_cooc.W.PET Contrast_cooc.W.PET Dissimilarity_cooc.W.PET
## Min. : -0.062353 Min. : 1.089 Min. : 0.6561
## 1st Qu.: -0.004474 1st Qu.: 11.192 1st Qu.: 2.6785
## Median : 0.016520 Median : 30.108 Median : 4.6500
## Mean : 0.014274 Mean : 44.970 Mean : 5.1596
## 3rd Qu.: 0.034118 3rd Qu.: 73.855 3rd Qu.: 7.0237
## Max. : 0.253551 Max. :202.948 Max. :15.3052
## Inv_diff_cooc.W.PET Inv_diff_norm_cooc.W.PET IDM_cooc.W.PET
## Min. :0.1633 Min. :0.7791 Min. :0.07432
## 1st Qu.:0.2752 1st Qu.:0.8451 1st Qu.:0.18502
## Median :0.3964 Median :0.8758 Median :0.30145
## Mean :0.4418 Mean :1.0870 Mean :0.33895
## 3rd Qu.:0.5466 3rd Qu.:1.6416 3rd Qu.:0.43576
## Max. :1.2799 Max. :1.9114 Max. :1.21935
## IDM_norm_cooc.W.PET Inv_var_cooc.W.PET Correlation_cooc.W.PET
## Min. :0.8769 Min. :0.07723 Min. : -0.0277
## 1st Qu.:0.9430 1st Qu.:0.19117 1st Qu.: 0.3427
## Median :0.9636 Median :0.28977 Median : 0.4127
## Mean :1.1979 Mean :0.32696 Mean : 0.4866
## 3rd Qu.:1.8477 3rd Qu.:0.41129 3rd Qu.: 0.6186
## Max. :2.0164 Max. :1.04619 Max. : 1.2818
## Autocorrelation_cooc.W.PET Tendency_cooc.W.PET Shade_cooc.W.PET
## Min. : 2.776 Min. : 2.122 Min. : -472.31
## 1st Qu.: 32.984 1st Qu.: 25.538 1st Qu.: 24.62
## Median : 86.175 Median : 72.682 Median : 218.44
## Mean :130.362 Mean :104.483 Mean : 692.68
## 3rd Qu.:178.427 3rd Qu.:139.053 3rd Qu.: 707.21
## Max. :749.138 Max. :665.393 Max. :16137.66
## Prominence_cooc.W.PET IC1_d.W.PET IC2_d.W.PET
## Min. : 21.1 Min. : -0.21907 Min. :0.3013
## 1st Qu.: 1874.4 1st Qu.: -0.08709 1st Qu.:0.4948
## Median : 13676.0 Median : -0.05299 Median :0.5904
## Mean : 55611.2 Mean : -0.06354 Mean :0.6821
## 3rd Qu.: 45767.4 3rd Qu.: -0.03315 3rd Qu.:0.8056
## Max. :1509311.3 Max. : 0.00861 Max. :1.5168
## Coarseness_vdif.W.PET Contrast_vdif.W.PET Busyness_vdif.W.PET
## Min. : -0.06146 Min. :0.000965 Min. : 0.03516
## 1st Qu.: -0.00453 1st Qu.:0.150611 1st Qu.: 0.56267
## Median : 0.01781 Median :0.280164 Median : 1.43660
## Mean : 0.01721 Mean :0.342734 Mean : 2.16432
## 3rd Qu.: 0.03610 3rd Qu.:0.452249 3rd Qu.: 3.15534
## Max. : 0.20872 Max. :1.444736 Max. :11.12206
## Complexity_vdif.W.PET Strength_vdif.W.PET SRE_align.W.PET LRE_align.W.PET
## Min. : 5.614 Min. : 0.1781 Min. :0.7395 Min. :1.046
## 1st Qu.: 194.871 1st Qu.: 1.1065 1st Qu.:0.9134 1st Qu.:1.170
## Median : 984.268 Median : 2.2893 Median :0.9574 Median :1.370
## Mean : 2062.542 Mean : 5.0491 Mean :1.1734 Mean :1.662

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##	3rd Qu.: 2569.228	3rd Qu.: 5.8991	3rd Qu.:1.7269	3rd Qu.:2.255
##	Max. :20059.404	Max. :61.7200	Max. :1.9861	Max. :3.585
##	GLNU_align.W.PET	RLNU_align.W.PET	RP_align.W.PET	LGRE_align.W.PET
##	Min. : 5.344	Min. : 34.44	Min. :0.6657	Min. : -0.01941
##	1st Qu.: 27.625	1st Qu.: 243.12	1st Qu.:0.8961	1st Qu.: 0.09795
##	Median : 60.907	Median : 588.96	Median :0.9437	Median : 0.17543
##	Mean : 93.014	Mean : 1247.59	Mean :1.1491	Mean : 0.21609
##	3rd Qu.:112.549	3rd Qu.: 1477.14	3rd Qu.:1.6687	3rd Qu.: 0.28936
##	Max. :585.246	Max. :14756.99	Max. :1.9718	Max. : 0.80922
##	HGRE_align.W.PET	LGSRE_align.W.PET	HGSRE_align.W.PET	LGHRE_align.W.PET
##	Min. : 2.83	Min. : -0.02025	Min. : 2.439	Min. : -0.01581
##	1st Qu.: 31.63	1st Qu.: 0.09226	1st Qu.: 29.165	1st Qu.: 0.11778
##	Median : 85.35	Median : 0.15830	Median : 82.365	Median : 0.22250
##	Mean :130.67	Mean : 0.19832	Mean :125.584	Mean : 0.31693
##	3rd Qu.:181.54	3rd Qu.: 0.27032	3rd Qu.:176.987	3rd Qu.: 0.43051
##	Max. :749.93	Max. : 0.70224	Max. :721.820	Max. : 2.01331
##	HGLRE_align.W.PET	GLNU_norm_align.W.PET	RLNU_norm_align.W.PET	
##	Min. : 5.043	Min. : -0.03140	Min. :0.5313	
##	1st Qu.: 41.894	1st Qu.: 0.05388	1st Qu.:0.8197	
##	Median :102.892	Median : 0.09042	Median :0.8985	
##	Mean :153.740	Mean : 0.11510	Mean :1.0688	
##	3rd Qu.:207.370	3rd Qu.: 0.15921	3rd Qu.:1.3888	
##	Max. :872.887	Max. : 0.53440	Max. :1.9165	
##	GLVAR_align.W.PET	RLVAR_align.W.PET	Entropy_align.W.PET	SZSE.W.PET
##	Min. : 0.6799	Min. : -0.02491	Min. : 2.364	Min. :0.1446
##	1st Qu.: 8.9257	1st Qu.: 0.05873	1st Qu.: 3.940	1st Qu.:0.7905
##	Median : 26.1549	Median : 0.11017	Median : 4.641	Median :0.8713
##	Mean : 37.3810	Mean : 0.14379	Mean : 5.332	Mean :1.0228
##	3rd Qu.: 51.2124	3rd Qu.: 0.19111	3rd Qu.: 5.889	3rd Qu.:1.2783
##	Max. :197.9114	Max. : 0.74587	Max. :10.991	Max. :1.8620
##	LZSE.W.PET	LGLZE.W.PET	HGLZE.W.PET	SZLGE.W.PET
##	Min. : 1.319	Min. : -0.01897	Min. : 4.719	Min. : -0.02662
##	1st Qu.: 1.828	1st Qu.: 0.09971	1st Qu.: 32.919	1st Qu.: 0.08003
##	Median : 3.062	Median : 0.16869	Median : 88.919	Median : 0.13095
##	Mean : 5.582	Mean : 0.20838	Mean :132.558	Mean : 0.15976
##	3rd Qu.: 5.821	3rd Qu.: 0.29480	3rd Qu.:187.907	3rd Qu.: 0.22850
##	Max. :52.606	Max. : 0.74683	Max. :739.930	Max. : 0.59463
##	SZHGE.W.PET	LZLGE.W.PET	LZHGE.W.PET	GLNU_area.W.PET
##	Min. : 3.586	Min. : -0.00334	Min. : 29.12	Min. : 3.955
##	1st Qu.: 24.620	1st Qu.: 0.17882	1st Qu.: 117.24	1st Qu.: 19.251
##	Median : 77.473	Median : 0.39627	Median : 219.86	Median : 43.031
##	Mean :116.907	Mean : 1.68893	Mean : 279.58	Mean : 70.400
##	3rd Qu.:164.783	3rd Qu.: 1.22155	3rd Qu.: 390.53	3rd Qu.: 80.177
##	Max. :648.206	Max. :38.43046	Max. :1468.92	Max. :523.768
##	ZSNU.W.PET	ZSP.W.PET	GLNU_norm.W.PET	ZSNU_norm.W.PET
##	Min. : 13.29	Min. :0.2638	Min. : -0.03171	Min. :0.3028
##	1st Qu.: 126.68	1st Qu.:0.6851	1st Qu.: 0.05384	1st Qu.:0.5907
##	Median : 369.19	Median :0.8149	Median : 0.08874	Median :0.7271
##	Mean : 807.76	Mean :0.9093	Mean : 0.11167	Mean :0.8091
##	3rd Qu.: 976.44	3rd Qu.:0.9165	3rd Qu.: 0.15491	3rd Qu.:0.8512
##	Max. :10982.07	Max. :1.8140	Max. : 0.53949	Max. :1.6323
##	GLVAR_area.W.PET	ZSVAR.W.PET	Entropy_area.W.PET	Min_hist.ADC
##	Min. : 1.139	Min. : 0.08773	Min. : 3.231	Min. : -0.0629
##	1st Qu.: 9.309	1st Qu.: 0.31288	1st Qu.: 4.692	1st Qu.: 0.0159

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## Median : 26.776   Median : 0.82646   Median : 5.089   Median : 202.0159
## Mean : 38.267   Mean : 2.67281   Mean : 6.053   Mean : 372.1823
## 3rd Qu.: 52.241   3rd Qu.: 2.10797   3rd Qu.: 6.989   3rd Qu.: 657.0025
## Max. :205.064   Max. :42.32352   Max. :11.929   Max. :1834.0386
## Max_hist.ADC Mean_hist.ADC Variance_hist.ADC Standard_Deviation_hist.ADC
## Min. :1584   Min. : 770.5   Min. : 24185   Min. :155.5
## 1st Qu.:2157   1st Qu.:1105.7   1st Qu.: 54876   1st Qu.:237.2
## Median :2491   Median :1246.8   Median : 97348   Median :324.6
## Mean :2881   Mean :1471.6   Mean :110699   Mean :358.0
## 3rd Qu.:3206   3rd Qu.:1698.2   3rd Qu.:128881   3rd Qu.:420.9
## Max. :6566   Max. :3979.1   Max. :433425   Max. :931.1
## Skewness_hist.ADC Kurtosis_hist.ADC Energy_hist.ADC Entropy_hist.ADC
## Min. : -2.86142   Min. : -1.03080   Min. : -0.061697   Min. : 6.367
## 1st Qu.: 0.08714   1st Qu.: 0.07697   1st Qu.: -0.010850   1st Qu.: 8.912
## Median : 0.47482   Median : 0.56705   Median : 0.005925   Median : 9.427
## Mean : 0.48975   Mean : 0.91228   Mean : 0.002762   Mean :11.377
## 3rd Qu.: 0.86498   3rd Qu.: 1.22031   3rd Qu.: 0.018290   3rd Qu.:12.734
## Max. : 2.90688   Max. : 7.95446   Max. : 0.056900   Max. :21.409
## AUC_hist.ADC Volume.ADC X3D_surface.ADC ratio_3ds_vol.ADC
## Min. :0.4209   Min. : 3309   Min. : 836.3   Min. :0.06764
## 1st Qu.:0.5013   1st Qu.: 17331   1st Qu.: 4274.9   1st Qu.:0.19507
## Median :0.5321   Median : 34939   Median : 7760.7   Median :0.26240
## Mean :0.6578   Mean : 49327   Mean :11891.5   Mean :0.31648
## 3rd Qu.:0.8417   3rd Qu.: 69781   3rd Qu.:15321.4   3rd Qu.:0.35928
## Max. :1.2567   Max. :283036   Max. :60866.2   Max. :1.12860
## ratio_3ds_vol_norm.ADC irregularity.ADC Compactness_v1.ADC Compactness_v2.ADC
## Min. :1.152   Min. :1.420   Min. : -0.04630   Min. :0.03537
## 1st Qu.:1.419   1st Qu.:1.660   1st Qu.: 0.01935   1st Qu.:0.27212
## Median :1.530   Median :1.775   Median : 0.03492   Median :0.34432
## Mean :1.892   Mean :2.192   Mean : 0.03625   Mean :0.39037
## 3rd Qu.:2.633   3rd Qu.:2.840   3rd Qu.: 0.04998   3rd Qu.:0.45219
## Max. :4.304   Max. :4.526   Max. : 0.10334   Max. :0.94104
## Spherical_disproportion.ADC Sphericity.ADC Asphericity.ADC
## Min. :1.152   Min. :0.3986   Min. :0.1525
## 1st Qu.:1.419   1st Qu.:0.6457   1st Qu.:0.4186
## Median :1.530   Median :0.7019   Median :0.5299
## Mean :1.892   Mean :0.8408   Mean :0.6381
## 3rd Qu.:2.633   3rd Qu.:0.8910   3rd Qu.:0.7901
## Max. :4.304   Max. :1.5696   Max. :2.3040
## Center_of_mass.ADC Max_3D_diam.ADC Major_axis_length.ADC
## Min. :0.03906   Min. : 19.46   Min. : 18.66
## 1st Qu.:0.44876   1st Qu.: 59.94   1st Qu.: 44.70
## Median :0.74819   Median : 84.20   Median : 58.07
## Mean :1.14812   Mean :101.26   Mean : 67.84
## 3rd Qu.:1.44506   3rd Qu.:124.32   3rd Qu.: 80.89
## Max. :6.61714   Max. :319.24   Max. :205.34
## Minor_axis_length.ADC Least_axis_length.ADC Elongation.ADC Flatness.ADC
## Min. : 11.84   Min. : 9.012   Min. :0.3876   Min. :0.2899
## 1st Qu.: 29.77   1st Qu.: 21.457   1st Qu.:0.6664   1st Qu.:0.4574
## Median : 43.04   Median : 31.121   Median :0.8188   Median :0.5959
## Mean : 49.96   Mean : 36.797   Mean :0.9163   Mean :0.6695
## 3rd Qu.: 60.53   3rd Qu.: 45.643   3rd Qu.:0.9657   3rd Qu.:0.7832
## Max. :146.27   Max. :126.071   Max. :1.9194   Max. :1.6007
## Max_cooc.L.ADC Average_cooc.L.ADC Variance_cooc.L.ADC Entropy_cooc.L.ADC

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## Min.      :-0.060698   Min.      :11.94      Min.      : 26.79      Min.      : 7.953
## 1st Qu.: -0.005478   1st Qu.:24.84      1st Qu.: 57.78      1st Qu.: 9.459
## Median : 0.009990   Median :29.80      Median : 91.69      Median : 9.990
## Mean    : 0.008675   Mean    :34.80      Mean    :102.87      Mean    :12.091
## 3rd Qu.: 0.024420   3rd Qu.:41.31      3rd Qu.:125.60      3rd Qu.:16.775
## Max.    : 0.070194   Max.    :87.69      Max.    :364.52      Max.    :21.438
## DAVE_cooc.L.ADC   DVAR_cooc.L.ADC   DENT_cooc.L.ADC   SAVE_cooc.L.ADC
## Min.      : 3.797   Min.      : 15.20   Min.      : 3.477   Min.      : 23.88
## 1st Qu.: 6.137   1st Qu.: 31.59   1st Qu.: 4.117   1st Qu.: 49.69
## Median : 7.790   Median : 45.96   Median : 4.445   Median : 59.59
## Mean    : 8.909   Mean    : 52.47   Mean    : 5.329   Mean    : 69.60
## 3rd Qu.: 9.895   3rd Qu.: 63.89   3rd Qu.: 7.051   3rd Qu.: 82.59
## Max.    :24.018   Max.    :192.64   Max.    :10.000   Max.    :175.38
## SVAR_cooc.L.ADC   SENT_cooc.L.ADC   ASM_cooc.L.ADC   Contrast_cooc.L.ADC
## Min.      : 76.88   Min.      : 0.4244   Min.      :-0.06258   Min.      : 30.25
## 1st Qu.:168.78   1st Qu.: 3.5924   1st Qu.: -0.01124   1st Qu.: 68.18
## Median :238.12   Median : 4.6982   Median : 0.00535   Median :101.13
## Mean    :290.97   Mean    : 4.9922   Mean    : 0.00231   Mean    :120.50
## 3rd Qu.:361.56   3rd Qu.: 5.2351   3rd Qu.: 0.01817   3rd Qu.:146.32
## Max.    :977.73   Max.    :10.7853   Max.    : 0.04834   Max.    :480.30
## Dissimilarity_cooc.L.ADC   Inv_diff_cooc.L.ADC   Inv_diff_norm_cooc.L.ADC
## Min.      : 3.797   Min.      :0.1211   Min.      :0.8159
## 1st Qu.: 6.137   1st Qu.:0.2120   1st Qu.:0.8884
## Median : 7.790   Median :0.2541   Median :0.9164
## Mean    : 8.909   Mean    :0.3072   Mean    :1.1370
## 3rd Qu.: 9.895   3rd Qu.:0.3664   3rd Qu.:1.7296
## Max.    :24.018   Max.    :0.7329   Max.    :1.9233
## IDM_cooc.L.ADC   IDM_norm_cooc.L.ADC   Inv_var_cooc.L.ADC
## Min.      :0.03829   Min.      :0.9046   Min.      :0.04011
## 1st Qu.:0.12604   1st Qu.:0.9695   1st Qu.:0.13166
## Median :0.16496   Median :0.9873   Median :0.17144
## Mean    :0.19917   Mean    :1.2268   Mean    :0.20488
## 3rd Qu.:0.24259   3rd Qu.:1.9071   3rd Qu.:0.24624
## Max.    :0.56514   Max.    :2.0233   Max.    :0.57456
## Correlation_cooc.L.ADC   Autocorrelation_.L.ADC   Tendency_cooc.L.ADC
## Min.      :0.1004   Min.      : 159.6   Min.      : 76.88
## 1st Qu.:0.3627   1st Qu.: 660.4   1st Qu.:168.78
## Median :0.4566   Median : 901.9   Median :238.12
## Mean    :0.5177   Mean    :1049.5   Mean    :290.97
## 3rd Qu.:0.5883   3rd Qu.:1255.8   3rd Qu.:361.56
## Max.    :1.3433   Max.    :3868.3   Max.    :977.73
## Shade_.L.ADC   Prominence_cooc.L.ADC   IC1_.L.ADC   IC2_.L.ADC
## Min.      : -9355.5   Min.      : 31891   Min.      : -0.355780   Min.      : 0.3575
## 1st Qu.: 339.3   1st Qu.: 104430   1st Qu.: -0.105700   1st Qu.: 0.6076
## Median : 1241.6   Median : 193879   Median : -0.069750   Median : 0.6945
## Mean    : 1925.1   Mean    : 271202   Mean    : -0.082097   Mean    : 0.8307
## 3rd Qu.: 2696.2   3rd Qu.: 358073   3rd Qu.: -0.049570   3rd Qu.: 0.9135
## Max.    :17923.8   Max.    :1477801   Max.    : -0.000042   Max.    :1.8831
## Coarseness_vdif_.L.ADC   Contrast_vdif_.L.ADC   Busyness_vdif_.L.ADC
## Min.      : -0.061827   Min.      :0.03438   Min.      : -0.00377
## 1st Qu.: -0.006482   1st Qu.:0.18037   1st Qu.: 0.07402
## Median : 0.011012   Median :0.30336   Median : 0.15940
## Mean    : 0.010556   Mean    :0.43449   Mean    : 0.28774
## 3rd Qu.: 0.024980   3rd Qu.:0.50912   3rd Qu.: 0.38552

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## Max. : 0.159060      Max. :2.88890      Max. : 2.83448
## Complexity_vdif_.L.ADC Strength_vdif_.L.ADC SRE_align.L.ADC LRE_align.L.ADC
## Min. : 3160          Min. : 0.6215      Min. :0.8781      Min. :1.013
## 1st Qu.: 5699        1st Qu.: 3.5323      1st Qu.:0.9595     1st Qu.:1.099
## Median : 7329         Median : 6.7704      Median :0.9763     Median :1.158
## Mean : 7989           Mean : 11.7712      Mean :1.2112      Mean :1.444
## 3rd Qu.: 8949         3rd Qu.: 10.9074    3rd Qu.:1.8500     3rd Qu.:2.124
## Max. :19146          Max. :124.5108      Max. :2.0115      Max. :2.695
## GLNU_align.L.ADC RLNU_align.L.ADC RP_align.L.ADC LGRE_align.L.ADC
## Min. : 2.928         Min. : 83.32        Min. :0.8566      Min. : -0.060495
## 1st Qu.: 23.171      1st Qu.: 735.51     1st Qu.:0.9450     1st Qu.: -0.009555
## Median : 58.656       Median : 1490.24     Median :0.9671     Median : 0.011670
## Mean : 139.308        Mean : 3196.96       Mean :1.1970      Mean : 0.007212
## 3rd Qu.: 184.212     3rd Qu.: 3845.10    3rd Qu.:1.8070     3rd Qu.: 0.023320
## Max. :1551.693       Max. :32004.16      Max. :2.0027      Max. : 0.104120
## HGRE_align.L.ADC LGSRE_align.L.ADC HGSRE_align.L.ADC LGHRE_align.L.ADC
## Min. : 222.5         Min. : -0.060661    Min. : 213.9       Min. : -0.060251
## 1st Qu.: 760.1       1st Qu.: -0.009606  1st Qu.: 730.4     1st Qu.: -0.009340
## Median : 990.4        Median : 0.011614    Median : 953.5     Median : 0.012690
## Mean :1151.2          Mean : 0.006945      Mean :1118.1       Mean : 0.008564
## 3rd Qu.:1363.1       3rd Qu.: 0.022950    3rd Qu.:1335.9     3rd Qu.: 0.024449
## Max. :3836.6         Max. : 0.099580      Max. :3606.7       Max. : 0.129340
## HGLRE_align.L.ADC GLNU_norm_align.L.ADC RLNU_norm_align.L.ADC
## Min. : 263.5         Min. : -0.03396     Min. :0.7932
## 1st Qu.: 811.0       1st Qu.: 0.02674     1st Qu.:0.9002
## Median :1161.0       Median : 0.04254     Median :0.9359
## Mean :1299.7         Mean : 0.04488       Mean :1.1483
## 3rd Qu.:1507.8       3rd Qu.: 0.05889     3rd Qu.:1.6802
## Max. :4967.3         Max. : 0.15004       Max. :1.9751
## GLVAR_align.L.ADC RLVAR_align.L.ADC Entropy_align.L.ADC SZSE.L.ADC
## Min. : 34.75         Min. : -0.03777     Min. : 4.855       Min. :0.7951
## 1st Qu.: 66.38       1st Qu.: 0.03397     1st Qu.: 5.201     1st Qu.:0.8893
## Median : 99.51        Median : 0.05501     Median : 5.413     Median :0.9265
## Mean :113.33          Mean : 0.06600       Mean : 6.663       Mean :1.1414
## 3rd Qu.:137.79       3rd Qu.: 0.09048     3rd Qu.: 9.883     3rd Qu.:1.6840
## Max. :414.54         Max. : 0.27810       Max. :11.550       Max. :1.9782
## LZSE.L.ADC LGLZE.L.ADC HGLZE.L.ADC SZLGE.L.ADC
## Min. :1.095          Min. : -0.060558     Min. : 247.2       Min. : -0.060905
## 1st Qu.:1.378        1st Qu.: -0.009506   1st Qu.: 765.0     1st Qu.: -0.009813
## Median :1.602         Median : 0.011602     Median :1004.7     Median : 0.009820
## Mean :2.053           Mean : 0.007065       Mean :1162.8       Mean : 0.006419
## 3rd Qu.:2.632         3rd Qu.: 0.023204     3rd Qu.:1385.0     3rd Qu.: 0.022040
## Max. :5.694           Max. : 0.094520       Max. :3778.6       Max. : 0.083520
## SZHGE.L.ADC LZLGE.L.ADC LZHGE.L.ADC GLNU_area.L.ADC
## Min. : 221.9         Min. : -0.05978     Min. : 572.3       Min. : 2.825
## 1st Qu.: 716.6        1st Qu.: -0.00818     1st Qu.:1056.8     1st Qu.: 21.085
## Median : 924.7         Median : 0.01568     Median :1444.9     Median : 51.834
## Mean :1070.6          Mean : 0.01295       Mean :1770.0       Mean : 117.810
## 3rd Qu.:1273.6       3rd Qu.: 0.02897     3rd Qu.:2113.7     3rd Qu.: 141.882
## Max. :3188.0         Max. : 0.19624       Max. :8508.1       Max. :1158.523
## ZSNU.L.ADC ZSP.L.ADC GLNU_norm.L.ADC ZSNU_norm.L.ADC
## Min. : 78.23         Min. :0.7039         Min. : -0.03427     Min. :0.6298
## 1st Qu.: 593.23       1st Qu.:0.8479       1st Qu.: 0.02621     1st Qu.:0.7773
## Median : 1285.11      Median :0.8961       Median : 0.04183     Median :0.8263

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## Mean : 2429.57 Mean :1.0881 Mean : 0.04322 Mean :0.9974
## 3rd Qu.: 2959.09 3rd Qu.:1.5089 3rd Qu.: 0.05692 3rd Qu.:1.3535
## Max. :25131.32 Max. :1.9628 Max. : 0.13852 Max. :1.8940
## GLVAR_area.L.ADC ZSVAR.L.ADC Entropy_area.L.ADC Max_cooc.H.ADC
## Min. : 37.86 Min. :0.03177 Min. : 5.194 Min. : -0.061367
## 1st Qu.: 68.97 1st Qu.:0.14187 1st Qu.: 5.561 1st Qu.: -0.011254
## Median :101.65 Median :0.21926 Median : 5.754 Median : 0.005600
## Mean :116.09 Mean :0.36882 Mean : 7.090 Mean : 0.002366
## 3rd Qu.:139.58 3rd Qu.:0.42200 3rd Qu.:10.476 3rd Qu.: 0.018330
## Max. :425.25 Max. :2.14718 Max. :12.226 Max. : 0.049158
## Average_cooc.H.ADC Variance_cooc.H.ADC Entropy_cooc.H.ADC DAVE_cooc.H.ADC
## Min. :28.16 Min. :297.5 Min. : 9.89 Min. :10.34
## 1st Qu.:30.69 1st Qu.:314.3 1st Qu.:11.38 1st Qu.:13.82
## Median :31.71 Median :321.4 Median :11.58 Median :15.39
## Mean :39.11 Mean :397.5 Mean :14.26 Mean :18.54
## 3rd Qu.:56.32 3rd Qu.:601.2 3rd Qu.:19.78 3rd Qu.:20.68
## Max. :68.81 Max. :663.0 Max. :23.56 Max. :37.03
## DVAR_cooc.H.ADC DENT_cooc.H.ADC SAVE_cooc.H.ADC SVAR_cooc.H.ADC
## Min. : 97.48 Min. : 4.857 Min. : 56.32 Min. : 724.4
## 1st Qu.:139.62 1st Qu.: 5.226 1st Qu.: 61.38 1st Qu.: 857.9
## Median :160.65 Median : 5.370 Median : 63.42 Median : 955.4
## Mean :189.30 Mean : 6.636 Mean : 78.21 Mean :1121.2
## 3rd Qu.:197.36 3rd Qu.: 9.714 3rd Qu.:112.64 3rd Qu.:1448.9
## Max. :400.90 Max. :11.187 Max. :137.58 Max. :2106.8
## SENT_cooc.H.ADC ASM_cooc.H.ADC Contrast_cooc.H.ADC
## Min. :3.088 Min. : -6.334e-02 Min. : 210.8
## 1st Qu.:3.594 1st Qu.: -1.234e-02 1st Qu.: 338.6
## Median :3.768 Median : 3.080e-03 Median : 402.3
## Mean :4.602 Mean : 6.846e-05 Mean : 468.8
## 3rd Qu.:6.240 3rd Qu.: 1.633e-02 3rd Qu.: 518.7
## Max. :8.211 Max. : 3.973e-02 Max. :1062.3
## Dissimilarity_cooc.H.ADC Inv_diff_cooc.H.ADC Inv_diff_norm_cooc.H.ADC
## Min. :10.34 Min. :0.06013 Min. :0.7359
## 1st Qu.:13.82 1st Qu.:0.13807 1st Qu.:0.8182
## Median :15.39 Median :0.16200 Median :0.8424
## Mean :18.54 Mean :0.18794 Mean :1.0408
## 3rd Qu.:20.68 3rd Qu.:0.21904 3rd Qu.:1.5697
## Max. :37.03 Max. :0.43808 Max. :1.7813
## IDM_cooc.H.ADC IDM_norm_cooc.H.ADC Inv_var_cooc.H.ADC
## Min. : -0.00194 Min. :0.8397 Min. : -0.000839
## 1st Qu.: 0.07046 1st Qu.:0.9197 1st Qu.: 0.076110
## Median : 0.09089 Median :0.9388 Median : 0.094310
## Mean : 0.10088 Mean :1.1632 Mean : 0.104632
## 3rd Qu.: 0.13118 3rd Qu.:1.7772 3rd Qu.: 0.128963
## Max. : 0.28066 Max. :1.9478 Max. : 0.284360
## Correlation_cooc.H.ADC Autocorrelation_cooc.H.ADC Tendency_cooc.H.ADC
## Min. :0.1050 Min. : 876.6 Min. : 724.4
## 1st Qu.:0.3585 1st Qu.:1080.2 1st Qu.: 857.9
## Median :0.4504 Median :1116.9 Median : 955.4
## Mean :0.5131 Mean :1385.0 Mean :1121.2
## 3rd Qu.:0.5837 3rd Qu.:1753.3 3rd Qu.:1448.9
## Max. :1.3649 Max. :2505.6 Max. :2106.8
## Shade_cooc.H.ADC Prominence_cooc.H.ADC IC1_d.H.ADC IC2_d.H.ADC
## Min. : -8499.7 Min. :1213171 Min. : -0.570580 Min. :0.4320

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## 1st Qu.: 748.5    1st Qu.:1618184    1st Qu.: -0.112350    1st Qu.: 0.6404
## Median : 3042.8    Median :1824374    Median : -0.068910    Median : 0.7285
## Mean : 2950.7    Mean : 2126432    Mean : -0.090971    Mean : 0.8845
## 3rd Qu.: 5104.4    3rd Qu.:2426342    3rd Qu.: -0.044849    3rd Qu.: 1.0007
## Max. : 18630.6    Max. : 4294925    Max. : -0.003503    Max. : 2.0014
## Coarseness_vdif.H.ADC Contrast_vdif.H.ADC Busyness_vdif.H.ADC
## Min. : -0.061933    Min. : 1.145    Min. : 0.01268
## 1st Qu.: -0.007910    1st Qu.: 1.612    1st Qu.: 0.09566
## Median : 0.009940    Median : 1.840    Median : 0.22381
## Mean : 0.009101    Mean : 2.202    Mean : 0.43392
## 3rd Qu.: 0.024210    3rd Qu.: 2.314    3rd Qu.: 0.50409
## Max. : 0.153460    Max. : 4.627    Max. : 4.36709
## Complexity_vdif.H.ADC Strength_vdif.H.ADC SRE_align.H.ADC LRE_align.H.ADC
## Min. : 9957    Min. : 0.4551    Min. : 0.9156    Min. : 0.9794
## 1st Qu.: 14427    1st Qu.: 2.6916    1st Qu.: 0.9784    1st Qu.: 1.0466
## Median : 16384    Median : 6.1903    Median : 0.9908    Median : 1.0801
## Mean : 19867    Mean : 13.4790    Mean : 1.2334    Mean : 1.3406
## 3rd Qu.: 21148    3rd Qu.: 10.5148    3rd Qu.: 1.9250    3rd Qu.: 2.0588
## Max. : 42297    Max. : 181.9847    Max. : 2.0252    Max. : 2.3153
## GLNU_align.H.ADC RLNU_align.H.ADC RP_align.H.ADC LGRE_align.H.ADC
## Min. : 1.584    Min. : 85.87    Min. : 0.9078    Min. : -0.03979
## 1st Qu.: 12.706    1st Qu.: 764.05    1st Qu.: 0.9724    1st Qu.: 0.01467
## Median : 25.814    Median : 1550.12    Median : 0.9859    Median : 0.02747
## Mean : 58.815    Mean : 3496.20    Mean : 1.2264    Mean : 0.02925
## 3rd Qu.: 70.386    3rd Qu.: 4241.95    3rd Qu.: 1.9094    3rd Qu.: 0.04298
## Max. : 588.394    Max. : 34324.60    Max. : 2.0230    Max. : 0.09034
## HGRE_align.H.ADC LGSRE_align.H.ADC HGSRE_align.H.ADC LGHRE_align.H.ADC
## Min. : 1339    Min. : -0.04251    Min. : 1291    Min. : -0.03747
## 1st Qu.: 1357    1st Qu.: 0.01308    1st Qu.: 1332    1st Qu.: 0.02119
## Median : 1361    Median : 0.02689    Median : 1343    Median : 0.03304
## Mean : 1704    Mean : 0.02799    Mean : 1677    Mean : 0.03599
## 3rd Qu.: 2678    3rd Qu.: 0.04101    3rd Qu.: 2582    3rd Qu.: 0.04858
## Max. : 2770    Max. : 0.09016    Max. : 2766    Max. : 0.11562
## HGLRE_align.H.ADC GLNU_norm_align.H.ADC RLNU_norm_align.H.ADC
## Min. : 1393    Min. : -0.047696    Min. : 0.8817
## 1st Qu.: 1440    1st Qu.: 0.003221    1st Qu.: 0.9506
## Median : 1472    Median : 0.018760    Median : 0.9658
## Mean : 1826    Mean : 0.019683    Mean : 1.2020
## 3rd Qu.: 2787    3rd Qu.: 0.035140    3rd Qu.: 1.8572
## Max. : 3188    Max. : 0.071516    Max. : 2.0141
## GLVAR_align.H.ADC RLVAR_align.H.ADC Entropy_align.H.ADC SZSE.H.ADC
## Min. : 322.1    Min. : -0.04738    Min. : 5.897    Min. : 0.8714
## 1st Qu.: 327.3    1st Qu.: 0.01435    1st Qu.: 6.059    1st Qu.: 0.9437
## Median : 329.0    Median : 0.03147    Median : 6.110    Median : 0.9633
## Mean : 411.1    Mean : 0.03018    Mean : 7.628    Mean : 1.1969
## 3rd Qu.: 644.2    3rd Qu.: 0.04710    3rd Qu.: 11.797    3rd Qu.: 1.8366
## Max. : 666.8    Max. : 0.14354    Max. : 12.434    Max. : 2.0318
## LZSE.H.ADC LGLZE.H.ADC HGLZE.H.ADC SZLGE.H.ADC
## Min. : 1.002    Min. : -0.04387    Min. : 1294    Min. : -0.04717
## 1st Qu.: 1.170    1st Qu.: 0.01170    1st Qu.: 1345    1st Qu.: 0.01008
## Median : 1.273    Median : 0.02622    Median : 1358    Median : 0.02373
## Mean : 1.565    Mean : 0.02660    Mean : 1693    Mean : 0.02353
## 3rd Qu.: 2.032    3rd Qu.: 0.04063    3rd Qu.: 2602    3rd Qu.: 0.03775
## Max. : 3.168    Max. : 0.09077    Max. : 2782    Max. : 0.09001

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##	SZHGE.H.ADC	LZLGE.H.ADC	LZHGE.H.ADC	GLNU_area.H.ADC
##	Min. :1194	Min. :-0.03357	Min. :1380	Min. : 1.591
##	1st Qu.:1276	1st Qu.: 0.03276	1st Qu.:1637	1st Qu.: 12.263
##	Median :1297	Median : 0.04771	Median :1730	Median : 24.973
##	Mean :1610	Mean : 0.05474	Mean :2186	Mean : 55.897
##	3rd Qu.:2389	3rd Qu.: 0.07758	3rd Qu.:2821	3rd Qu.: 67.941
##	Max. :2771	Max. : 0.25488	Max. :5458	Max. :558.830
##	ZSNU.H.ADC	ZSP.H.ADC	GLNU_norm.H.ADC	ZSNU_norm.H.ADC
##	Min. : 87.02	Min. :0.8333	Min. :-0.047639	Min. :0.7801
##	1st Qu.: 678.59	1st Qu.:0.9189	1st Qu.: 0.003343	1st Qu.:0.8701
##	Median : 1396.50	Median :0.9466	Median : 0.018810	Median :0.8990
##	Mean : 3030.35	Mean :1.1728	Mean : 0.019767	Mean :1.1151
##	3rd Qu.: 3667.15	3rd Qu.:1.7747	3rd Qu.: 0.035190	3rd Qu.:1.6280
##	Max. :29629.65	Max. :2.0318	Max. : 0.071972	Max. :2.0318
##	GLVAR_area.H.ADC	ZSVAR.H.ADC	Entropy_area.H.ADC	Max_cooc.W.ADC
##	Min. :304.7	Min. :-0.02688	Min. : 5.896	Min. :-0.062539
##	1st Qu.:319.8	1st Qu.: 0.05756	1st Qu.: 6.205	1st Qu.: -0.011760
##	Median :324.5	Median : 0.10225	Median : 6.310	Median : 0.005340
##	Mean :403.0	Mean : 0.12984	Mean : 7.838	Mean : 0.001454
##	3rd Qu.:612.4	3rd Qu.: 0.16953	3rd Qu.:11.797	3rd Qu.: 0.017830
##	Max. :667.6	Max. : 0.67137	Max. :13.040	Max. : 0.044078
##	Average_cooc.W.ADC	Variance_cooc.W.ADC	DAVE_cooc.W.ADC	DVAR_cooc.W.ADC
##	Min. : 29.56	Min. : 202.5	Min. :11.03	Min. : 111.7
##	1st Qu.: 76.40	1st Qu.: 515.9	1st Qu.:19.68	1st Qu.: 270.4
##	Median :101.18	Median : 875.9	Median :23.47	Median : 406.2
##	Mean :112.13	Mean :1021.3	Mean :26.92	Mean : 500.7
##	3rd Qu.:127.59	3rd Qu.:1215.9	3rd Qu.:31.46	3rd Qu.: 632.5
##	Max. :287.27	Max. :4153.9	Max. :67.92	Max. :1928.6
##	DENT_cooc.W.ADC	SAVE_cooc.W.ADC	SVAR_cooc.W.ADC	SENT_cooc.W.ADC
##	Min. : 4.951	Min. : 59.1	Min. : 576.1	Min. : 0.4612
##	1st Qu.: 5.724	1st Qu.:152.8	1st Qu.: 1358.0	1st Qu.: 4.4419
##	Median : 6.029	Median :201.6	Median : 2445.7	Median : 5.6292
##	Mean : 7.295	Mean :222.1	Mean : 2969.2	Mean : 6.2348
##	3rd Qu.: 9.905	3rd Qu.:258.6	3rd Qu.: 3452.3	3rd Qu.: 6.9115
##	Max. :13.086	Max. :574.5	Max. :13038.4	Max. :14.5664
##	ASM_cooc.W.ADC	Contrast_cooc.W.ADC	Dissemblarity_cooc.W.ADC	
##	Min. :-0.0633940	Min. : 234.1	Min. :11.03	
##	1st Qu.: -0.0125000	1st Qu.: 658.3	1st Qu.:19.68	
##	Median : 0.0031100	Median : 912.7	Median :23.47	
##	Mean :-0.0000207	Mean :1116.0	Mean :26.92	
##	3rd Qu.: 0.0161900	3rd Qu.:1396.9	3rd Qu.:31.46	
##	Max. : 0.0400080	Max. :4232.8	Max. :67.92	
##	Inv_diff_cooc.W.ADC	Inv_diff_norm_cooc.W.ADC	IDM_cooc.W.ADC	
##	Min. :-0.05393	Min. :0.8150	Min. :-0.02253	
##	1st Qu.: 0.09815	1st Qu.:0.8872	1st Qu.: 0.04441	
##	Median : 0.11970	Median :0.9153	Median : 0.06268	
##	Mean : 0.14050	Mean :1.1357	Mean : 0.07154	
##	3rd Qu.: 0.17216	3rd Qu.:1.7277	3rd Qu.: 0.09256	
##	Max. : 0.40997	Max. :1.9223	Max. : 0.25187	
##	IDM_norm_cooc.W.ADC	Inv_var_cooc.W.ADC	Correlation_cooc.W.ADC	
##	Min. :0.9041	Min. :-0.02408	Min. :0.1014	
##	1st Qu.:0.9687	1st Qu.: 0.04662	1st Qu.:0.3624	
##	Median :0.9868	Median : 0.06495	Median :0.4571	
##	Mean :1.2262	Mean : 0.07465	Mean :0.5182	

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## 3rd Qu.:1.9060      3rd Qu.: 0.09746      3rd Qu.:0.5887
## Max.      :2.0230      Max.      : 0.26587      Max.      :1.3440
## Autocorrelation_cooc.W.ADC Tendency_cooc.W.ADC Shade_cooc.W.ADC
## Min.      : 928.8      Min.      : 576.1      Min.      : -231517
## 1st Qu.: 5977.2      1st Qu.: 1358.0      1st Qu.: 7524
## Median : 9096.7      Median : 2445.7      Median : 31458
## Mean : 11144.9      Mean : 2969.2      Mean : 58766
## 3rd Qu.:14469.5      3rd Qu.: 3452.3      3rd Qu.: 85528
## Max.      :43202.8      Max.      :13038.4      Max.      : 755230
## Prominence_cooc.W.ADC IC1_d.W.ADC      IC2_d.W.ADC
## Min.      : 1433500      Min.      : -0.50566      Min.      : 0.5665
## 1st Qu.: 5716560      1st Qu.: -0.16643      1st Qu.: 0.7903
## Median : 19224987      Median : -0.11797      Median : 0.8772
## Mean : 33910637      Mean : -0.13225      Mean : 1.0345
## 3rd Qu.: 34839926      3rd Qu.: -0.07287      3rd Qu.: 1.2267
## Max.      :307755358      Max.      : -0.02415      Max.      : 1.9966
## Coarseness_vdif.W.ADC Contrast_vdif.W.ADC Busyness_vdif.W.ADC
## Min.      : -0.061838      Min.      : 0.2571      Min.      : -0.05337
## 1st Qu.: -0.006689      1st Qu.: 0.8881      1st Qu.: 0.01175
## Median : 0.010730      Median : 1.2594      Median : 0.02935
## Mean : 0.009025      Mean : 1.7176      Mean : 0.03315
## 3rd Qu.: 0.024410      3rd Qu.: 1.8783      3rd Qu.: 0.05108
## Max.      : 0.136240      Max.      : 11.8652      Max.      : 0.20823
## Complexity_vdif.W.ADC Strength_vdif.W.ADC SRE_align.W.ADC LRE_align.W.ADC
## Min.      : 13124      Min.      : 5.875      Min.      : 0.9168      Min.      : 0.971
## 1st Qu.: 80886      1st Qu.: 26.207      1st Qu.: 0.9827      1st Qu.: 1.033
## Median : 171030      Median : 39.950      Median : 0.9948      Median : 1.050
## Mean : 230384      Mean : 55.180      Mean : 1.2398      Mean : 1.309
## 3rd Qu.: 319660      3rd Qu.: 69.655      3rd Qu.: 1.9273      3rd Qu.: 2.036
## Max.      :1592687      Max.      : 275.938      Max.      : 2.0293      Max.      : 2.231
## GLNU_align.W.ADC RLNU_align.W.ADC RP_align.W.ADC LGRE_align.W.ADC
## Min.      : 2.009      Min.      : 84.52      Min.      : 0.9094      Min.      : -0.062656
## 1st Qu.: 9.596      1st Qu.: 782.23      1st Qu.: 0.9791      1st Qu.: -0.011249
## Median : 21.609      Median : 1579.33      Median : 0.9919      Median : 0.006620
## Mean : 41.983      Mean : 3616.56      Mean : 1.2353      Mean : 0.003831
## 3rd Qu.: 49.552      3rd Qu.: 4373.92      3rd Qu.: 1.9126      3rd Qu.: 0.019870
## Max.      :399.403      Max.      :37073.37      Max.      : 2.0264      Max.      : 0.083100
## HGRE_align.W.ADC LGSRE_align.W.ADC HGSRE_align.W.ADC LGHRE_align.W.ADC
## Min.      : 1203      Min.      : -0.062658      Min.      : 1197      Min.      : -0.062644
## 1st Qu.: 6277      1st Qu.: -0.011255      1st Qu.: 6229      1st Qu.: -0.011226
## Median :10535      Median : 0.006610      Median :10430      Median : 0.006850
## Mean :11874      Mean : 0.003696      Mean :11767      Mean : 0.004544
## 3rd Qu.:15160      3rd Qu.: 0.019860      3rd Qu.:15039      3rd Qu.: 0.020246
## Max.      :44980      Max.      : 0.079860      Max.      :44616      Max.      : 0.100080
## HGLRE_align.W.ADC GLNU_norm_align.W.ADC RLNU_norm_align.W.ADC
## Min.      : 1228      Min.      : -0.054220      Min.      : 0.8830
## 1st Qu.: 6510      1st Qu.: 0.001565      1st Qu.: 0.9630
## Median :10971      Median : 0.016165      Median : 0.9811
## Mean :12314      Mean : 0.015675      Mean : 1.2181
## 3rd Qu.:15680      3rd Qu.: 0.032238      3rd Qu.:1.8599
## Max.      :46468      Max.      : 0.087040      Max.      : 2.0143
## GLVAR_align.W.ADC RLVAR_align.W.ADC Entropy_align.W.ADC SZSE.W.ADC
## Min.      : 245.7      Min.      : -0.051522      Min.      : 5.391      Min.      : 0.8776
## 1st Qu.: 552.4      1st Qu.: 0.004423      1st Qu.: 6.386      1st Qu.: 0.9617

```



```
## Median : 976.3      Median : 0.019194      Median : 6.872      Median :0.9785
## Mean : 1109.8      Mean : 0.018487      Mean : 8.232      Mean : 1.2124
## 3rd Qu.:1292.1      3rd Qu.: 0.033640      3rd Qu.:10.782      3rd Qu.:1.8489
## Max. : 4324.2      Max. : 0.104882      Max. :15.143      Max. : 1.9947
## LZSE.W.ADC      LGLZE.W.ADC      HGLZE.W.ADC      SZLGE.W.ADC
## Min. :1.029      Min. : -0.062651      Min. : 1226      Min. : -0.062658
## 1st Qu.:1.103      1st Qu.: -0.011240      1st Qu.: 6306      1st Qu.: -0.011250
## Median :1.144      Median : 0.006480      Median :10639      Median : 0.006184
## Mean : 1.433      Mean : 0.003563      Mean :11908      Mean : 0.003268
## 3rd Qu.:2.069      3rd Qu.: 0.019763      3rd Qu.:15245      3rd Qu.: 0.019752
## Max. : 2.761      Max. : 0.073640      Max. :45137      Max. : 0.065320
## SZHGE.W.ADC      LZLGE.W.ADC      LZHGE.W.ADC      GLNU_area.W.ADC
## Min. : 1191      Min. : -0.062616      Min. : 1369      Min. : 2.016
## 1st Qu.: 6169      1st Qu.: -0.011160      1st Qu.: 6882      1st Qu.: 9.340
## Median :10324      Median : 0.009070      Median :11686      Median : 20.363
## Mean :11600      Mean : 0.006405      Mean :13334      Mean : 40.154
## 3rd Qu.:14845      3rd Qu.: 0.021579      3rd Qu.:17173      3rd Qu.: 48.480
## Max. :44249      Max. : 0.136980      Max. :51885      Max. :387.349
## ZSNU.W.ADC      ZSP.W.ADC      GLNU_norm.W.ADC      ZSNU_norm.W.ADC
## Min. : 84.04      Min. :0.8518      Min. : -0.054262      Min. :0.7920
## 1st Qu.: 741.28      1st Qu.:0.9458      1st Qu.: 0.001476      1st Qu.:0.9085
## Median : 1479.04      Median :0.9661      Median : 0.018532      Median :0.9380
## Mean : 3334.08      Mean :1.1938      Mean : 0.016572      Mean :1.1576
## 3rd Qu.: 3976.61      3rd Qu.:1.7974      3rd Qu.: 0.033476      3rd Qu.:1.6779
## Max. :35037.70      Max. :1.9805      Max. : 0.086040      Max. :2.0071
## GLVAR_area.W.ADC      ZSVAR.W.ADC      Entropy_area.W.ADC
## Min. : 253.6      Min. : -0.02982      Min. : 5.585
## 1st Qu.: 564.9      1st Qu.: 0.03180      1st Qu.: 6.626
## Median : 983.1      Median : 0.05597      Median : 7.026
## Mean :1114.7      Mean : 0.06550      Mean : 8.507
## 3rd Qu.:1295.2      3rd Qu.: 0.09194      3rd Qu.:11.170
## Max. :4306.8      Max. : 0.31875      Max. :15.381
```

Remove NA

```
df <- na.omit(df)
head(df)
```

```
## Institution Failure.binary      Failure      Entropy_cooc.W.ADC      GLNU_align.H.PET
## 1      A      0      49.30000      12.85352      46.25635
## 2      A      1      12.56667      12.21115      27.45454
## 3      A      0      79.80000      12.75682      90.19570
## 4      A      1      17.86667      13.46730      325.64333
## 5      A      0      39.56667      12.63733      89.57904
## 6      A      1      4.76667      13.16159      101.71345
## Min_hist.PET      Max_hist.PET      Mean_hist.PET      Variance_hist.PET
## 1      6.249117      17.825541      9.783773      6.814365
## 2      11.005214      26.469077      15.426640      12.932074
## 3      2.777718      6.877486      4.295330      0.923425
## 4      6.296588      22.029843      10.334779      6.649795
## 5      3.583846      7.922501      4.454175      0.572094
## 6      2.597947      6.206142      3.769041      0.615282
## Standard_Deviation_hist.PET      Skewness_hist.PET      Kurtosis_hist.PET
```

## 1	2.612479	0.688533	-0.339727		
## 2	3.598298	0.789526	-0.319613		
## 3	0.962163	0.248637	-0.944246		
## 4	2.580759	0.832011	0.855861		
## 5	0.757225	1.574845	3.250288		
## 6	0.785315	0.610611	-0.090239		
##	Energy_hist.PET	Entropy_hist.PET	AUC_hist.PET	H_suv.PET	Volume.PET
## 1	0.005095	9.629587	0.506553	1.123930	13751.970
## 2	0.006297	8.072951	0.507519	1.927281	9327.705
## 3	0.005015	9.669316	0.503300	0.410573	26624.003
## 4	0.003289	10.574730	0.544274	0.919612	51058.073
## 5	0.008066	7.621834	0.543922	0.306344	29414.553
## 6	0.005237	10.589120	0.507322	0.388752	14240.032
##	X3D_surface.PET	ratio_3ds_vol.PET	ratio_3ds_vol_norm.PET	irregularity.PET	
## 1	5622.519	3.214263	15.91400	2.212137	
## 2	8356.832	4.848032	21.09429	2.348324	
## 3	16832.003	3.163721	19.52154	2.121251	
## 4	29100.294	2.027384	20.12864	1.859572	
## 5	7769.379	4.815431	21.01721	2.219725	
## 6	9563.905	3.699578	18.53249	2.136984	
##	tumor_length.PET	Compactness_v1.PET	Compactness_v2.PET		
## 1	44.04796	0.003366	0.002778		
## 2	39.39796	0.003078	0.002637		
## 3	50.91422	0.003145	0.002664		
## 4	76.23900	0.003118	0.002653		
## 5	36.93490	0.003081	0.002638		
## 6	46.00253	0.003195	0.002687		
##	Spherical_disproportion.PET	Sphericity.PET	Asphericity.PET	Center_of_mass.PET	
## 1	15.91400	0.065378	14.91400	0.811086	
## 2	21.09429	0.049942	20.09429	0.587732	
## 3	19.52154	0.053762	18.52154	0.393189	
## 4	20.12864	0.052217	19.12864	0.866799	
## 5	21.01721	0.050116	20.01721	0.525997	
## 6	18.53249	0.056497	17.53249	0.308017	
##	Max_3D_diam.PET	Major_axis_length.PET	Minor_axis_length.PET		
## 1	44.04796	34.60475	25.88546		
## 2	39.39796	35.13100	27.30539		
## 3	50.91422	48.12896	30.37293		
## 4	76.23900	64.12797	54.46594		
## 5	36.93490	35.99413	23.84296		
## 6	46.00253	42.95117	31.60120		
##	Least_axis_length.PET	Elongation.PET	Flatness.PET	Max_cooc.L.PET	
## 1	24.98484	0.750543	0.724516	0.005020	
## 2	21.15130	0.779759	0.604571	0.008190	
## 3	27.52209	0.633585	0.574348	0.005033	
## 4	51.56490	0.851856	0.806616	0.005971	
## 5	21.38912	0.664919	0.596741	0.007553	
## 6	15.99647	0.738262	0.374927	0.005396	
##	Average_cooc.L.PET	Variance_cooc.L.PET	Entropy_cooc.L.PET	DAVE_cooc.L.PET	
## 1	22.87750	205.6627	10.688721	11.857838	
## 2	21.90654	226.6299	10.291026	13.993568	
## 3	27.25065	208.9461	10.878250	12.281559	
## 4	17.81061	102.6657	10.238635	7.473982	
## 5	15.35938	142.2193	9.829042	10.237690	

## 6	23.34637	181.6257	10.702694	11.660805
##	DVAR_cooc.L.PET	DENT_cooc.L.PET	SAVE_cooc.L.PET	SVAR_cooc.L.PET
## 1	84.21646	4.997454	45.75246	587.8808
## 2	129.35103	5.205762	43.81055	581.4143
## 3	85.30680	5.004455	54.49878	599.6980
## 4	43.94774	4.379716	35.61869	310.8875
## 5	79.40248	4.799453	30.71623	384.7110
## 6	87.31571	4.964671	46.69022	503.2667
##	SENT_cooc.L.PET	ASM_cooc.L.PET	Contrast_cooc.L.PET	Dissimilarity_cooc.L.PET
## 1	6.530649	0.003302	234.76478	11.857838
## 2	6.489125	0.003596	325.10017	13.993568
## 3	6.587702	0.003198	236.08136	12.281559
## 4	6.108770	0.003680	99.77033	7.473982
## 5	6.049095	0.004001	184.16098	10.237690
## 6	6.460137	0.003268	223.23109	11.660805
##	Inv_diff_cooc.L.PET	Inv_diff_norm_cooc.L.PET	IDM_cooc.L.PET	
## 1	0.165784	0.858670	0.088949	
## 2	0.156018	0.839093	0.085385	
## 3	0.154252	0.852986	0.079027	
## 4	0.228938	0.904866	0.141631	
## 5	0.188717	0.875632	0.108336	
## 6	0.166582	0.860102	0.090157	
##	IDM_norm_cooc.L.PET	Inv_var_cooc.L.PET	Correlation_cooc.L.PET	
## 1	0.953919	0.091308	0.431777	
## 2	0.937653	0.087501	0.285278	
## 3	0.952616	0.084629	0.437596	
## 4	0.980381	0.149832	0.516631	
## 5	0.963872	0.114365	0.355073	
## 6	0.955880	0.093295	0.387992	
##	Autocorrelation_cooc.L.PET	Tendency_cooc.L.PET	Shade_cooc.L.PET	
## 1	611.5456	587.8808	6860.4448	
## 2	543.8667	581.4143	4691.7137	
## 3	833.3669	599.6980	403.0883	
## 4	369.9095	310.8875	3805.6356	
## 5	285.9728	384.7110	9785.4495	
## 6	614.9464	503.2667	4106.7640	
##	Prominence_cooc.L.PET	IC1_.L.PET	IC2_.L.PET	Coarseness_vdif_.L.PET
## 1	869822.0	-0.083966	0.789572	0.014320
## 2	803734.5	-0.096731	0.814047	0.014196
## 3	800129.8	-0.072366	0.758160	0.016269
## 4	345452.5	-0.050269	0.655209	0.004936
## 5	743501.3	-0.070677	0.727840	0.017239
## 6	708597.7	-0.073872	0.759220	0.016045
##	Contrast_vdif_.L.PET	Busyness_vdif_.L.PET	Complexity_vdif_.L.PET	
## 1	1.021460	0.087378	17053.35	
## 2	1.510199	0.080209	21289.19	
## 3	1.014169	0.057518	15199.89	
## 4	0.306364	0.392674	10762.05	
## 5	0.854170	0.081956	16796.63	
## 6	0.895212	0.069338	15170.83	
##	Strength_vdif_.L.PET	SRE_align.L.PET	LRE_align.L.PET	GLNU_align.L.PET
## 1	27.40494	0.986583	1.070671	10.162131
## 2	35.76496	0.989835	1.057129	8.416510
## 3	24.45341	0.989308	1.057095	9.117958

## 4	5.55092	0.973462	1.129413	94.565775		
## 5	57.03783	0.986186	1.069172	10.574675		
## 6	26.08534	0.985853	1.070890	10.057347		
##	RLNU_align.L.PET	RP_align.L.PET	LGRE_align.L.PET	HGRE_align.L.PET		
## 1	383.8912	0.981089	0.063695	590.1484		
## 2	263.3486	0.985313	0.065825	560.1103		
## 3	394.6779	0.984963	0.039224	781.3663		
## 4	2941.3190	0.963661	0.048051	386.6793		
## 5	262.4745	0.981101	0.091713	295.6003		
## 6	397.9059	0.980630	0.048144	627.3399		
##	LGSRE_align.L.PET	HGSRE_align.L.PET	LGHRE_align.L.PET	HGLRE_align.L.PET		
## 1	0.062491	580.5855	0.068738	631.5734		
## 2	0.064212	554.5346	0.072438	583.5148		
## 3	0.038778	768.0350	0.041011	836.1597		
## 4	0.046564	376.9558	0.054360	428.3121		
## 5	0.090222	292.3243	0.097821	308.7154		
## 6	0.047408	618.2607	0.051089	665.2563		
##	GLNU_norm_align.L.PET	RLNU_norm_align.L.PET	GLVAR_align.L.PET			
## 1	0.027914	0.961445	201.5094			
## 2	0.033437	0.969710	214.6379			
## 3	0.024834	0.968128	216.6109			
## 4	0.032318	0.928789	107.6866			
## 5	0.041113	0.960224	121.3562			
## 6	0.026718	0.959459	187.2442			
##	RLVAR_align.L.PET	Entropy_align.L.PET	SZSE.L.PET	LZSE.L.PET	LGLZE.L.PET	
## 1	0.025908	5.586143	0.926936	1.384001	0.062262	
## 2	0.021453	5.385714	0.961338	1.244838	0.064793	
## 3	0.020843	5.702830	0.974475	1.114749	0.040452	
## 4	0.046375	5.480351	0.905696	1.617562	0.047964	
## 5	0.024509	5.053054	0.966013	1.148597	0.093268	
## 6	0.025153	5.622598	0.936782	1.322943	0.046110	
##	HGLZE.L.PET	SZLGE.L.PET	SZHGE.L.PET	LZLGE.L.PET	LZHGE.L.PET	GLNU_area.L.PET
## 1	592.5775	0.056127	553.5787	0.089951	831.7709	9.166018
## 2	566.7718	0.060570	546.1829	0.086532	650.3679	7.817915
## 3	769.6933	0.040391	735.9377	0.040694	904.7157	8.877842
## 4	393.5484	0.043346	360.6300	0.076789	591.1260	83.352565
## 5	300.9426	0.091138	295.8022	0.101787	321.5044	10.245976
## 6	617.0878	0.041385	567.5274	0.065899	836.6098	9.390127
##	ZSNU.L.PET	ZSP.L.PET	GLNU_norm.L.PET	ZSNU_norm.L.PET	GLVAR_area.L.PET	
## 1	301.1987	0.899841	0.027499	0.823228	201.7881	
## 2	233.4102	0.941158	0.032589	0.900252	213.9100	
## 3	372.1247	0.966472	0.024663	0.930516	216.4466	
## 4	2206.3053	0.860538	0.031941	0.781042	109.9100	
## 5	242.2684	0.956101	0.040895	0.909893	123.6639	
## 6	325.9069	0.913118	0.026787	0.844660	184.6198	
##	ZSVAR.L.PET	Entropy_area.L.PET	Max_cooc.H.PET	Average_cooc.H.PET		
## 1	0.142022	5.886187	0.031232	39.87474		
## 2	0.109793	5.546278	0.043568	39.22729		
## 3	0.038537	5.775912	0.169447	44.90994		
## 4	0.259194	5.901957	0.040212	38.15816		
## 5	0.048849	5.156114	0.423535	49.45276		
## 6	0.116919	5.851581	0.217884	46.26425		
##	Variance_cooc.H.PET	Entropy_cooc.H.PET	DAVE_cooc.H.PET	DVAR_cooc.H.PET		
## 1	255.25108	6.344137	13.397288	131.6433		

## 2	259.22064	7.168339	14.938851	146.5065
## 3	226.94291	3.662030	11.817845	143.8888
## 4	276.46636	6.205163	12.489582	129.5153
## 5	65.47745	2.835302	6.261891	56.9727
## 6	174.57711	3.122212	10.059360	134.1508
##	DENT_cooc.H.PET	SAVE_cooc.H.PET	SVAR_cooc.H.PET	SENT_cooc.H.PET
## 1	4.528843	79.74696	769.9364	5.285948
## 2	2.880112	75.45206	667.2773	5.693972
## 3	4.354173	89.81735	824.2760	3.057425
## 4	4.257568	76.31379	820.4186	5.186241
## 5	3.891832	98.90299	765.7524	2.360339
## 6	1.916625	92.52596	463.0127	2.599031
##	ASM_cooc.H.PET	Contrast_cooc.H.PET	Dissimilarity_cooc.H.PET	
## 1	0.017558	311.0628	13.397288	
## 2	0.012079	369.6002	14.938851	
## 3	0.096088	283.4905	11.817845	
## 4	0.020168	285.4418	12.489582	
## 5	0.233933	96.1523	6.261891	
## 6	0.146959	235.2907	10.059360	
##	Inv_diff_cooc.H.PET	Inv_diff_norm_cooc.H.PET	IDM_cooc.H.PET	
## 1	0.240428	0.846191	0.181276	
## 2	0.198536	0.831014	0.137656	
## 3	0.439712	0.866805	0.405377	
## 4	0.279879	0.856139	0.224079	
## 5	0.576561	0.923498	0.543300	
## 6	0.516123	0.886644	0.485744	
##	IDM_norm_cooc.H.PET	Inv_var_cooc.H.PET	Correlation_cooc.H.PET	
## 1	0.940222	0.030684	0.393202	
## 2	0.929828	0.032006	0.289621	
## 3	0.944553	0.011773	0.377943	
## 4	0.945253	0.032706	0.486297	
## 5	0.980482	0.021087	0.268281	
## 6	0.953100	0.009811	0.328640	
##	Autocorrelation_cooc.H.PET	Tendency_cooc.H.PET	Shade_cooc.H.PET	
## 1	1689.514	709.9364	-2209.927	
## 2	1613.004	667.2773	-4195.799	
## 3	2101.874	624.2760	-4303.802	
## 4	1589.599	820.4186	-5395.462	
## 5	2462.728	165.7524	1099.232	
## 6	2197.079	463.0127	-2285.992	
##	Prominence_cooc.H.PET	IC1_d.H.PET	IC2_d.H.PET	Coarseness_vdif.H.PET
## 1	1028531.31	-0.043805	0.512217	0.004319
## 2	957339.84	-0.023569	0.418010	0.005180
## 3	729696.02	-0.063791	0.473698	0.003375
## 4	1434052.83	-0.069422	0.611279	0.002825
## 5	55971.88	-0.044636	0.360145	0.003902
## 6	381561.77	-0.056410	0.417972	0.003199
##	Contrast_vdif.H.PET	Busyness_vdif.H.PET	Complexity_vdif.H.PET	
## 1	49.10863	0.141647	25517.13	
## 2	28.26579	0.103194	28339.01	
## 3	220.66779	0.236919	24028.42	
## 4	40.72831	0.833266	23437.94	
## 5	32.04753	0.124684	15279.35	
## 6	271.03091	0.279836	22773.21	

##	Strength_vdif.H.PET	SRE_align.H.PET	LRE_align.H.PET	RLNU_align.H.PET		
## 1	19.64713	0.917833	1.449477	291.82356		
## 2	25.47241	0.953059	1.241419	227.49063		
## 3	22.15293	0.774121	2.674531	165.69391		
## 4	2.79079	0.880393	1.732322	2033.70698		
## 5	53.29819	0.741090	2.918639	99.23077		
## 6	21.85351	0.720078	3.392842	140.39293		
##	RP_align.H.PET	LGRE_align.H.PET	HGRE_align.H.PET	LGSRE_align.H.PET		
## 1	0.888556	0.004341	1569.763	0.004198		
## 2	0.935326	0.004349	1536.186	0.004223		
## 3	0.710370	0.003527	1821.062	0.003336		
## 4	0.839415	0.005339	1588.246	0.005019		
## 5	0.684948	0.002975	2476.679	0.002849		
## 6	0.656286	0.003229	2111.778	0.003040		
##	HGSRE_align.H.PET	LGHRE_align.H.PET	HGLRE_align.H.PET	GLNU_norm_align.H.PET		
## 1	1433.081	0.005120	2278.993	0.130158		
## 2	1472.727	0.004991	1836.812	0.108781		
## 3	1318.500	0.004849	5694.966	0.309012		
## 4	1388.818	0.007300	2734.362	0.120339		
## 5	1889.628	0.003929	6544.325	0.470904		
## 6	1501.696	0.004877	7061.132	0.374988		
##	RLNU_norm_align.H.PET	GLVAR_align.H.PET	RLVAR_align.H.PET	Entropy_align.H.PET		
## 1	0.805658	271.94120	0.166759	3.665844		
## 2	0.881876	263.05257	0.089416	3.807145		
## 3	0.559747	231.23849	0.633026	2.962910		
## 4	0.733600	302.00409	0.279758	3.963763		
## 5	0.516961	63.36076	0.708711	2.615080		
## 6	0.492823	187.63061	0.894173	2.953297		
##	SZSE.H.PET	LZSE.H.PET	LGLZE.H.PET	HGLZE.H.PET	SZLGE.H.PET	SZHGE.H.PET
## 1	0.729896	6.346008	0.004206	1945.242	0.003751	1205.4141
## 2	0.889774	1.945761	0.004294	1541.326	0.004071	1371.5287
## 3	0.543152	38.343615	0.003595	1869.824	0.003145	833.9286
## 4	0.686000	28.192087	0.005281	2614.722	0.004412	1088.6316
## 5	0.494282	85.120177	0.002930	2778.032	0.002719	1427.6154
## 6	0.494144	151.989372	0.003258	2079.108	0.002893	988.7421
##	LZLGE.H.PET	LZHGE.H.PET	GLNU_area.H.PET	ZSNU.H.PET	ZSP.H.PET	GLNU_norm.H.PET
## 1	0.014967	9278.763	28.21123	112.61992	0.564877	0.125177
## 2	0.007054	2730.177	23.91083	171.00253	0.829245	0.106933
## 3	0.027806	99597.669	42.33586	36.25834	0.312626	0.330695
## 4	0.066848	39940.885	160.59767	604.01684	0.425782	0.117405
## 5	0.047180	166256.576	23.73782	17.00253	0.245387	0.351578
## 6	0.115459	288928.476	28.02885	17.76569	0.181354	0.371297
##	ZSNU_norm.H.PET	GLVAR_area.H.PET	ZSVAR.H.PET	Entropy_area.H.PET		
## 1	0.492171	263.01858	3.183797	4.580974		
## 2	0.749255	257.55868	0.482612	4.158935		
## 3	0.283583	218.15517	27.944240	4.080320		
## 4	0.434586	309.53854	22.609920	5.086907		
## 5	0.252530	70.97225	68.165160	3.954518		
## 6	0.236256	205.12926	120.717731	4.002762		
##	Max_cooc.W.PET	Average_cooc.W.PET	Variance_cooc.W.PET	Entropy_cooc.W.PET		
## 1	0.013277	8.741717	27.724284	8.310617		
## 2	0.015738	10.946398	54.254568	8.954940		
## 3	0.046074	4.019422	3.648015	5.580950		
## 4	0.013915	9.152454	25.597213	8.286935		

## 5	0.116685	2.577872	2.729045	4.706665
## 6	0.063098	3.127779	2.391005	5.013592
##	DAVE_cooc.W.PET	DVAR_cooc.W.PET	DENT_cooc.W.PET	SAVE_cooc.W.PET
## 1	4.361115	12.870015	3.611785	17.480905
## 2	6.845926	31.128005	4.224171	21.890266
## 3	1.595373	1.629296	2.279633	8.036314
## 4	3.728549	11.060383	3.431589	18.302378
## 5	1.376959	1.728999	2.205393	5.153215
## 6	1.306368	1.277859	2.076037	6.253029
##	SVAR_cooc.W.PET	SENT_cooc.W.PET	ASM_cooc.W.PET	Contrast_cooc.W.PET
## 1	79.024802	5.099087	0.006555	31.867274
## 2	139.053134	5.483416	0.005298	77.960077
## 3	10.420558	3.676978	0.027061	4.166444
## 4	77.440194	5.106053	0.007012	24.943599
## 5	7.293066	3.190894	0.061557	3.618055
## 6	6.581107	3.336839	0.041094	2.977854
##	Dissimilarity_cooc.W.PET	Inv_diff_cooc.W.PET	Inv_diff_norm_cooc.W.PET	
## 1	4.361115	0.306285	0.861048	
## 2	6.845926	0.244001	0.837985	
## 3	1.595373	0.503481	0.863798	
## 4	3.728549	0.343449	0.905179	
## 5	1.376959	0.558453	0.882471	
## 6	1.306368	0.553594	0.874095	
##	IDM_cooc.W.PET	IDM_norm_cooc.W.PET	Inv_var_cooc.W.PET	Correlation_cooc.W.PET
## 1	0.213874	0.955388	0.224294	0.427805
## 2	0.158456	0.936467	0.164222	0.284054
## 3	0.439777	0.957440	0.421156	0.431424
## 4	0.254836	0.980367	0.261941	0.515299
## 5	0.509374	0.964322	0.439330	0.339500
## 6	0.504966	0.961979	0.468899	0.379680
##	Autocorrelation_cooc.W.PET	Tendency_cooc.W.PET	Shade_cooc.W.PET	
## 1	88.165309	79.024802	341.143402	
## 2	135.044039	139.053134	552.913441	
## 3	17.701479	10.420558	2.361775	
## 4	96.847788	77.440194	471.374078	
## 5	7.553672	7.293066	26.823935	
## 6	10.670526	6.581107	7.170907	
##	Prominence_cooc.W.PET	IC1_d.W.PET	IC2_d.W.PET	Coarseness_vdif.W.PET
## 1	15813.1737	-0.042283	0.565302	0.015034
## 2	45767.4163	-0.044029	0.591913	0.015811
## 3	242.8423	-0.052987	0.524822	0.017811
## 4	21312.7505	-0.056187	0.630354	0.004934
## 5	276.1447	-0.033151	0.398878	0.018221
## 6	124.4042	-0.044775	0.466821	0.017235
##	Contrast_vdif.W.PET	Busyness_vdif.W.PET	Complexity_vdif.W.PET	
## 1	0.294464	0.717283	869.48613	
## 2	0.599158	0.420854	2313.88985	
## 3	0.112568	2.860859	40.08855	
## 4	0.133588	1.549091	1346.28621	
## 5	0.078944	3.650188	44.97271	
## 6	0.079545	4.181398	27.61148	
##	Strength_vdif.W.PET	SRE_align.W.PET	LRE_align.W.PET	GLNU_align.W.PET
## 1	3.919855	0.961787	1.191350	24.97624
## 2	8.341981	0.977438	1.116168	14.88136

## 3	0.511453	0.889821	1.618702	53.72505
## 4	1.384522	0.943354	1.291573	179.17215
## 5	1.109636	0.876250	1.674603	59.72108
## 6	0.444774	0.863194	1.800706	67.44333
##	RLNU_align.W.PET	RP_align.W.PET	LGRE_align.W.PET	HGRE_align.W.PET
## 1	347.5995	0.947236	0.150278	85.345885
## 2	250.6373	0.968373	0.127690	139.175484
## 3	265.0196	0.853307	0.272808	15.983362
## 4	2609.2747	0.922696	0.092857	101.288786
## 5	170.2453	0.840992	0.466475	7.937118
## 6	245.9412	0.822440	0.339659	10.636341
##	LGSRE_align.W.PET	HGSRE_align.W.PET	LGHRE_align.W.PET	HGLRE_align.W.PET
## 1	0.144360	82.365395	0.178628	98.96776
## 2	0.122525	136.722689	0.150485	150.71592
## 3	0.245883	13.790048	0.414898	28.12741
## 4	0.087782	95.978334	0.117784	126.22675
## 5	0.401364	7.231352	0.833918	11.22377
## 6	0.297964	9.120687	0.601806	18.69612
##	GLNU_norm_align.W.PET	RLNU_norm_align.W.PET	GLVAR_align.W.PET	
## 1	0.067162	0.901536	27.361255	
## 2	0.058138	0.938874	51.482886	
## 3	0.154351	0.749487	3.691659	
## 4	0.061479	0.859819	27.190856	
## 5	0.256845	0.724823	2.405984	
## 6	0.196000	0.702794	2.523334	
##	RLVAR_align.W.PET	Entropy_align.W.PET	SZSE.W.PET	LZSE.W.PET
## 1	0.069370	4.413771	0.862196	2.111226
## 2	0.043126	4.601911	0.939019	1.436265
## 3	0.229632	3.470022	0.737823	5.821460
## 4	0.107059	4.683410	0.816094	3.396694
## 5	0.239812	2.974484	0.688181	6.186741
## 6	0.289495	3.306066	0.662526	12.143891
##	HGLZE.W.PET	SZLGE.W.PET	SZHGE.W.PET	LZLGE.W.PET
## 1	88.918679	0.112325	79.094274	0.392257
## 2	138.464377	0.116457	128.987889	0.195656
## 3	14.973723	0.247502	10.310508	1.043890
## 4	106.496868	0.073436	88.831921	0.286957
## 5	9.015688	0.284427	6.692377	3.360406
## 6	10.745985	0.252353	6.482655	5.046844
##	ZSNU.W.PET	ZSP.W.PET	GLNU_norm.W.PET	ZSNU_norm.W.PET
## 1	224.38141	0.789816	0.065066	0.699359
## 2	211.55675	0.901447	0.056642	0.852145
## 3	121.85027	0.586665	0.160280	0.503961
## 4	1419.26821	0.697656	0.059662	0.620677
## 5	66.31832	0.545387	0.232966	0.438818
## 6	77.07583	0.451942	0.195918	0.406055
##	ZSVAR.W.PET	Entropy_area.W.PET	Min_hist.ADC	Max_hist.ADC
## 1	0.497852	4.937916	549.00253	2268.003
## 2	0.198720	4.834988	0.00253	2211.003
## 3	2.890741	4.143192	634.00253	2860.003
## 4	1.327156	5.449999	0.00253	2869.003
## 5	2.793389	3.991207	0.00253	2389.003
## 6	7.192684	4.330361	0.00253	2498.003
##	Variance_hist.ADC	Standard_Deviation_hist.ADC	Skewness_hist.ADC	
##				

## 1	113473.17		336.8603	1.05752	
## 2	83953.26		289.7494	-0.49105	
## 3	193194.07		439.5410	1.53649	
## 4	132561.08		364.0919	0.24067	
## 5	110268.35		332.0693	0.31916	
## 6	276984.10		526.2953	-0.19996	
##	Kurtosis_hist.ADC	Energy_hist.ADC	Entropy_hist.ADC	AUC_hist.ADC	Volume.ADC
## 1	0.39978	0.00757	7.72697	0.52307	14702.81
## 2	1.41215	0.00503	8.82392	0.49147	11850.17
## 3	2.15473	0.00426	9.42564	0.56722	26067.89
## 4	0.23359	0.00365	10.02927	0.52148	51577.90
## 5	0.50069	0.00454	9.12787	0.50458	27419.14
## 6	-1.03080	0.00413	9.41989	0.49047	16131.31
##	X3D_surface.ADC	ratio_3ds_vol.ADC	ratio_3ds_vol_norm.ADC	irregularity.ADC	
## 1	2621.908	0.39370	1.52762		1.93975
## 2	3814.097	0.27791	1.37006		1.76130
## 3	5638.645	0.21884	1.32876		1.57930
## 4	11033.100	0.21644	1.64907		1.63673
## 5	5670.769	0.22562	1.35892		1.61457
## 6	6099.528	0.30552	1.70690		1.72859
##	Compactness_v1.ADC	Compactness_v2.ADC	Spherical_disproportion.ADC		
## 1	0.03070	0.28444	1.52762		
## 2	0.03570	0.39354	1.37006		
## 3	0.03727	0.43122	1.32876		
## 4	0.02764	0.22655	1.64907		
## 5	0.03611	0.40326	1.35892		
## 6	0.02637	0.20451	1.70690		
##	Sphericity.ADC	Asphericity.ADC	Center_of_mass.ADC	Max_3D_diam.ADC	
## 1	0.65823	0.52762	0.97407	46.80855	
## 2	0.73378	0.37006	1.00173	57.64178	
## 3	0.75655	0.32876	1.48789	64.07496	
## 4	0.60987	0.64907	1.32794	85.02235	
## 5	0.73978	0.35892	0.57983	59.88998	
## 6	0.58926	0.70690	1.60559	66.42410	
##	Major_axis_length.ADC	Minor_axis_length.ADC	Least_axis_length.ADC		
## 1	45.53640	20.24517	13.58989		
## 2	35.07877	28.70241	23.63536		
## 3	42.14714	36.72698	25.93458		
## 4	58.00549	42.98623	35.06326		
## 5	39.28351	35.40209	31.13508		
## 6	52.01087	34.53146	21.82211		
##	Elongation.ADC	Flatness.ADC	Max_cooc.L.ADC	Average_cooc.L.ADC	
## 1	0.44709	0.30093	0.01362	24.26969	
## 2	0.82074	0.67629	0.00769	34.15443	
## 3	0.87392	0.61784	0.00984	17.40595	
## 4	0.74359	0.60699	0.00893	26.20041	
## 5	0.90372	0.79509	0.00863	27.03123	
## 6	0.66644	0.42207	0.00548	33.31549	
##	Variance_cooc.L.ADC	Entropy_cooc.L.ADC	DAVE_cooc.L.ADC	DVAR_cooc.L.ADC	
## 1	135.95808	9.35172	9.33833	95.10941	
## 2	60.59539	9.52569	6.58341	31.97649	
## 3	159.14565	9.93157	8.05607	81.58702	
## 4	57.02199	9.50974	5.46198	23.67951	
## 5	65.76514	9.76494	6.96837	33.58727	

## 6	176.68232	10.64861	9.13371	70.36682
##	DENT_cooc.L.ADC	SAVE_cooc.L.ADC	SVAR_cooc.L.ADC	SENT_cooc.L.ADC
## 1	4.68745	48.53685	361.5607	4.49616
## 2	4.18551	68.30632	167.0920	2.32433
## 3	4.48343	34.80936	490.1310	5.16708
## 4	3.95039	52.39829	174.5978	4.55938
## 5	4.26293	54.05993	180.9453	4.48500
## 6	4.65758	66.62846	552.9789	3.08233
##	ASM_cooc.L.ADC	Contrast_cooc.L.ADC	Dissemblarity_cooc.L.ADC	
## 1	0.00535	182.26652	9.33833	
## 2	0.00448	75.28447	6.58341	
## 3	0.00458	146.44656	8.05607	
## 4	0.00454	53.48506	5.46198	
## 5	0.00414	82.11021	6.96837	
## 6	0.00338	153.74529	9.13371	
##	Inv_diff_cooc.L.ADC	Inv_diff_norm_cooc.L.ADC	IDM_cooc.L.ADC	
## 1	0.23569	0.88844	0.15619	
## 2	0.24103	0.91456	0.15044	
## 3	0.24921	0.90225	0.16496	
## 4	0.27847	0.92805	0.18834	
## 5	0.23450	0.90993	0.14567	
## 6	0.20980	0.88787	0.12604	
##	IDM_norm_cooc.L.ADC	Inv_var_cooc.L.ADC	Correlation_cooc.L.ADC	
## 1	0.96528	0.15633	0.33222	
## 2	0.98542	0.15887	0.38132	
## 3	0.97276	0.17144	0.54243	
## 4	0.99019	0.19368	0.53355	
## 5	0.98376	0.15283	0.37826	
## 6	0.96963	0.13018	0.56744	
##	Autocorrelation_.L.ADC	Tendency_cooc.L.ADC	Shade_.L.ADC	Prominence_cooc.L.ADC
## 1	633.7211	361.5607	7639.8939	517154.08
## 2	1189.3065	167.0920	-1156.8109	112937.29
## 3	388.8025	490.1310	17093.4493	1296059.93
## 4	716.6097	174.5978	616.3283	88605.95
## 5	755.2618	180.9453	592.0947	113320.37
## 6	1209.5645	552.9789	-1837.1897	590287.94
##	IC1_.L.ADC	IC2_.L.ADC	Coarseness_vdif_.L.ADC	Contrast_vdif_.L.ADC
## 1	-0.11842	0.83912	0.02135	0.71307
## 2	-0.05061	0.63924	0.01258	0.23808
## 3	-0.07274	0.73740	0.00784	0.40394
## 4	-0.06200	0.68774	0.00556	0.15512
## 5	-0.04812	0.63329	0.01085	0.27967
## 6	-0.09225	0.81078	0.01042	0.60161
##	Busyness_vdif_.L.ADC	Complexity_vdif_.L.ADC	Strength_vdif_.L.ADC	
## 1	0.04811	8748.919	30.44366	
## 2	0.05243	5213.433	10.85376	
## 3	0.21602	9811.189	12.83805	
## 4	0.20181	4912.319	3.52728	
## 5	0.08515	5705.778	8.31391	
## 6	0.06946	8974.106	10.09240	
##	SRE_align.L.ADC	LRE_align.L.ADC	GLNU_align.L.ADC	RLNU_align.L.ADC
## 1	0.97677	1.11587	9.40856	232.7602
## 2	0.97564	1.11803	26.43616	645.9593
## 3	0.96919	1.14834	43.70925	1177.5699

## 4	0.96126	1.18592	102.31243	2562.1046		
## 5	0.97703	1.11715	28.40221	788.2562		
## 6	0.98211	1.08986	21.25471	890.8892		
##	RP_align.L.ADC	LGRE_align.L.ADC	HGRE_align.L.ADC	LGSRE_align.L.ADC		
## 1	0.96871	0.00908	831.5410	0.00900		
## 2	0.96669	0.00605	1191.1595	0.00602		
## 3	0.95823	0.01361	487.9258	0.01321		
## 4	0.94795	0.00810	786.0107	0.00784		
## 5	0.96795	0.00721	833.8975	0.00716		
## 6	0.97551	0.00591	1362.5846	0.00587		
##	HGSRE_align.L.ADC	LGHRE_align.L.ADC	HGLRE_align.L.ADC	GLNU_norm_align.L.ADC		
## 1	820.9252	0.00946	876.2823	0.04038		
## 2	1157.5280	0.00615	1335.5219	0.04066		
## 3	478.4817	0.01531	528.1310	0.03656		
## 4	757.7992	0.00954	909.4492	0.03841		
## 5	815.1979	0.00741	917.7657	0.03626		
## 6	1335.9421	0.00607	1478.8704	0.02516		
##	RLNU_norm_align.L.ADC	GLVAR_align.L.ADC	RLVAR_align.L.ADC	Entropy_align.L.ADC		
## 1	0.93826	154.93296	0.04141	5.29371		
## 2	0.93411	69.45486	0.04188	5.17751		
## 3	0.91877	156.30297	0.05240	5.47452		
## 4	0.90022	64.98946	0.06534	5.31012		
## 5	0.93819	78.05347	0.04295	5.30441		
## 6	0.95061	175.82591	0.03219	5.74239		
##	SZSE.L.ADC	LZSE.L.ADC	LGLZE.L.ADC	HGLZE.L.ADC	SZLGE.L.ADC	SZHGE.L.ADC
## 1	0.93703	1.33159	0.00927	858.5837	0.00905	831.8537
## 2	0.92448	1.39444	0.00624	1184.8610	0.00617	1086.4222
## 3	0.87706	1.82170	0.01338	514.4899	0.01189	468.7768
## 4	0.90217	1.59820	0.00767	792.5723	0.00686	720.2240
## 5	0.91279	1.55603	0.00757	833.3315	0.00743	760.6074
## 6	0.93634	1.29245	0.00606	1348.0807	0.00598	1247.0381
##	LZLGE.L.ADC	LZHGE.L.ADC	GLNU_area.L.ADC	ZSNU.L.ADC	ZSP.L.ADC	GLNU_norm.L.ADC
## 1	0.01042	981.8102	8.25894	197.1051	0.91304	0.03781
## 2	0.00662	1681.2171	24.10984	524.4053	0.89683	0.04002
## 3	0.02376	734.9103	34.98083	798.7819	0.82545	0.03416
## 4	0.01300	1204.1618	90.93063	1994.0215	0.86029	0.03768
## 5	0.00840	1283.7978	24.73040	600.5032	0.87065	0.03520
## 6	0.00644	1779.7534	19.65712	741.6164	0.91756	0.02479
##	ZSNU_norm.L.ADC	GLVAR_area.L.ADC	ZSVAR.L.ADC	Entropy_area.L.ADC		
## 1	0.84485	158.37071	0.12535	5.53926		
## 2	0.81809	71.19097	0.14408	5.46224		
## 3	0.72475	157.77185	0.34501	6.00431		
## 4	0.77331	66.76247	0.23904	5.67242		
## 5	0.79579	82.41219	0.22912	5.69671		
## 6	0.84241	176.08461	0.09810	6.01150		
##	Max_cooc.H.ADC	Average_cooc.H.ADC	Variance_cooc.H.ADC	Entropy_cooc.H.ADC		
## 1	0.00464	29.95976	310.9790	11.72265		
## 2	0.00420	33.61846	312.8265	11.35537		
## 3	0.00622	30.58315	335.7248	11.53210		
## 4	0.00461	30.75681	310.6464	11.60919		
## 5	0.00393	31.26939	305.7453	11.56749		
## 6	0.00496	30.52540	330.9954	11.34674		
##	DAVE_cooc.H.ADC	DVAR_cooc.H.ADC	DENT_cooc.H.ADC	SAVE_cooc.H.ADC		
## 1	15.71847	162.7022	5.37436	59.91700		

## 2	15.39980	148.1637	5.34697	67.23440
## 3	13.82367	148.1751	5.24052	61.16377
## 4	12.67796	118.4962	5.12061	61.51110
## 5	15.22805	152.9835	5.34969	62.53624
## 6	12.68957	134.2114	5.12373	61.04826
##	SVAR_cooc.H.ADC	SENT_cooc.H.ADC	ASM_cooc.H.ADC	Contrast_cooc.H.ADC
## 1	834.2180	3.87272	0.00312	409.6931
## 2	866.0614	3.21841	0.00292	385.2396
## 3	1003.6953	3.81762	0.00296	339.1990
## 4	963.4178	3.73436	0.00290	279.1628
## 5	838.1762	3.61892	0.00291	384.8001
## 6	1028.8043	3.58842	0.00300	295.1723
##	Dissimilarity_cooc.H.ADC	Inv_diff_cooc.H.ADC	Inv_diff_norm_cooc.H.ADC	
## 1	15.71847	0.14449	0.82408	
## 2	15.39980	0.13871	0.82594	
## 3	13.82367	0.16711	0.84276	
## 4	12.67796	0.16941	0.85215	
## 5	15.22805	0.14798	0.82834	
## 6	12.68957	0.17461	0.85365	
##	IDM_cooc.H.ADC	IDM_norm_cooc.H.ADC	Inv_var_cooc.H.ADC	Correlation_cooc.H.ADC
## 1	0.07807	0.92422	0.08536	0.34381
## 2	0.06993	0.92757	0.07472	0.38679
## 3	0.09608	0.93697	0.09823	0.49736
## 4	0.09588	0.94673	0.09742	0.55321
## 5	0.07991	0.92793	0.08208	0.37325
## 6	0.09995	0.94500	0.10213	0.55665
##	Autocorrelation_cooc.H.ADC	Tendency_cooc.H.ADC	Shade_cooc.H.ADC	
## 1	1003.570	834.2180	4888.58538	
## 2	1250.239	866.0614	-4080.74039	
## 3	1101.301	1003.6953	7361.25628	
## 4	1116.892	963.4178	2723.56893	
## 5	1090.963	838.1762	-98.86912	
## 6	1115.056	1028.8043	509.16337	
##	Prominence_cooc.H.ADC	IC1_d.H.ADC	IC2_d.H.ADC	Coarseness_vdif.H.ADC
## 1	1518300	-0.15943	0.92667	0.02421
## 2	1589114	-0.05988	0.72703	0.01048
## 3	2077405	-0.06514	0.74687	0.00767
## 4	1824192	-0.05338	0.70043	0.00496
## 5	1538643	-0.05818	0.72034	0.00898
## 6	1971550	-0.09605	0.83415	0.00994
##	Contrast_vdif.H.ADC	Busyness_vdif.H.ADC	Complexity_vdif.H.ADC	
## 1	1.85757	0.03586	16806.66	
## 2	1.80534	0.09301	16186.56	
## 3	1.49359	0.14284	13464.93	
## 4	1.41213	0.29907	12641.54	
## 5	1.83534	0.11398	16384.39	
## 6	1.45238	0.09984	12914.39	
##	Strength_vdif.H.ADC	SRE_align.H.ADC	LRE_align.H.ADC	GLNU_align.H.ADC
## 1	29.66079	0.99220	1.04664	4.07230
## 2	10.90410	0.99123	1.04949	11.31108
## 3	7.03589	0.98442	1.08787	20.88959
## 4	3.31909	0.98263	1.08821	46.68109
## 5	8.83863	0.98826	1.06328	13.66324
## 6	10.10115	0.98601	1.07180	15.03108

##	RLNU_align.H.ADC	RP_align.H.ADC	LGRE_align.H.ADC	HGRE_align.H.ADC		
## 1	246.9236	0.98876	0.02752	1363.457		
## 2	687.6470	0.98755	0.02717	1357.005		
## 3	1249.7235	0.97718	0.02776	1343.165		
## 4	2786.7832	0.97588	0.02638	1359.587		
## 5	824.1350	0.98339	0.02668	1358.525		
## 6	904.6320	0.98077	0.02665	1361.936		
##	LGSRE_align.H.ADC	HGSRE_align.H.ADC	LGHRE_align.H.ADC	HGLRE_align.H.ADC		
## 1	0.02695	1349.190	0.02979	1430.871		
## 2	0.02648	1340.025	0.02994	1430.336		
## 3	0.02707	1310.372	0.03080	1516.790		
## 4	0.02500	1334.267	0.03403	1466.691		
## 5	0.02577	1338.937	0.03083	1444.863		
## 6	0.02539	1342.295	0.03304	1444.991		
##	GLNU_norm_align.H.ADC	RLNU_norm_align.H.ADC	GLVAR_align.H.ADC			
## 1	0.01859	0.97614	329.5023			
## 2	0.01850	0.97320	329.3505			
## 3	0.01848	0.95625	325.6524			
## 4	0.01843	0.95150	327.9251			
## 5	0.01850	0.96576	329.3047			
## 6	0.01845	0.96023	327.5799			
##	RLVAR_align.H.ADC	Entropy_align.H.ADC	SZSE.H.ADC	LZSE.H.ADC	LGLZE.H.ADC	
## 1	0.01753	6.01510	0.96829	1.15763	0.02871	
## 2	0.01839	6.04615	0.96505	1.15896	0.02661	
## 3	0.03446	6.10308	0.93628	1.65499	0.02502	
## 4	0.03209	6.13418	0.95168	1.26414	0.02388	
## 5	0.02330	6.06848	0.95866	1.24670	0.02517	
## 6	0.02577	6.08534	0.94459	1.30242	0.02141	
##	HGLZE.H.ADC	SZLGE.H.ADC	SZHGE.H.ADC	LZLGE.H.ADC	LZHGE.H.ADC	GLNU_area.H.ADC
## 1	1353.052	0.02838	1303.023	0.03004	1618.472	3.99028
## 2	1355.552	0.02483	1302.738	0.03376	1584.380	10.95282
## 3	1293.549	0.02152	1196.086	0.04888	2953.476	19.42358
## 4	1353.634	0.02049	1283.290	0.04521	1725.853	44.63370
## 5	1328.345	0.02373	1252.666	0.04477	1783.557	13.08842
## 6	1363.271	0.01864	1280.446	0.06832	1716.544	14.22012
##	ZSNU.H.ADC	ZSP.H.ADC	GLNU_norm.H.ADC	ZSNU_norm.H.ADC	GLVAR_area.H.ADC	
## 1	223.9086	0.95584	0.01881	0.91643	324.0822	
## 2	619.2862	0.95385	0.01854	0.90792	327.6186	
## 3	1007.9399	0.89316	0.01876	0.84458	305.6363	
## 4	2450.9039	0.93025	0.01848	0.87848	321.4979	
## 5	727.4123	0.93716	0.01859	0.89506	324.1160	
## 6	762.1457	0.92170	0.01856	0.86177	315.8327	
##	ZSVAR.H.ADC	Entropy_area.H.ADC	Max_cooc.W.ADC	Average_cooc.W.ADC		
## 1	0.05727	6.06723	0.00675	65.37977		
## 2	0.05401	6.18594	0.00382	118.60405		
## 3	0.39430	6.37088	0.00376	60.27417		
## 4	0.10225	6.32299	0.00302	117.52784		
## 5	0.10193	6.21756	0.00355	101.18139		
## 6	0.11881	6.31556	0.00343	130.61014		
##	Variance_cooc.W.ADC	DAVE_cooc.W.ADC	DVAR_cooc.W.ADC	DENT_cooc.W.ADC		
## 1	1010.0875	25.43812	706.5272	6.06338		
## 2	746.1691	23.15154	390.8192	5.94785		
## 3	1991.6618	28.49457	1018.7085	6.25261		
## 4	1181.5174	24.91785	487.4797	6.07963		

## 5	945.7911	26.38488	481.6157	6.14012
## 6	2779.9243	36.21365	1103.2759	6.60187
##	SAVE_cooc.W.ADC	SVAR_cooc.W.ADC	SENT_cooc.W.ADC	ASM_cooc.W.ADC
## 1	130.7570	2686.849	5.54316	0.00323
## 2	237.2056	2057.975	2.77584	0.00280
## 3	120.5458	6136.137	6.76239	0.00275
## 4	235.0531	3617.812	6.13864	0.00265
## 5	202.3602	2605.515	5.80987	0.00273
## 6	261.2178	8705.171	3.87339	0.00266
##	Contrast_cooc.W.ADC	Dissimilarity_cooc.W.ADC	Inv_diff_cooc.W.ADC	
## 1	1353.496	25.43812	0.12826	
## 2	926.696	23.15154	0.10420	
## 3	1830.505	28.49457	0.10990	
## 4	1108.253	24.91785	0.10456	
## 5	1177.644	26.38488	0.09861	
## 6	2414.521	36.21365	0.08344	
##	Inv_diff_norm_cooc.W.ADC	IDM_cooc.W.ADC	IDM_norm_cooc.W.ADC	
## 1	0.88720	0.06987	0.96438	
## 2	0.91342	0.04700	0.98505	
## 3	0.90097	0.05282	0.97202	
## 4	0.92684	0.04905	0.98983	
## 5	0.90880	0.04557	0.98327	
## 6	0.88642	0.03696	0.96879	
##	Inv_var_cooc.W.ADC	Correlation_cooc.W.ADC	Autocorrelation_cooc.W.ADC	
## 1	0.07218	0.33254	4607.525	
## 2	0.04790	0.38156	14349.142	
## 3	0.05640	0.54299	4709.081	
## 4	0.04962	0.53354	14439.590	
## 5	0.04452	0.37996	10594.131	
## 6	0.03757	0.56825	18631.013	
##	Tendency_cooc.W.ADC	Shade_cooc.W.ADC	Prominence_cooc.W.ADC	IC1_d.W.ADC
## 1	2686.849	154504.57	28492973	-0.20561
## 2	2057.975	-49857.50	17100002	-0.13210
## 3	6136.137	755229.72	202604689	-0.13981
## 4	3617.812	57995.75	38091821	-0.08828
## 5	2605.515	31890.26	23457384	-0.13836
## 6	8705.171	-113889.96	146542333	-0.23037
##	IC2_d.W.ADC	Coarseness_vdif.W.ADC	Contrast_vdif.W.ADC	Busyness_vdif.W.ADC
## 1	0.96152	0.01818	4.78265	0.01774
## 2	0.91270	0.01162	1.49489	0.00979
## 3	0.92904	0.00742	1.99390	0.02744
## 4	0.85241	0.00544	1.11708	0.01846
## 5	0.92596	0.01002	1.72379	0.01257
## 6	0.98684	0.00959	3.20701	0.00873
##	Complexity_vdif.W.ADC	Strength_vdif.W.ADC	SRE_align.W.ADC	LRE_align.W.ADC
## 1	94483.95	120.21874	0.99193	1.04495
## 2	123984.35	70.45906	0.99469	1.03484
## 3	322896.60	118.12334	0.99389	1.03917
## 4	270786.27	41.10745	0.99307	1.04143
## 5	183481.75	68.98942	0.99446	1.03681
## 6	408132.18	116.30778	0.99699	1.02540
##	GLNU_align.W.ADC	RLNU_align.W.ADC	RP_align.W.ADC	LGRE_align.W.ADC
## 1	4.26622	246.5777	0.98876	0.00683
## 2	8.60033	696.8829	0.99205	0.00418

```

## 3      13.91071      1298.3291      0.99080      0.00430
## 4      24.38419      2904.1988      0.98991      0.00579
## 5       8.43212       844.4260      0.99159      0.00400
## 6       6.05624       944.0342      0.99512      0.00374
##  HGRE_align.W.ADC LGSRE_align.W.ADC HGSRE_align.W.ADC LGHRE_align.W.ADC
## 1      5992.756           0.00683      5952.927      0.00685
## 2     14395.425           0.00418     14281.115      0.00418
## 3      5853.808           0.00429      5824.143      0.00434
## 4     15776.936           0.00562     15649.652      0.00681
## 5     11683.555           0.00400     11599.962      0.00400
## 6     21008.240           0.00373     20894.393      0.00374
##  HGLRE_align.W.ADC GLNU_norm_align.W.ADC RLNU_norm_align.W.ADC
## 1      6152.074           0.01935      0.97502
## 2     14868.922           0.01462      0.98198
## 3      5983.117           0.01300      0.97996
## 4     16293.667           0.01072      0.97773
## 5     12044.998           0.01230      0.98150
## 6     21478.153           0.00885      0.98802
##  GLVAR_align.W.ADC RLVAR_align.W.ADC Entropy_align.W.ADC SZSE.W.ADC LZSE.W.ADC
## 1      1139.4041          0.01629      6.94511      0.98460      1.07424
## 2       842.8456          0.01345      6.67452      0.96527      1.11797
## 3      1938.7178          0.01519      6.79621      0.98765      1.17872
## 4      1327.6869          0.01562      7.20649      0.98060      1.10239
## 5      1109.3728          0.01437      6.95074      0.97667      1.13245
## 6      2767.6284          0.01027      7.49193      0.98323      1.08445
##  LGLZE.W.ADC HGLZE.W.ADC SZLGE.W.ADC SZHGE.W.ADC LZLGE.W.ADC LZHGE.W.ADC
## 1      0.00686     6055.150      0.00686     6018.454      0.00690     6201.935
## 2      0.00422     14407.506      0.00422     14026.413      0.00423     16054.013
## 3      0.00433      5883.686      0.00430      5711.245      0.00453      6674.638
## 4      0.00511     15809.845      0.00455     15506.485      0.00888     17172.910
## 5      0.00403     11663.603      0.00403     11366.888      0.00405     13231.943
## 6      0.00376     20996.110      0.00375     20573.429      0.00377     22707.428
##  GLNU_area.W.ADC ZSNU.W.ADC ZSP.W.ADC GLNU_norm.W.ADC ZSNU_norm.W.ADC
## 1       4.13400      239.2894      0.97918           0.01899      0.95586
## 2       8.37627      644.7370      0.95637           0.01461      0.93288
## 3      13.11686     1165.7026      0.97268           0.02501      0.91537
## 4      23.84726     2760.4129      0.97203           0.01069      0.94658
## 5       8.14437      784.5973      0.96469           0.02526      0.93769
## 6       5.93657      893.1791      0.97662           0.00884      0.95272
##  GLVAR_area.W.ADC ZSVAR.W.ADC Entropy_area.W.ADC
## 1      1145.1050          0.02586      6.28632
## 2      847.5254          0.04153      6.77853
## 3     1923.8571          0.07104      7.15685
## 4     1329.9529          0.03848      7.29521
## 5     1116.3867          0.05223      7.05149
## 6     2743.2376          0.03055      7.54787

```

Separate the training data (features) and their labels in the dataset

```

x_train <- data.matrix(df[,-2])
label <- df[2]

```

Standardize the training data

```
x_train <- scale(x_train)
summary(x_train)
```

```
##      Institution      Failure      Entropy_cooc.W.ADC      GLNU_align.H.PET
## Min.      :-0.7095      Min.      :-1.1289      Min.      :-2.6407173      Min.      :-0.9982
## 1st Qu.: -0.7095      1st Qu.: -0.7892      1st Qu.: -0.6921994      1st Qu.: -0.6721
## Median : -0.7095      Median : -0.3066      Median : 0.0001827      Median : -0.1783
## Mean    : 0.0000      Mean    : 0.0000      Mean    : 0.0000000      Mean    : 0.0000
## 3rd Qu.: 1.0940      3rd Qu.: 0.6028      3rd Qu.: 0.6719746      3rd Qu.: 0.1947
## Max.    : 1.9957      Max.    : 3.7247      Max.    : 2.1464095      Max.    : 5.3894
## Min_hist.PET      Max_hist.PET      Mean_hist.PET      Variance_hist.PET
## Min.      :-1.4098      Min.      :-1.3604      Min.      :-1.3802      Min.      :-0.9758
## 1st Qu.: -0.6742      1st Qu.: -0.7578      1st Qu.: -0.7186      1st Qu.: -0.7523
## Median : -0.2256      Median : -0.2204      Median : -0.2033      Median : -0.3017
## Mean    : 0.0000      Mean    : 0.0000      Mean    : 0.0000      Mean    : 0.0000
## 3rd Qu.: 0.4998      3rd Qu.: 0.6421      3rd Qu.: 0.5710      3rd Qu.: 0.3681
## Max.    : 3.9898      Max.    : 3.7697      Max.    : 4.0472      Max.    : 4.2731
## Standard_Deviation_hist.PET      Skewness_hist.PET      Kurtosis_hist.PET
## Min.      :-1.4225      Min.      :-1.3197      Min.      :-0.906441
## 1st Qu.: -0.7628      1st Qu.: -0.6752      1st Qu.: -0.334292
## Median : -0.1704      Median : -0.2561      Median : -0.216370
## Mean    : 0.0000      Mean    : 0.0000      Mean    : 0.000000
## 3rd Qu.: 0.6276      3rd Qu.: 0.4162      3rd Qu.: 0.003553
## Max.    : 3.7217      Max.    : 5.7654      Max.    : 10.932045
## Energy_hist.PET      Entropy_hist.PET      AUC_hist.PET      H_suv.PET
## Min.      :-2.3215      Min.      :-1.4015      Min.      :-0.8502      Min.      :-1.4116
## 1st Qu.: -0.5462      1st Qu.: -0.6977      1st Qu.: -0.5790      1st Qu.: -0.8097
## Median : 0.1416      Median : -0.3109      Median : -0.5232      Median : -0.2091
## Mean    : 0.0000      Mean    : 0.0000      Mean    : 0.0000      Mean    : 0.0000
## 3rd Qu.: 0.5743      3rd Qu.: 0.3033      3rd Qu.: 1.4352      3rd Qu.: 0.4785
## Max.    : 2.9868      Max.    : 3.2567      Max.    : 2.0653      Max.    : 3.8765
## Volume.PET      X3D_surface.PET      ratio_3ds_vol.PET      ratio_3ds_vol_norm.PET
## Min.      :-0.9976      Min.      :-0.67301      Min.      :-1.46122      Min.      :-1.4293
## 1st Qu.: -0.7025      1st Qu.: -0.45312      1st Qu.: -0.56332      1st Qu.: -0.4508
## Median : -0.3145      Median : -0.25696      Median : -0.08817      Median : -0.2012
## Mean    : 0.0000      Mean    : 0.00000      Mean    : 0.00000      Mean    : 0.0000
## 3rd Qu.: 0.4610      3rd Qu.: 0.04246      3rd Qu.: 0.46611      3rd Qu.: 0.5039
## Max.    : 5.2306      Max.    : 8.76871      Max.    : 3.06294      Max.    : 3.9993
## irregularity.PET      tumor_length.PET      Compactness_v1.PET      Compactness_v2.PET
## Min.      :-0.9167      Min.      :-1.3131      Min.      :-2.8712      Min.      :-1.18599
## 1st Qu.: -0.6689      1st Qu.: -0.6263      1st Qu.: -0.0845      1st Qu.: -0.42580
## Median : -0.4986      Median : -0.3025      Median : 0.0234      Median : -0.26942
## Mean    : 0.0000      Mean    : 0.0000      Mean    : 0.0000      Mean    : 0.00000
## 3rd Qu.: 1.0201      3rd Qu.: 0.3586      3rd Qu.: 0.5081      3rd Qu.: -0.07615
## Max.    : 2.6689      Max.    : 6.5779      Max.    : 1.5563      Max.    : 5.56600
## Spherical_disproportion.PET      Sphericity.PET      Asphericity.PET
## Min.      :-1.4293      Min.      :-0.7419      Min.      :-1.4360
## 1st Qu.: -0.4508      1st Qu.: -0.4912      1st Qu.: -0.4400
## Median : -0.2012      Median : -0.4224      Median : -0.1860
## Mean    : 0.0000      Mean    : 0.0000      Mean    : 0.0000
## 3rd Qu.: 0.5039      3rd Qu.: -0.1356      3rd Qu.: 0.5296
## Max.    : 3.9993      Max.    : 4.3869      Max.    : 4.0153
## Center_of_mass.PET      Max_3D_diam.PET      Major_axis_length.PET
```


## Min. :-1.0766	Min. :-1.2376	Min. :-1.2762	
## 1st Qu.:-0.5755	1st Qu.:-0.7045	1st Qu.:-0.7141	
## Median :-0.2760	Median :-0.3091	Median :-0.3055	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 0.2817	3rd Qu.: 0.3615	3rd Qu.: 0.4158	
## Max. : 6.7859	Max. : 4.3245	Max. : 5.3569	
## Minor_axis_length.PET	Least_axis_length.PET	Elongation.PET	
## Min. :-1.4576	Min. :-1.4299	Min. :-1.5978	
## 1st Qu.:-0.7494	1st Qu.:-0.6863	1st Qu.:-0.6012	
## Median :-0.1394	Median :-0.2241	Median :-0.2718	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 0.3841	3rd Qu.: 0.3090	3rd Qu.: 0.2418	
## Max. : 4.5198	Max. : 4.9092	Max. : 2.8276	
## Flatness.PET	Max_cooc.L.PET	Average_cooc.L.PET	Variance_cooc.L.PET
## Min. :-1.6295	Min. :-2.3063	Min. :-1.8155	Min. :-1.8240
## 1st Qu.:-0.6460	1st Qu.:-0.5161	1st Qu.:-0.5656	1st Qu.:-0.7476
## Median :-0.1984	Median : 0.1172	Median :-0.3274	Median :-0.1502
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.2702	3rd Qu.: 0.5711	3rd Qu.: 0.1736	3rd Qu.: 0.3612
## Max. : 2.9366	Max. : 1.8750	Max. : 3.3868	Max. : 3.3880
## Entropy_cooc.L.PET	DAVE_cooc.L.PET	DVAR_cooc.L.PET	DENT_cooc.L.PET
## Min. :-1.0745	Min. :-1.5187	Min. :-1.4327	Min. :-1.1172
## 1st Qu.:-0.5674	1st Qu.:-0.7917	1st Qu.:-0.7535	1st Qu.:-0.6459
## Median :-0.5112	Median :-0.1931	Median :-0.2010	Median :-0.4587
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.7073	3rd Qu.: 0.2613	3rd Qu.: 0.3063	3rd Qu.: 0.5602
## Max. : 2.0941	Max. : 3.9795	Max. : 4.5360	Max. : 2.2650
## SAVE_cooc.L.PET	SVAR_cooc.L.PET	SENT_cooc.L.PET	ASM_cooc.L.PET
## Min. :-1.8170	Min. :-1.9401	Min. :-1.0602	Min. :-2.3413
## 1st Qu.:-0.5659	1st Qu.:-0.7133	1st Qu.:-0.5543	1st Qu.:-0.4833
## Median :-0.3280	Median :-0.1350	Median :-0.4595	Median : 0.1113
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.1719	3rd Qu.: 0.3703	3rd Qu.: 0.7475	3rd Qu.: 0.5870
## Max. : 3.3867	Max. : 3.9295	Max. : 2.0924	Max. : 1.5898
## Contrast_cooc.L.PET	Dissimilarity_cooc.L.PET	Inv_diff_cooc.L.PET	
## Min. :-1.3944	Min. :-1.5187	Min. :-1.3782	
## 1st Qu.:-0.7826	1st Qu.:-0.7917	1st Qu.:-0.6753	
## Median :-0.1960	Median :-0.1931	Median :-0.3702	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 0.3115	3rd Qu.: 0.2613	3rd Qu.: 0.4971	
## Max. : 5.0946	Max. : 3.9795	Max. : 3.9843	
## Inv_diff_norm_cooc.L.PET	IDM_cooc.L.PET	IDM_norm_cooc.L.PET	
## Min. :-0.7941	Min. :-1.6038	Min. :-0.7477	
## 1st Qu.:-0.6216	1st Qu.:-0.6426	1st Qu.:-0.5955	
## Median :-0.5340	Median :-0.3162	Median :-0.5474	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 1.3523	3rd Qu.: 0.4831	3rd Qu.: 1.4669	
## Max. : 2.1111	Max. : 4.5547	Max. : 1.9113	
## Inv_var_cooc.L.PET	Correlation_cooc.L.PET	Autocorrelation_cooc.L.PET	
## Min. :-1.5503	Min. :-2.0530	Min. :-1.7897	
## 1st Qu.:-0.6248	1st Qu.:-0.5957	1st Qu.:-0.5697	
## Median :-0.2984	Median :-0.2707	Median :-0.2234	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 0.5020	3rd Qu.: 0.5649	3rd Qu.: 0.3314	

```

## Max. : 4.4029 Max. : 3.2432 Max. : 4.3290
## Tendency_cooc.L.PET Shade_cooc.L.PET Prominence_cooc.L.PET IC1_.L.PET
## Min. :-1.9401 Min. :-2.5311 Min. :-1.6096 Min. :-4.3900
## 1st Qu.:-0.7133 1st Qu.:-0.7290 1st Qu.:-0.7749 1st Qu.:-0.4323
## Median :-0.1350 Median :-0.2164 Median :-0.1665 Median : 0.1972
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.3703 3rd Qu.: 0.4457 3rd Qu.: 0.4638 3rd Qu.: 0.7461
## Max. : 3.9295 Max. : 3.4552 Max. : 4.7110 Max. : 1.5577
## IC2_.L.PET Coarseness_vdif_.L.PET Contrast_vdif_.L.PET
## Min. :-1.3125 Min. :-2.19089 Min. :-0.62417
## 1st Qu.:-0.6877 1st Qu.:-0.58292 1st Qu.:-0.45572
## Median :-0.3269 Median : 0.09101 Median :-0.22491
## Mean : 0.0000 Mean : 0.00000 Mean : 0.00000
## 3rd Qu.: 0.1265 3rd Qu.: 0.56210 3rd Qu.: 0.02051
## Max. : 2.8100 Max. : 3.70237 Max. : 8.76892
## Busyness_vdif_.L.PET Complexity_vdif_.L.PET Strength_vdif_.L.PET
## Min. :-0.9015 Min. :-1.2644 Min. :-0.8182
## 1st Qu.:-0.5980 1st Qu.:-0.7164 1st Qu.:-0.6788
## Median :-0.3190 Median :-0.2554 Median :-0.3579
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.1867 3rd Qu.: 0.2340 3rd Qu.: 0.3429
## Max. : 6.6543 Max. : 5.0903 Max. : 5.5183
## SRE_align.L.PET LRE_align.L.PET GLNU_align.L.PET RLNU_align.L.PET
## Min. :-0.8310 Min. :-0.7771 Min. :-0.6911 Min. :-0.7305
## 1st Qu.:-0.5835 1st Qu.:-0.6287 1st Qu.:-0.5835 1st Qu.:-0.5912
## Median :-0.5429 Median :-0.5633 Median :-0.3710 Median :-0.3704
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 1.5509 3rd Qu.: 1.4519 3rd Qu.: 0.2985 3rd Qu.: 0.2121
## Max. : 1.8088 Max. : 2.1577 Max. : 6.5043 Max. : 7.4324
## RP_align.L.PET LGRE_align.L.PET HGRE_align.L.PET LGSRE_align.L.PET
## Min. :-0.7933 Min. :-1.7593 Min. :-1.7899 Min. :-1.7791
## 1st Qu.:-0.5897 1st Qu.:-0.6273 1st Qu.:-0.5532 1st Qu.:-0.6347
## Median :-0.5401 Median :-0.1805 Median :-0.2588 Median :-0.1576
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 1.5347 3rd Qu.: 0.4789 3rd Qu.: 0.3678 3rd Qu.: 0.5035
## Max. : 1.8283 Max. : 4.7561 Max. : 3.9761 Max. : 4.6553
## HGSRE_align.L.PET LGHRE_align.L.PET HGLRE_align.L.PET GLNU_norm_align.L.PET
## Min. :-1.7826 Min. :-1.6709 Min. :-1.8146 Min. :-2.01031
## 1st Qu.:-0.5598 1st Qu.:-0.6111 1st Qu.:-0.5634 1st Qu.:-0.37038
## Median :-0.2781 Median :-0.2078 Median :-0.2117 Median :-0.09112
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000 Mean : 0.00000
## 3rd Qu.: 0.3506 3rd Qu.: 0.4492 3rd Qu.: 0.3849 3rd Qu.: 0.40169
## Max. : 3.9653 Max. : 5.1552 Max. : 3.9930 Max. : 3.95815
## RLNU_norm_align.L.PET GLVAR_align.L.PET RLVAR_align.L.PET Entropy_align.L.PET
## Min. :-0.7729 Min. :-1.8808 Min. :-2.1546 Min. :-1.0695
## 1st Qu.:-0.6031 1st Qu.:-0.7164 1st Qu.:-0.4296 1st Qu.:-0.5786
## Median :-0.5322 Median :-0.1558 Median :-0.1405 Median :-0.5251
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 1.4250 3rd Qu.: 0.3734 3rd Qu.: 0.4813 3rd Qu.: 0.7270
## Max. : 1.8933 Max. : 3.3364 Max. : 3.4224 Max. : 2.0307
## SZSE.L.PET LZSE.L.PET LGLZE.L.PET HGLZE.L.PET
## Min. :-2.2713 Min. :-0.9047 Min. :-1.7850 Min. :-1.8049
## 1st Qu.:-0.5709 1st Qu.:-0.6106 1st Qu.:-0.6137 1st Qu.:-0.5579
## Median :-0.4887 Median :-0.4838 Median :-0.1840 Median :-0.2683

```

## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 1.3993	3rd Qu.: 0.7175	3rd Qu.: 0.5007	3rd Qu.: 0.3570
## Max. : 1.8445	Max. : 4.8194	Max. : 4.7727	Max. : 3.7380
## SZLGE.L.PET	SZHGE.L.PET	LZLGE.L.PET	LZHGE.L.PET
## Min. : -1.9920	Min. : -1.7536	Min. : -1.4035	Min. : -1.5923
## 1st Qu.: -0.6213	1st Qu.: -0.5513	1st Qu.: -0.6129	1st Qu.: -0.5958
## Median : -0.1637	Median : -0.2719	Median : -0.2433	Median : -0.2804
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.5831	3rd Qu.: 0.3612	3rd Qu.: 0.3249	3rd Qu.: 0.2929
## Max. : 4.3225	Max. : 3.7642	Max. : 6.4375	Max. : 4.1325
## GLNU_area.L.PET	ZSNU.L.PET	ZSP.L.PET	GLNU_norm.L.PET
## Min. : -0.6914	Min. : -0.7314	Min. : -1.7968	Min. : -2.01371
## 1st Qu.: -0.5796	1st Qu.: -0.5842	1st Qu.: -0.5892	1st Qu.: -0.36931
## Median : -0.3735	Median : -0.3565	Median : -0.4930	Median : -0.07108
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.00000
## 3rd Qu.: 0.3189	3rd Qu.: 0.1320	3rd Qu.: 1.1986	3rd Qu.: 0.40606
## Max. : 6.7070	Max. : 7.4588	Max. : 1.9416	Max. : 3.87814
## ZSNU_norm.L.PET	GLVAR_area.L.PET	ZSVAR.L.PET	Entropy_area.L.PET
## Min. : -0.9004	Min. : -1.8796	Min. : -1.0498	Min. : -1.0506
## 1st Qu.: -0.6398	1st Qu.: -0.7025	1st Qu.: -0.5880	1st Qu.: -0.5791
## Median : -0.4933	Median : -0.1695	Median : -0.3215	Median : -0.5115
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 1.0332	3rd Qu.: 0.3718	3rd Qu.: 0.1266	3rd Qu.: 1.0068
## Max. : 2.0513	Max. : 3.2261	Max. : 5.2109	Max. : 2.0092
## Max_cooc.H.PET	Average_cooc.H.PET	Variance_cooc.H.PET	Entropy_cooc.H.PET
## Min. : -1.1988	Min. : -0.8105	Min. : -2.38574	Min. : -1.580753
## 1st Qu.: -0.5903	1st Qu.: -0.6985	1st Qu.: -0.61533	1st Qu.: -0.634054
## Median : -0.2918	Median : -0.5036	Median : -0.22579	Median : -0.217121
## Mean : 0.0000	Mean : 0.0000	Mean : 0.00000	Mean : 0.000000
## 3rd Qu.: 0.3327	3rd Qu.: 1.2098	3rd Qu.: -0.06314	3rd Qu.: 0.009014
## Max. : 5.6239	Max. : 2.3267	Max. : 2.40699	Max. : 2.432758
## DAVE_cooc.H.PET	DVAR_cooc.H.PET	DENT_cooc.H.PET	SAVE_cooc.H.PET
## Min. : -2.2715	Min. : -2.2424	Min. : -1.9708	Min. : -0.7658
## 1st Qu.: -0.6281	1st Qu.: -0.6424	1st Qu.: -0.7111	1st Qu.: -0.6657
## Median : -0.3166	Median : -0.2366	Median : -0.1393	Median : -0.5665
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.2732	3rd Qu.: 0.2944	3rd Qu.: 0.3360	3rd Qu.: 1.3226
## Max. : 2.9198	Max. : 3.0270	Max. : 3.1543	Max. : 2.4774
## SVAR_cooc.H.PET	SENT_cooc.H.PET	ASM_cooc.H.PET	Contrast_cooc.H.PET
## Min. : -2.4962	Min. : -1.7399	Min. : -1.3487	Min. : -2.0431
## 1st Qu.: -0.5488	1st Qu.: -0.7667	1st Qu.: -0.4947	1st Qu.: -0.6495
## Median : -0.2607	Median : -0.0498	Median : -0.2169	Median : -0.2124
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.1377	3rd Qu.: 0.3208	3rd Qu.: 0.3106	3rd Qu.: 0.3562
## Max. : 2.7932	Max. : 2.7141	Max. : 7.3847	Max. : 3.5180
## Dissimilarity_cooc.H.PET	Inv_diff_cooc.H.PET	Inv_diff_norm_cooc.H.PET	
## Min. : -2.2715	Min. : -1.3295	Min. : -0.8346	
## 1st Qu.: -0.6281	1st Qu.: -0.7485	1st Qu.: -0.6168	
## Median : -0.3166	Median : -0.2692	Median : -0.5386	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 0.2732	3rd Qu.: 0.5024	3rd Qu.: 1.3838	
## Max. : 2.9198	Max. : 4.3984	Max. : 2.0111	
## IDM_cooc.H.PET	IDM_norm_cooc.H.PET	Inv_var_cooc_.H.PET	
## Min. : -1.3223	Min. : -0.7823	Min. : -2.36605	

```

## 1st Qu.: -0.7621 1st Qu.: -0.5924 1st Qu.: -0.49549
## Median : -0.2472 Median : -0.5455 Median : 0.02372
## Mean : 0.0000 Mean : 0.0000 Mean : 0.00000
## 3rd Qu.: 0.4259 3rd Qu.: 1.4702 3rd Qu.: 0.51799
## Max. : 4.5673 Max. : 1.8868 Max. : 2.80467
## Correlation_cooc.H.PET Autocorrelation_cooc.H.PET Tendency_cooc.H.PET
## Min. : -1.9872 Min. : -0.9010 Min. : -2.3578
## 1st Qu.: -0.5949 1st Qu.: -0.7473 1st Qu.: -0.5740
## Median : -0.2552 Median : -0.4396 Median : -0.2217
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.4751 3rd Qu.: 0.9161 3rd Qu.: 0.1629
## Max. : 3.4144 Max. : 2.7356 Max. : 2.6966
## Shade_cooc.H.PET Prominence_cooc.H.PET IC1_d.H.PET IC2_d.H.PET
## Min. : -3.52117 Min. : -1.80967 Min. : -3.7681 Min. : -1.4586
## 1st Qu.: -0.49100 1st Qu.: -0.72248 1st Qu.: -0.5716 1st Qu.: -0.6520
## Median : 0.04694 Median : -0.06048 Median : 0.2356 Median : -0.3001
## Mean : 0.00000 Mean : 0.00000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.61650 3rd Qu.: 0.38037 3rd Qu.: 0.7171 3rd Qu.: 0.4610
## Max. : 2.25176 Max. : 2.98834 Max. : 1.5960 Max. : 3.2512
## Coarseness_vdif.H.PET Contrast_vdif.H.PET Busyness_vdif.H.PET
## Min. : -2.3467 Min. : -0.7552 Min. : -0.3915
## 1st Qu.: -0.5062 1st Qu.: -0.5001 1st Qu.: -0.3665
## Median : 0.1375 Median : -0.3378 Median : -0.3347
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.5970 3rd Qu.: 0.1423 3rd Qu.: -0.2468
## Max. : 1.8301 Max. : 6.6160 Max. : 6.4429
## Complexity_vdif.H.PET Strength_vdif.H.PET SRE_align.H.PET LRE_align.H.PET
## Min. : -1.5450 Min. : -0.255369 Min. : -1.4539 Min. : -0.9776
## 1st Qu.: -0.5707 1st Qu.: -0.228103 1st Qu.: -0.6077 1st Qu.: -0.7704
## Median : -0.1093 Median : -0.167165 Median : -0.4349 Median : -0.3787
## Mean : 0.0000 Mean : 0.000000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.3507 3rd Qu.: -0.000167 3rd Qu.: 0.8920 3rd Qu.: 0.4111
## Max. : 3.0416 Max. : 13.485338 Max. : 2.0686 Max. : 3.9848
## RLNU_align.H.PET RP_align.H.PET LGRE_align.H.PET HGRE_align.H.PET
## Min. : -0.6807 Min. : -1.5208 Min. : -2.3681 Min. : -0.8599
## 1st Qu.: -0.5850 1st Qu.: -0.5999 1st Qu.: -0.4890 1st Qu.: -0.7219
## Median : -0.3564 Median : -0.4076 Median : 0.1038 Median : -0.4500
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.1596 3rd Qu.: 0.8237 3rd Qu.: 0.5846 3rd Qu.: 1.0208
## Max. : 8.0403 Max. : 2.1558 Max. : 2.0491 Max. : 3.5783
## LGSRE_align.H.PET HGSRE_align.H.PET LGHRE_align.H.PET HGLRE_align.H.PET
## Min. : -2.3686 Min. : -1.0830 Min. : -2.36459 Min. : -0.8964
## 1st Qu.: -0.4876 1st Qu.: -0.6569 1st Qu.: -0.50531 1st Qu.: -0.7256
## Median : 0.1083 Median : -0.5275 Median : 0.09526 Median : -0.2641
## Mean : 0.0000 Mean : 0.0000 Mean : 0.00000 Mean : 0.0000
## 3rd Qu.: 0.5902 3rd Qu.: 1.1850 3rd Qu.: 0.58394 3rd Qu.: 0.3434
## Max. : 2.0338 Max. : 2.8829 Max. : 2.09944 Max. : 4.4495
## GLNU_norm_align.H.PET RLNU_norm_align.H.PET GLVAR_align.H.PET
## Min. : -1.3690 Min. : -1.7457 Min. : -2.30021
## 1st Qu.: -0.7088 1st Qu.: -0.6077 1st Qu.: -0.65667
## Median : -0.2977 Median : -0.3120 Median : -0.20754
## Mean : 0.0000 Mean : 0.0000 Mean : 0.00000
## 3rd Qu.: 0.4460 3rd Qu.: 0.2832 3rd Qu.: 0.03569
## Max. : 4.0729 Max. : 2.3962 Max. : 2.64762

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##	RLVAR_align.H.PET	Entropy_align.H.PET	SZSE.H.PET	LZSE.H.PET
##	Min. : -0.9927	Min. : -1.3773	Min. : -2.01033	Min. : -0.2197
##	1st Qu.: -0.6599	1st Qu.: -0.6408	1st Qu.: -0.61818	1st Qu.: -0.2148
##	Median : -0.3255	Median : -0.3720	Median : -0.23766	Median : -0.2048
##	Mean : 0.0000	Mean : 0.0000	Mean : 0.00000	Mean : 0.0000
##	3rd Qu.: 0.3407	3rd Qu.: 0.2830	3rd Qu.: 0.02202	3rd Qu.: -0.1624
##	Max. : 4.7189	Max. : 2.8563	Max. : 2.33769	Max. : 9.1121
##	LGLZE.H.PET	HGLZE.H.PET	SZLGE.H.PET	SZHGE.H.PET
##	Min. : -2.3646	Min. : -1.1843	Min. : -2.3595	Min. : -1.9479
##	1st Qu.: -0.4844	1st Qu.: -0.7924	1st Qu.: -0.5077	1st Qu.: -0.5651
##	Median : 0.1001	Median : -0.3822	Median : 0.1138	Median : -0.3540
##	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
##	3rd Qu.: 0.5754	3rd Qu.: 0.6900	3rd Qu.: 0.5750	3rd Qu.: 0.3140
##	Max. : 2.2097	Max. : 3.1106	Max. : 2.2017	Max. : 2.9780
##	LZLGE.H.PET	LZHGE.H.PET	GLNU_area.H.PET	ZSNU.H.PET
##	Min. : -0.54529	Min. : -0.2440	Min. : -0.7448	Min. : -0.60734
##	1st Qu.: -0.27961	1st Qu.: -0.2395	1st Qu.: -0.5834	1st Qu.: -0.54030
##	Median : -0.20354	Median : -0.2241	Median : -0.3505	Median : -0.37798
##	Mean : 0.00000	Mean : 0.0000	Mean : 0.0000	Mean : 0.00000
##	3rd Qu.: -0.04833	3rd Qu.: -0.1796	3rd Qu.: 0.3100	3rd Qu.: 0.07023
##	Max. : 8.32302	Max. : 8.7283	Max. : 6.3626	Max. : 8.51176
##	ZSP.H.PET	GLNU_norm.H.PET	ZSNU_norm.H.PET	GLVAR_area.H.PET
##	Min. : -1.79277	Min. : -1.3840	Min. : -1.5075	Min. : -2.2073
##	1st Qu.: -0.66964	1st Qu.: -0.6997	1st Qu.: -0.7051	1st Qu.: -0.6524
##	Median : -0.04715	Median : -0.2758	Median : -0.1138	Median : -0.1862
##	Mean : 0.00000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
##	3rd Qu.: 0.34632	3rd Qu.: 0.4626	3rd Qu.: 0.2882	3rd Qu.: 0.1152
##	Max. : 2.65243	Max. : 4.1164	Max. : 2.6790	Max. : 2.7256
##	ZSVAR_H.PET	Entropy_area.H.PET	Max_cooc.W.PET	Average_cooc.W.PET
##	Min. : -0.2318	Min. : -1.2574	Min. : -1.6095	Min. : -1.4019
##	1st Qu.: -0.2286	1st Qu.: -0.6018	1st Qu.: -0.4558	1st Qu.: -0.8122
##	Median : -0.2166	Median : -0.4339	Median : -0.1391	Median : -0.2448
##	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
##	3rd Qu.: -0.1786	3rd Qu.: 0.6244	3rd Qu.: 0.3108	3rd Qu.: 0.5870
##	Max. : 9.0394	Max. : 2.4985	Max. : 7.1859	Max. : 3.8583
##	Variance_cooc.W.PET	Entropy_cooc.W.PET	DAVE_cooc.W.PET	DVAR_cooc.W.PET
##	Min. : -0.9724	Min. : -1.7194	Min. : -1.4328	Min. : -1.0019
##	1st Qu.: -0.7462	1st Qu.: -0.7078	1st Qu.: -0.7893	1st Qu.: -0.7729
##	Median : -0.2752	Median : -0.2573	Median : -0.1621	Median : -0.3202
##	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
##	3rd Qu.: 0.4203	3rd Qu.: 0.2226	3rd Qu.: 0.5930	3rd Qu.: 0.5429
##	Max. : 4.3665	Max. : 2.6984	Max. : 3.2278	Max. : 3.7577
##	DENT_cooc.W.PET	SAVE_cooc.W.PET	SVAR_cooc.W.PET	SENT_cooc.W.PET
##	Min. : -1.5151	Min. : -1.4034	Min. : -0.9176	Min. : -1.6147
##	1st Qu.: -0.7070	1st Qu.: -0.8136	1st Qu.: -0.7077	1st Qu.: -0.7088
##	Median : -0.2302	Median : -0.2408	Median : -0.2851	Median : -0.3249
##	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
##	3rd Qu.: 0.1586	3rd Qu.: 0.5895	3rd Qu.: 0.3099	3rd Qu.: 0.2781
##	Max. : 2.5901	Max. : 3.8567	Max. : 5.0280	Max. : 2.7969
##	ASM_cooc.W.PET	Contrast_cooc.W.PET	Dissimilarity_cooc.W.PET	
##	Min. : -1.99234	Min. : -1.0299	Min. : -1.4328	
##	1st Qu.: -0.48745	1st Qu.: -0.7928	1st Qu.: -0.7893	
##	Median : 0.05841	Median : -0.3488	Median : -0.1621	
##	Mean : 0.00000	Mean : 0.0000	Mean : 0.0000	

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## 3rd Qu.: 0.51597 3rd Qu.: 0.6780 3rd Qu.: 0.5930
## Max. : 6.22137 Max. : 3.7078 Max. : 3.2278
## Inv_diff_cooc.W.PET Inv_diff_norm_cooc.W.PET IDM_cooc.W.PET
## Min. : -1.3099 Min. : -0.7856 Min. : -1.3363
## 1st Qu.: -0.7837 1st Qu.: -0.6173 1st Qu.: -0.7773
## Median : -0.2135 Median : -0.5389 Median : -0.1893
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.4930 3rd Qu.: 1.4149 3rd Qu.: 0.4888
## Max. : 3.9426 Max. : 2.1031 Max. : 4.4456
## IDM_norm_cooc.W.PET Inv_var_cooc.W.PET Correlation_cooc.W.PET
## Min. : -0.7484 Min. : -1.4005 Min. : -2.0998
## 1st Qu.: -0.5943 1st Qu.: -0.7615 1st Qu.: -0.5874
## Median : -0.5463 Median : -0.2085 Median : -0.3015
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 1.5152 3rd Qu.: 0.4729 3rd Qu.: 0.5390
## Max. : 1.9086 Max. : 4.0334 Max. : 3.2472
## Autocorrelation_cooc.W.PET Tendency_cooc.W.PET Shade_cooc.W.PET
## Min. : -0.9699 Min. : -0.9176 Min. : -0.642572
## 1st Qu.: -0.7403 1st Qu.: -0.7077 1st Qu.: -0.368478
## Median : -0.3359 Median : -0.2851 Median : -0.261575
## Mean : 0.0000 Mean : 0.0000 Mean : 0.000000
## 3rd Qu.: 0.3654 3rd Qu.: 0.3099 3rd Qu.: 0.008015
## Max. : 4.7041 Max. : 5.0280 Max. : 8.518947
## Prominence_cooc.W.PET IC1_d.W.PET IC2_d.W.PET
## Min. : -0.34028 Min. : -3.6791 Min. : -1.3917
## 1st Qu.: -0.32894 1st Qu.: -0.5572 1st Qu.: -0.6843
## Median : -0.25670 Median : 0.2495 Median : -0.3351
## Mean : 0.00000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: -0.06026 3rd Qu.: 0.7187 3rd Qu.: 0.4516
## Max. : 8.89848 Max. : 1.7065 Max. : 3.0508
## Coarseness_vdif.W.PET Contrast_vdif.W.PET Busyness_vdif.W.PET
## Min. : -1.99411 Min. : -1.3073 Min. : -1.0270
## 1st Qu.: -0.55094 1st Qu.: -0.7349 1st Qu.: -0.7725
## Median : 0.01536 Median : -0.2393 Median : -0.3510
## Mean : 0.00000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.47908 3rd Qu.: 0.4189 3rd Qu.: 0.4780
## Max. : 4.85464 Max. : 4.2154 Max. : 4.3207
## Complexity_vdif.W.PET Strength_vdif.W.PET SRE_align.W.PET LRE_align.W.PET
## Min. : -0.6810 Min. : -0.6419 Min. : -1.0181 Min. : -0.9674
## 1st Qu.: -0.6183 1st Qu.: -0.5195 1st Qu.: -0.6101 1st Qu.: -0.7727
## Median : -0.3570 Median : -0.3637 Median : -0.5069 Median : -0.4586
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.1677 3rd Qu.: 0.1120 3rd Qu.: 1.2989 3rd Qu.: 0.9322
## Max. : 5.9579 Max. : 7.4677 Max. : 1.9071 Max. : 3.0236
## GLNU_align.W.PET RLNU_align.W.PET RP_align.W.PET LGRE_align.W.PET
## Min. : -0.8453 Min. : -0.6972 Min. : -1.1501 Min. : -1.4375
## 1st Qu.: -0.6305 1st Qu.: -0.5773 1st Qu.: -0.6020 1st Qu.: -0.7212
## Median : -0.3096 Median : -0.3785 Median : -0.4886 Median : -0.2482
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.1883 3rd Qu.: 0.1319 3rd Qu.: 1.2365 3rd Qu.: 0.4473
## Max. : 4.7459 Max. : 7.7636 Max. : 1.9575 Max. : 3.6206
## HGRE_align.W.PET LGSRE_align.W.PET HGSRE_align.W.PET LGHRE_align.W.PET
## Min. : -0.9727 Min. : -1.5082 Min. : -0.9636 Min. : -1.1145
## 1st Qu.: -0.7535 1st Qu.: -0.7319 1st Qu.: -0.7545 1st Qu.: -0.6670

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## Median :-0.3449 Median :-0.2761 Median :-0.3382 Median :-0.3163
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.3870 3rd Qu.: 0.4968 3rd Qu.: 0.4022 3rd Qu.: 0.3804
## Max. : 4.7116 Max. : 3.4773 Max. : 4.6655 Max. : 5.6818
## HGLRE_align.W.PET GLNU_norm_align.W.PET RLNU_norm_align.W.PET
## Min. :-1.0113 Min. :-1.5704 Min. :-1.3413
## 1st Qu.: -0.7607 1st Qu.: -0.6563 1st Qu.: -0.6216
## Median :-0.3458 Median :-0.2646 Median :-0.4249
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.3648 3rd Qu.: 0.4728 3rd Qu.: 0.7986
## Max. : 4.8912 Max. : 4.4945 Max. : 2.1157
## GLVAR_align.W.PET RLVAR_align.W.PET Entropy_align.W.PET SZSE.W.PET
## Min. :-0.9778 Min. :-1.2760 Min. :-1.4547 Min. :-2.1793
## 1st Qu.: -0.7581 1st Qu.: -0.6434 1st Qu.: -0.6822 1st Qu.: -0.5764
## Median :-0.2991 Median :-0.2543 Median :-0.3384 Median :-0.3760
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.3685 3rd Qu.: 0.3579 3rd Qu.: 0.2730 3rd Qu.: 0.6341
## Max. : 4.2771 Max. : 4.5541 Max. : 2.7738 Max. : 2.0828
## LZSE.W.PET LGLZE.W.PET HGLZE.W.PET SZLGE.W.PET
## Min. :-0.56525 Min. :-1.4829 Min. :-0.9676 Min. :-1.6516
## 1st Qu.: -0.49773 1st Qu.: -0.7088 1st Qu.: -0.7541 1st Qu.: -0.7065
## Median :-0.33414 Median :-0.2589 Median :-0.3303 Median :-0.2553
## Mean : 0.00000 Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.03172 3rd Qu.: 0.5637 3rd Qu.: 0.4189 3rd Qu.: 0.6091
## Max. : 6.23487 Max. : 3.5121 Max. : 4.5971 Max. : 3.8533
## SZHGE.W.PET LZLGE.W.PET LZHGE.W.PET GLNU_area.W.PET
## Min. :-0.9315 Min. :-0.3661 Min. :-1.1058 Min. :-0.7987
## 1st Qu.: -0.7586 1st Qu.: -0.3267 1st Qu.: -0.7168 1st Qu.: -0.6149
## Median :-0.3241 Median :-0.2797 Median :-0.2637 Median :-0.3290
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.3935 3rd Qu.: -0.1011 3rd Qu.: 0.4898 3rd Qu.: 0.1175
## Max. : 4.3673 Max. : 7.9493 Max. : 5.2512 Max. : 5.4500
## ZSNU.W.PET ZSP.W.PET GLNU_norm.W.PET ZSNU_norm.W.PET
## Min. :-0.6430 Min. :-1.66591 Min. :-1.6056 Min. :-1.4766
## 1st Qu.: -0.5512 1st Qu.: -0.57871 1st Qu.: -0.6475 1st Qu.: -0.6368
## Median :-0.3550 Median :-0.24376 Median :-0.2568 Median :-0.2391
## Mean : 0.0000 Mean : 0.00000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.1365 3rd Qu.: 0.01851 3rd Qu.: 0.4843 3rd Qu.: 0.1228
## Max. : 8.2345 Max. : 2.33471 Max. : 4.7909 Max. : 2.4009
## GLVAR_area.W.PET ZSVAR.W.PET Entropy_area.W.PET Min_hist.ADC
## Min. :-0.9650 Min. :-0.45407 Min. :-1.2694 Min. :-0.8659
## 1st Qu.: -0.7526 1st Qu.: -0.41452 1st Qu.: -0.6122 1st Qu.: -0.8657
## Median :-0.2987 Median :-0.32431 Median :-0.4336 Median :-0.3958
## Mean : 0.0000 Mean : 0.00000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.3632 3rd Qu.: -0.09921 3rd Qu.: 0.4213 3rd Qu.: 0.6625
## Max. : 4.3352 Max. : 6.96463 Max. : 2.6434 Max. : 3.4005
## Max_hist.ADC Mean_hist.ADC Variance_hist.ADC
## Min. :-1.1458 Min. :-1.1633 Min. :-1.1378
## 1st Qu.: -0.6395 1st Qu.: -0.6070 1st Qu.: -0.7342
## Median :-0.3444 Median :-0.3730 Median :-0.1756
## Mean : 0.0000 Mean : 0.0000 Mean : 0.0000
## 3rd Qu.: 0.2875 3rd Qu.: 0.3761 3rd Qu.: 0.2391
## Max. : 3.2565 Max. : 4.1608 Max. : 4.2445
## Standard_Deviation_hist.ADC Skewness_hist.ADC Kurtosis_hist.ADC

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## Min. :-1.2692	Min. :-4.4869	Min. :-1.3821	
## 1st Qu.:-0.7569	1st Qu.:-0.5391	1st Qu.:-0.5941	
## Median :-0.2092	Median :-0.0200	Median :-0.2456	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 0.3944	3rd Qu.: 0.5024	3rd Qu.: 0.2191	
## Max. : 3.5929	Max. : 3.2363	Max. : 5.0090	
## Energy_hist.ADC	Entropy_hist.ADC	AUC_hist.ADC	Volume.ADC
## Min. :-2.2980	Min. :-1.2091	Min. :-0.9703	Min. :-1.0257
## 1st Qu.:-0.4853	1st Qu.:-0.5949	1st Qu.:-0.6408	1st Qu.:-0.7131
## Median : 0.1128	Median :-0.4706	Median :-0.5148	Median :-0.3207
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.5536	3rd Qu.: 0.3276	3rd Qu.: 0.7533	3rd Qu.: 0.4559
## Max. : 1.9300	Max. : 2.4215	Max. : 2.4529	Max. : 5.2090
## X3D_surface.ADC	ratio_3ds_vol.ADC	ratio_3ds_vol_norm.ADC	irregularity.ADC
## Min. :-0.9942	Min. :-1.3129	Min. :-1.0356	Min. :-0.9512
## 1st Qu.:-0.6849	1st Qu.:-0.6406	1st Qu.:-0.6629	1st Qu.:-0.6557
## Median :-0.3715	Median :-0.2853	Median :-0.5071	Median :-0.5135
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.3084	3rd Qu.: 0.2258	3rd Qu.: 1.0377	3rd Qu.: 0.7975
## Max. : 4.4041	Max. : 4.2847	Max. : 3.3783	Max. : 2.8739
## Compactness_v1.ADC	Compactness_v2.ADC	Spherical_disproportion.ADC	
## Min. :-2.36966	Min. :-1.8949	Min. :-1.0356	
## 1st Qu.:-0.48498	1st Qu.:-0.6312	1st Qu.:-0.6629	
## Median :-0.03812	Median :-0.2458	Median :-0.5071	
## Mean : 0.00000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 0.39424	3rd Qu.: 0.3300	3rd Qu.: 1.0377	
## Max. : 1.92604	Max. : 2.9393	Max. : 3.3783	
## Sphericity.ADC	Asphericity.ADC	Center_of_mass.ADC	Max_3D_diam.ADC
## Min. :-1.3956	Min. :-1.4420	Min. :-1.0193	Min. :-1.3856
## 1st Qu.:-0.6158	1st Qu.:-0.6518	1st Qu.:-0.6428	1st Qu.:-0.7000
## Median :-0.4383	Median :-0.3215	Median :-0.3676	Median :-0.2890
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.1583	3rd Qu.: 0.4512	3rd Qu.: 0.2729	3rd Qu.: 0.3907
## Max. : 2.3002	Max. : 4.9466	Max. : 5.0265	Max. : 3.6923
## Major_axis_length.ADC	Minor_axis_length.ADC	Least_axis_length.ADC	
## Min. :-1.4031	Min. :-1.3722	Min. :-1.2557	
## 1st Qu.:-0.6601	1st Qu.:-0.7267	1st Qu.:-0.6933	
## Median :-0.2786	Median :-0.2491	Median :-0.2565	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 0.3723	3rd Qu.: 0.3804	3rd Qu.: 0.3998	
## Max. : 3.9229	Max. : 3.4663	Max. : 4.0347	
## Elongation.ADC	Flatness.ADC	Max_cooc.L.ADC	Average_cooc.L.ADC
## Min. :-1.4264	Min. :-1.3266	Min. :-2.40536	Min. :-1.5647
## 1st Qu.:-0.6741	1st Qu.:-0.7412	1st Qu.:-0.49072	1st Qu.:-0.6815
## Median :-0.2632	Median :-0.2571	Median : 0.04561	Median :-0.3424
## Mean : 0.0000	Mean : 0.0000	Mean : 0.00000	Mean : 0.0000
## 3rd Qu.: 0.1331	3rd Qu.: 0.3973	3rd Qu.: 0.54594	3rd Qu.: 0.4455
## Max. : 2.7058	Max. : 3.2541	Max. : 2.13306	Max. : 3.6204
## Variance_cooc.L.ADC	Entropy_cooc.L.ADC	DAVE_cooc.L.ADC	DVAR_cooc.L.ADC
## Min. :-1.2859	Min. :-0.9824	Min. :-1.2864	Min. :-1.1717
## 1st Qu.:-0.7621	1st Qu.:-0.6248	1st Qu.:-0.6974	1st Qu.:-0.6565
## Median :-0.1890	Median :-0.4987	Median :-0.2815	Median :-0.2047
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.3842	3rd Qu.: 1.1123	3rd Qu.: 0.2482	3rd Qu.: 0.3589


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## Max. : 4.4226      Max. : 2.2194      Max. : 3.8017      Max. : 4.4068
## DENT_cooc.L.ADC   SAVE_cooc.L.ADC   SVAR_cooc.L.ADC   SENT_cooc.L.ADC
## Min. : -0.9759    Min. : -1.5653    Min. : -1.2644    Min. : -1.9727
## 1st Qu.: -0.6384   1st Qu.: -0.6818   1st Qu.: -0.7216   1st Qu.: -0.6045
## Median : -0.4655    Median : -0.3427    Median : -0.3121    Median : -0.1270
## Mean : 0.0000      Mean : 0.0000      Mean : 0.0000      Mean : 0.0000
## 3rd Qu.: 0.9078     3rd Qu.: 0.4446     3rd Qu.: 0.4169     3rd Qu.: 0.1049
## Max. : 2.4613      Max. : 3.6211      Max. : 4.0559      Max. : 2.5018
## ASM_cooc.L.ADC    Contrast_cooc.L.ADC Dissimilarity_cooc.L.ADC
## Min. : -2.3863     Min. : -1.1727     Min. : -1.2864
## 1st Qu.: -0.4982    1st Qu.: -0.6799     1st Qu.: -0.6974
## Median : 0.1118     Median : -0.2518     Median : -0.2815
## Mean : 0.0000      Mean : 0.0000      Mean : 0.0000
## 3rd Qu.: 0.5833     3rd Qu.: 0.3354     3rd Qu.: 0.2482
## Max. : 1.6927      Max. : 4.6750      Max. : 3.8017
## Inv_diff_cooc.L.ADC Inv_diff_norm_cooc.L.ADC IDM_cooc.L.ADC
## Min. : -1.3386     Min. : -0.7848     Min. : -1.5068
## 1st Qu.: -0.6851    1st Qu.: -0.6074     1st Qu.: -0.6849
## Median : -0.3821     Median : -0.5390     Median : -0.3204
## Mean : 0.0000      Mean : 0.0000      Mean : 0.0000
## 3rd Qu.: 0.4258     3rd Qu.: 1.4482     3rd Qu.: 0.4067
## Max. : 3.0608      Max. : 1.9217      Max. : 3.4277
## IDM_norm_cooc.L.ADC Inv_var_cooc.L.ADC Correlation_cooc.L.ADC
## Min. : -0.7347     Min. : -1.5182     Min. : -1.5857
## 1st Qu.: -0.5868    1st Qu.: -0.6747     1st Qu.: -0.5887
## Median : -0.5461     Median : -0.3082     Median : -0.2321
## Mean : 0.0000      Mean : 0.0000      Mean : 0.0000
## 3rd Qu.: 1.5511     3rd Qu.: 0.3811     3rd Qu.: 0.2686
## Max. : 1.8161      Max. : 3.4062      Max. : 3.1376
## Autocorrelation_.L.ADC Tendency_cooc.L.ADC Shade_.L.ADC
## Min. : -1.4980     Min. : -1.2644     Min. : -3.0880
## 1st Qu.: -0.6548    1st Qu.: -0.7216     1st Qu.: -0.4341
## Median : -0.2485     Median : -0.3121     Median : -0.1871
## Mean : 0.0000      Mean : 0.0000      Mean : 0.0000
## 3rd Qu.: 0.3473     3rd Qu.: 0.4169     3rd Qu.: 0.2111
## Max. : 4.7450      Max. : 4.0559      Max. : 4.3795
## Prominence_cooc.L.ADC IC1_.L.ADC IC2_.L.ADC
## Min. : -0.9301     Min. : -5.1869     Min. : -1.3787
## 1st Qu.: -0.6482    1st Qu.: -0.4473     1st Qu.: -0.6500
## Median : -0.3005     Median : 0.2340      Median : -0.3969
## Mean : 0.0000      Mean : 0.0000      Mean : 0.0000
## 3rd Qu.: 0.3376     3rd Qu.: 0.6165     3rd Qu.: 0.2411
## Max. : 4.6896      Max. : 1.5551      Max. : 3.0658
## Coarseness_vdif_.L.ADC Contrast_vdif_.L.ADC Busyness_vdif_.L.ADC
## Min. : -2.02453     Min. : -0.9205     Min. : -0.7744
## 1st Qu.: -0.47654    1st Qu.: -0.5846     1st Qu.: -0.5677
## Median : 0.01276     Median : -0.3017     Median : -0.3409
## Mean : 0.00000      Mean : 0.0000      Mean : 0.0000
## 3rd Qu.: 0.40344     3rd Qu.: 0.1717     3rd Qu.: 0.2597
## Max. : 4.15362      Max. : 5.6466      Max. : 6.7651
## Complexity_vdif_.L.ADC Strength_vdif_.L.ADC SRE_align.L.ADC
## Min. : -1.4237     Min. : -0.65013     Min. : -0.7719
## 1st Qu.: -0.6752    1st Qu.: -0.48041     1st Qu.: -0.5832
## Median : -0.1945     Median : -0.29159     Median : -0.5443

```

## Mean : 0.0000	Mean : 0.00000	Mean : 0.0000	
## 3rd Qu.: 0.2832	3rd Qu.: -0.05036	3rd Qu.: 1.4803	
## Max. : 3.2894	Max. : 6.57379	Max. : 1.8545	
## LRE_align.L.ADC	GLNU_align.L.ADC	RLNU_align.L.ADC	RP_align.L.ADC
## Min. : -0.8114	Min. : -0.6574	Min. : -0.7015	Min. : -0.7982
## 1st Qu.: -0.6500	1st Qu.: -0.5599	1st Qu.: -0.5546	1st Qu.: -0.5910
## Median : -0.5388	Median : -0.3888	Median : -0.3845	Median : -0.5391
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 1.2822	3rd Qu.: 0.2165	3rd Qu.: 0.1460	3rd Qu.: 1.4307
## Max. : 2.3579	Max. : 6.8086	Max. : 6.4904	Max. : 1.8896
## LGRE_align.L.ADC	HGRE_align.L.ADC	LGSRE_align.L.ADC	HGSRE_align.L.ADC
## Min. : -2.2148	Min. : -1.5774	Min. : -2.2243	Min. : -1.5947
## 1st Qu.: -0.5485	1st Qu.: -0.6643	1st Qu.: -0.5445	1st Qu.: -0.6838
## Median : 0.1458	Median : -0.2731	Median : 0.1536	Median : -0.2903
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.5269	3rd Qu.: 0.3600	3rd Qu.: 0.5266	3rd Qu.: 0.3842
## Max. : 3.1699	Max. : 4.5613	Max. : 3.0478	Max. : 4.3891
## LGHRE_align.L.ADC	HGLRE_align.L.ADC	GLNU_norm_align.L.ADC	
## Min. : -2.1734	Min. : -1.4860	Min. : -2.11008	
## 1st Qu.: -0.5655	1st Qu.: -0.7008	1st Qu.: -0.48538	
## Median : 0.1303	Median : -0.1989	Median : -0.06251	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.00000	
## 3rd Qu.: 0.5017	3rd Qu.: 0.2984	3rd Qu.: 0.37502	
## Max. : 3.8145	Max. : 5.2592	Max. : 2.81475	
## RLNU_norm_align.L.ADC	GLVAR_align.L.ADC	RLVAR_align.L.ADC	Entropy_align.L.ADC
## Min. : -0.8664	Min. : -1.2324	Min. : -1.8814	Min. : -0.7768
## 1st Qu.: -0.6053	1st Qu.: -0.7363	1st Qu.: -0.5808	1st Qu.: -0.6281
## Median : -0.5184	Median : -0.2167	Median : -0.1993	Median : -0.5369
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 1.2976	3rd Qu.: 0.3836	3rd Qu.: 0.4437	3rd Qu.: 1.3840
## Max. : 2.0169	Max. : 4.7240	Max. : 3.8452	Max. : 2.1004
## SZSE.L.ADC	LZSE.L.ADC	LGLZE.L.ADC	HGLZE.L.ADC
## Min. : -0.8496	Min. : -0.9893	Min. : -2.2245	Min. : -1.5684
## 1st Qu.: -0.6186	1st Qu.: -0.6976	1st Qu.: -0.5451	1st Qu.: -0.6815
## Median : -0.5273	Median : -0.4658	Median : 0.1492	Median : -0.2709
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 1.3310	3rd Qu.: 0.5987	3rd Qu.: 0.5309	3rd Qu.: 0.3807
## Max. : 2.0528	Max. : 3.7629	Max. : 2.8769	Max. : 4.4810
## SZLGE.L.ADC	SZHGE.L.ADC	LZLGE.L.ADC	LZHGE.L.ADC
## Min. : -2.2426	Min. : -1.6111	Min. : -1.99415	Min. : -1.0980
## 1st Qu.: -0.5407	1st Qu.: -0.6719	1st Qu.: -0.57935	1st Qu.: -0.6538
## Median : 0.1133	Median : -0.2769	Median : 0.07479	Median : -0.2980
## Mean : 0.0000	Mean : 0.0000	Mean : 0.00000	Mean : 0.0000
## 3rd Qu.: 0.5203	3rd Qu.: 0.3855	3rd Qu.: 0.43939	3rd Qu.: 0.3151
## Max. : 2.5683	Max. : 4.0198	Max. : 5.02589	Max. : 6.1772
## GLNU_area.L.ADC	ZSNU.L.ADC	ZSP.L.ADC	GLNU_norm.L.ADC
## Min. : -0.6701	Min. : -0.7023	Min. : -0.9792	Min. : -2.11873
## 1st Qu.: -0.5637	1st Qu.: -0.5485	1st Qu.: -0.6124	1st Qu.: -0.46511
## Median : -0.3845	Median : -0.3419	Median : -0.4893	Median : -0.03802
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.00000
## 3rd Qu.: 0.1403	3rd Qu.: 0.1582	3rd Qu.: 1.0724	3rd Qu.: 0.37453
## Max. : 6.0648	Max. : 6.7810	Max. : 2.2292	Max. : 2.60581
## ZSNU_norm.L.ADC	GLVAR_area.L.ADC	ZSVAR.L.ADC	Entropy_area.L.ADC
## Min. : -1.0136	Min. : -1.2168	Min. : -0.8481	Min. : -0.7653

## 1st Qu.: -0.6068	1st Qu.: -0.7329	1st Qu.: -0.5710	1st Qu.: -0.6170
## Median : -0.4718	Median : -0.2247	Median : -0.3763	Median : -0.5393
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.9821	3rd Qu.: 0.3653	3rd Qu.: 0.1338	3rd Qu.: 1.3657
## Max. : 2.4730	Max. : 4.8084	Max. : 4.4745	Max. : 2.0718
## Max_cooc.H.ADC	Average_cooc.H.ADC	Variance_cooc.H.ADC	Entropy_cooc.H.ADC
## Min. : -2.3371	Min. : -0.7948	Min. : -0.7235	Min. : -0.8847
## 1st Qu.: -0.4994	1st Qu.: -0.6111	1st Qu.: -0.6025	1st Qu.: -0.5826
## Median : 0.1186	Median : -0.5369	Median : -0.5508	Median : -0.5426
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.5854	3rd Qu.: 1.2501	3rd Qu.: 1.4743	3rd Qu.: 1.1187
## Max. : 1.7159	Max. : 2.1569	Max. : 1.9213	Max. : 1.8848
## DAVE_cooc.H.ADC	DVAR_cooc.H.ADC	DENT_cooc.H.ADC	SAVE_cooc.H.ADC
## Min. : -1.1715	Min. : -1.1938	Min. : -0.7651	Min. : -0.7953
## 1st Qu.: -0.6742	1st Qu.: -0.6459	1st Qu.: -0.6067	1st Qu.: -0.6114
## Median : -0.4508	Median : -0.3725	Median : -0.5447	Median : -0.5374
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.3058	3rd Qu.: 0.1048	3rd Qu.: 1.3235	3rd Qu.: 1.2503
## Max. : 2.6408	Max. : 2.7511	Max. : 1.9569	Max. : 2.1563
## SVAR_cooc.H.ADC	SENT_cooc.H.ADC	ASM_cooc.H.ADC	Contrast_cooc.H.ADC
## Min. : -0.9707	Min. : -0.9294	Min. : -2.3505	Min. : -1.2775
## 1st Qu.: -0.6441	1st Qu.: -0.6185	1st Qu.: -0.4601	1st Qu.: -0.6448
## Median : -0.4055	Median : -0.5117	Median : 0.1116	Median : -0.3296
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.8015	3rd Qu.: 1.0046	3rd Qu.: 0.6028	3rd Qu.: 0.2470
## Max. : 2.4109	Max. : 2.2145	Max. : 1.4704	Max. : 2.9382
## Dissimilarity_cooc.H.ADC	Inv_diff_cooc.H.ADC	Inv_diff_norm_cooc.H.ADC	
## Min. : -1.1715	Min. : -1.5080	Min. : -0.8136	
## 1st Qu.: -0.6742	1st Qu.: -0.5884	1st Qu.: -0.5940	
## Median : -0.4508	Median : -0.3060	Median : -0.5295	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 0.3058	3rd Qu.: 0.3670	3rd Qu.: 1.4111	
## Max. : 2.6408	Max. : 2.9514	Max. : 1.9758	
## IDM_cooc.H.ADC	IDM_norm_cooc.H.ADC	Inv_var_cooc.H.ADC	
## Min. : -1.8238	Min. : -0.7770	Min. : -1.8455	
## 1st Qu.: -0.5396	1st Qu.: -0.5848	1st Qu.: -0.4991	
## Median : -0.1772	Median : -0.5391	Median : -0.1806	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 0.5376	3rd Qu.: 1.4745	3rd Qu.: 0.4257	
## Max. : 3.1890	Max. : 1.8842	Max. : 3.1448	
## Correlation_cooc.H.ADC	Autocorrelation_cooc.H.ADC	Tendency_cooc.H.ADC	
## Min. : -1.5337	Min. : -1.0271	Min. : -0.9707	
## 1st Qu.: -0.5809	1st Qu.: -0.6158	1st Qu.: -0.6441	
## Median : -0.2354	Median : -0.5417	Median : -0.4055	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 0.2656	3rd Qu.: 0.7441	3rd Qu.: 0.8015	
## Max. : 3.2010	Max. : 2.2641	Max. : 2.4109	
## Shade_cooc.H.ADC	Prominence_cooc.H.ADC	IC1_d.H.ADC	IC2_d.H.ADC
## Min. : -2.77052	Min. : -1.1193	Min. : -6.0367	Min. : -1.2413
## 1st Qu.: -0.53284	1st Qu.: -0.6229	1st Qu.: -0.2691	1st Qu.: -0.6695
## Median : 0.02229	Median : -0.3702	Median : 0.2777	Median : -0.4280
## Mean : 0.00000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.52112	3rd Qu.: 0.3676	3rd Qu.: 0.5805	3rd Qu.: 0.3188
## Max. : 3.79390	Max. : 2.6578	Max. : 1.1009	Max. : 3.0638

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## Coarseness_vdif.H.ADC Contrast_vdif.H.ADC Busyness_vdif.H.ADC
## Min.      :-2.03513      Min.      :-1.2124      Min.      :-0.6917
## 1st Qu.: -0.48736      1st Qu.: -0.6760      1st Qu.: -0.5554
## Median : 0.02405      Median : -0.4152      Median : -0.3450
## Mean : 0.00000      Mean : 0.0000      Mean : 0.0000
## 3rd Qu.: 0.43289      3rd Qu.: 0.1278      3rd Qu.: 0.1152
## Max. : 4.13594      Max. : 2.7803      Max. : 6.4584
## Complexity_vdif.H.ADC Strength_vdif.H.ADC SRE_align.H.ADC LRE_align.H.ADC
## Min.      :-1.2507      Min.      :-0.5432      Min.      :-0.7222      Min.      :-0.7514
## 1st Qu.: -0.6866      1st Qu.: -0.4499      1st Qu.: -0.5795      1st Qu.: -0.6115
## Median : -0.4396      Median : -0.3040      Median : -0.5513      Median : -0.5418
## Mean : 0.0000      Mean : 0.0000      Mean : 0.0000      Mean : 0.0000
## 3rd Qu.: 0.1617      3rd Qu.: -0.1236      3rd Qu.: 1.5719      3rd Qu.: 1.4942
## Max. : 2.8308      Max. : 7.0284      Max. : 1.7996      Max. : 2.0278
## GLNU_align.H.ADC RLNU_align.H.ADC RP_align.H.ADC LGRE_align.H.ADC
## Min.      :-0.6935      Min.      :-0.7005      Min.      :-0.7282      Min.      :-2.15229
## 1st Qu.: -0.5587      1st Qu.: -0.5612      1st Qu.: -0.5806      1st Qu.: -0.45456
## Median : -0.3999      Median : -0.3997      Median : -0.5496      Median : -0.05554
## Mean : 0.0000      Mean : 0.0000      Mean : 0.0000      Mean : 0.00000
## 3rd Qu.: 0.1402      3rd Qu.: 0.1532      3rd Qu.: 1.5612      3rd Qu.: 0.42792
## Max. : 6.4171      Max. : 6.3321      Max. : 1.8209      Max. : 1.90419
## HGRE_align.H.ADC LGSRE_align.H.ADC HGSRE_align.H.ADC LGHRE_align.H.ADC
## Min.      :-0.6158      Min.      :-2.21358      Min.      :-0.6616      Min.      :-2.16369
## 1st Qu.: -0.5856      1st Qu.: -0.46834      1st Qu.: -0.5905      1st Qu.: -0.43595
## Median : -0.5793      Median : -0.03469      Median : -0.5732      Median : -0.08695
## Mean : 0.0000      Mean : 0.00000      Mean : 0.0000      Mean : 0.00000
## 3rd Qu.: 1.6403      3rd Qu.: 0.40877      3rd Qu.: 1.5502      3rd Qu.: 0.37072
## Max. : 1.7953      Max. : 1.95168      Max. : 1.8648      Max. : 2.34515
## HGLRE_align.H.ADC GLNU_norm_align.H.ADC RLNU_norm_align.H.ADC
## Min.      :-0.6756      Min.      :-2.22103      Min.      :-0.7467
## 1st Qu.: -0.6034      1st Qu.: -0.54265      1st Qu.: -0.5861
## Median : -0.5529      Median : -0.03044      Median : -0.5508
## Mean : 0.0000      Mean : 0.00000      Mean : 0.0000
## 3rd Qu.: 1.4993      3rd Qu.: 0.50950      3rd Qu.: 1.5274
## Max. : 2.1245      Max. : 1.70856      Max. : 1.8932
## GLVAR_align.H.ADC RLVAR_align.H.ADC Entropy_align.H.ADC SZSE.H.ADC
## Min.      :-0.6228      Min.      :-2.23664      Min.      :-0.6485      Min.      :-0.7613
## 1st Qu.: -0.5864      1st Qu.: -0.45655      1st Qu.: -0.5877      1st Qu.: -0.5921
## Median : -0.5747      Median : 0.03709      Median : -0.5689      Median : -0.5464
## Mean : 0.0000      Mean : 0.00000      Mean : 0.0000      Mean : 0.0000
## 3rd Qu.: 1.6294      3rd Qu.: 0.48787      3rd Qu.: 1.5623      3rd Qu.: 1.4964
## Max. : 1.7875      Max. : 3.26888      Max. : 1.8011      Max. : 1.9530
## LZSE.H.ADC LGLZE.H.ADC HGLZE.H.ADC SZLGE.H.ADC
## Min.      :-0.9658      Min.      :-2.22947      Min.      :-0.6777      Min.      :-2.274047
## 1st Qu.: -0.6763      1st Qu.: -0.47148      1st Qu.: -0.5910      1st Qu.: -0.432630
## Median : -0.4997      Median : -0.01215      Median : -0.5690      Median : 0.006384
## Mean : 0.0000      Mean : 0.00000      Mean : 0.0000      Mean : 0.000000
## 3rd Qu.: 0.8006      3rd Qu.: 0.44354      3rd Qu.: 1.5427      3rd Qu.: 0.457299
## Max. : 2.7486      Max. : 2.02997      Max. : 1.8487      Max. : 2.138033
## SZHGE.H.ADC LZLGE.H.ADC LZHGE.H.ADC GLNU_area.H.ADC
## Min.      :-0.7407      Min.      :-1.9143      Min.      :-0.9615      Min.      :-0.6950
## 1st Qu.: -0.5947      1st Qu.: -0.4764      1st Qu.: -0.6552      1st Qu.: -0.5584
## Median : -0.5574      Median : -0.1523      Median : -0.5438      Median : -0.3958
## Mean : 0.0000      Mean : 0.0000      Mean : 0.0000      Mean : 0.0000

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## 3rd Qu.: 1.3859	3rd Qu.: 0.4952	3rd Qu.: 0.7570	3rd Qu.: 0.1541
## Max. : 2.0669	Max. : 4.3386	Max. : 3.9017	Max. : 6.4362
## ZSNU.H.ADC	ZSP.H.ADC	GLNU_norm.H.ADC	ZSNU_norm.H.ADC
## Min. :-0.7054	Min. :-0.8087	Min. :-2.22083	Min. :-0.8353
## 1st Qu.: -0.5636	1st Qu.: -0.6050	1st Qu.: -0.54112	1st Qu.: -0.6110
## Median : -0.3916	Median : -0.5389	Median : -0.03152	Median : -0.5388
## Mean : 0.0000	Mean : 0.0000	Mean : 0.00000	Mean : 0.0000
## 3rd Qu.: 0.1526	3rd Qu.: 1.4343	3rd Qu.: 0.50815	3rd Qu.: 1.2790
## Max. : 6.3748	Max. : 2.0467	Max. : 1.72002	Max. : 2.2862
## GLVAR_area.H.ADC	ZSVAR.H.ADC	Entropy_area.H.ADC	Max_cooc.W.ADC
## Min. :-0.7003	Min. :-1.3982	Min. :-0.7062	Min. :-2.3379
## 1st Qu.: -0.5925	1st Qu.: -0.6448	1st Qu.: -0.5938	1st Qu.: -0.4827
## Median : -0.5589	Median : -0.2461	Median : -0.5557	Median : 0.1420
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 1.4922	3rd Qu.: 0.3541	3rd Qu.: 1.4400	3rd Qu.: 0.5983
## Max. : 1.8856	Max. : 4.8315	Max. : 1.8920	Max. : 1.5572
## Average_cooc.W.ADC	Variance_cooc.W.ADC	DAVE_cooc.W.ADC	DVAR_cooc.W.ADC
## Min. :-1.4890	Min. :-1.1255	Min. :-1.4215	Min. :-1.1708
## 1st Qu.: -0.6443	1st Qu.: -0.6947	1st Qu.: -0.6477	1st Qu.: -0.6932
## Median : -0.1974	Median : -0.1999	Median : -0.3082	Median : -0.2843
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.2788	3rd Qu.: 0.2675	3rd Qu.: 0.4060	3rd Qu.: 0.3968
## Max. : 3.1582	Max. : 4.3063	Max. : 3.6687	Max. : 4.2974
## DENT_cooc.W.ADC	SAVE_cooc.W.ADC	SVAR_cooc.W.ADC	SENT_cooc.W.ADC
## Min. :-0.9201	Min. :-1.5115	Min. :-1.0500	Min. :-1.9175
## 1st Qu.: -0.6168	1st Qu.: -0.6428	1st Qu.: -0.7069	1st Qu.: -0.5955
## Median : -0.4971	Median : -0.1899	Median : -0.2297	Median : -0.2012
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 1.0249	3rd Qu.: 0.3385	3rd Qu.: 0.2119	3rd Qu.: 0.2247
## Max. : 2.2735	Max. : 3.2681	Max. : 4.4179	Max. : 2.7670
## ASM_cooc.W.ADC	Contrast_cooc.W.ADC	Dissemblarity_cooc.W.ADC	
## Min. :-2.3485	Min. :-1.2599	Min. :-1.4215	
## 1st Qu.: -0.4625	1st Qu.: -0.6538	1st Qu.: -0.6477	
## Median : 0.1160	Median : -0.2904	Median : -0.3082	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 0.6007	3rd Qu.: 0.4014	3rd Qu.: 0.4060	
## Max. : 1.4834	Max. : 4.4526	Max. : 3.6687	
## Inv_diff_cooc.W.ADC	Inv_diff_norm_cooc.W.ADC	IDM_cooc.W.ADC	
## Min. :-2.4673	Min. :-0.7847	Min. :-1.8818	
## 1st Qu.: -0.5374	1st Qu.: -0.6079	1st Qu.: -0.5428	
## Median : -0.2640	Median : -0.5392	Median : -0.1774	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 0.4018	3rd Qu.: 1.4483	3rd Qu.: 0.4203	
## Max. : 3.4195	Max. : 1.9241	Max. : 3.6069	
## IDM_norm_cooc.W.ADC	Inv_var_cooc.W.ADC	Correlation_cooc.W.ADC	
## Min. :-0.7349	Min. :-1.8864	Min. :-1.5829	
## 1st Qu.: -0.5875	1st Qu.: -0.5355	1st Qu.: -0.5917	
## Median : -0.5463	Median : -0.1854	Median : -0.2323	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 1.5506	3rd Qu.: 0.4358	3rd Qu.: 0.2677	
## Max. : 1.8175	Max. : 3.6532	Max. : 3.1362	
## Autocorrelation_cooc.W.ADC	Tendency_cooc.W.ADC	Shade_cooc.W.ADC	
## Min. :-1.2943	Min. :-1.0500	Min. :-2.2695	
## 1st Qu.: -0.6547	1st Qu.: -0.7069	1st Qu.: -0.4006	

## Median :-0.2595	Median :-0.2297	Median :-0.2135	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 0.4212	3rd Qu.: 0.2119	3rd Qu.: 0.2092	
## Max. : 4.0616	Max. : 4.4179	Max. : 5.4450	
## Prominence_cooc.W.ADC	IC1_d.W.ADC	IC2_d.W.ADC	
## Min. :-0.6919	Min. :-4.5975	Min. :-1.2237	
## 1st Qu.: -0.6007	1st Qu.: -0.4209	1st Qu.: -0.6385	
## Median :-0.3129	Median : 0.1758	Median :-0.4111	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	
## 3rd Qu.: 0.0198	3rd Qu.: 0.7310	3rd Qu.: 0.5026	
## Max. : 5.8345	Max. : 1.3308	Max. : 2.5156	
## Coarseness_vdif.W.ADC	Contrast_vdif.W.ADC	Busyness_vdif.W.ADC	
## Min. :-2.1195	Min. :-0.9791	Min. :-2.11863	
## 1st Qu.: -0.4700	1st Qu.: -0.5561	1st Qu.: -0.52395	
## Median : 0.0510	Median :-0.3072	Median :-0.09297	
## Mean : 0.0000	Mean : 0.0000	Mean : 0.00000	
## 3rd Qu.: 0.4602	3rd Qu.: 0.1078	3rd Qu.: 0.43915	
## Max. : 3.8050	Max. : 6.8033	Max. : 4.28742	
## Complexity_vdif.W.ADC	Strength_vdif.W.ADC	SRE_align.W.ADC	LRE_align.W.ADC
## Min. :-0.9709	Min. :-1.1121	Min. :-0.7308	Min. :-0.7211
## 1st Qu.: -0.6681	1st Qu.: -0.6535	1st Qu.: -0.5816	1st Qu.: -0.5887
## Median :-0.2653	Median :-0.3435	Median :-0.5543	Median :-0.5529
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.3990	3rd Qu.: 0.3265	3rd Qu.: 1.5552	3rd Qu.: 1.5492
## Max. : 6.0882	Max. : 4.9793	Max. : 1.7860	Max. : 1.9636
## GLNU_align.W.ADC	RLNU_align.W.ADC	RP_align.W.ADC	LGRE_align.W.ADC
## Min. :-0.7333	Min. :-0.6902	Min. :-0.7401	Min. :-2.27237
## 1st Qu.: -0.5941	1st Qu.: -0.5539	1st Qu.: -0.5818	1st Qu.: -0.51539
## Median :-0.3737	Median :-0.3981	Median :-0.5526	Median : 0.09534
## Mean : 0.0000	Mean : 0.0000	Mean : 0.0000	Mean : 0.00000
## 3rd Qu.: 0.1388	3rd Qu.: 0.1480	3rd Qu.: 1.5379	3rd Qu.: 0.54819
## Max. : 6.5566	Max. : 6.5382	Max. : 1.7965	Max. : 2.70926
## HGRE_align.W.ADC	LGSRE_align.W.ADC	HGSRE_align.W.ADC	LGHRE_align.W.ADC
## Min. :-1.3135	Min. :-2.27566	Min. :-1.3136	Min. :-2.24791
## 1st Qu.: -0.6889	1st Qu.: -0.51275	1st Qu.: -0.6882	1st Qu.: -0.52760
## Median :-0.1647	Median : 0.09994	Median :-0.1662	Median : 0.07717
## Mean : 0.0000	Mean : 0.00000	Mean : 0.0000	Mean : 0.00000
## 3rd Qu.: 0.4045	3rd Qu.: 0.55436	3rd Qu.: 0.4067	3rd Qu.: 0.52536
## Max. : 4.0753	Max. : 2.61211	Max. : 4.0823	Max. : 3.19638
## HGLRE_align.W.ADC	GLNU_norm_align.W.ADC	RLNU_norm_align.W.ADC	
## Min. :-1.3123	Min. :-2.28055	Min. :-0.7720	
## 1st Qu.: -0.6870	1st Qu.: -0.46039	1st Qu.: -0.5878	
## Median :-0.1590	Median : 0.01598	Median :-0.5460	
## Mean : 0.0000	Mean : 0.00000	Mean : 0.0000	
## 3rd Qu.: 0.3984	3rd Qu.: 0.54042	3rd Qu.: 1.4790	
## Max. : 4.0428	Max. : 2.32851	Max. : 1.8347	
## GLVAR_align.W.ADC	RLVAR_align.W.ADC	Entropy_align.W.ADC	SZSE.W.ADC
## Min. :-1.1389	Min. :-2.29100	Min. :-0.9913	Min. :-0.7773
## 1st Qu.: -0.7347	1st Qu.: -0.46023	1st Qu.: -0.6439	1st Qu.: -0.5819
## Median :-0.1759	Median : 0.02314	Median :-0.4745	Median :-0.5430
## Mean : 0.0000	Mean : 0.00000	Mean : 0.0000	Mean : 0.0000
## 3rd Qu.: 0.2403	3rd Qu.: 0.49588	3rd Qu.: 0.8898	3rd Qu.: 1.4776
## Max. : 4.2367	Max. : 2.82723	Max. : 2.4115	Max. : 1.8160
## LZSE.W.ADC	LGLZE.W.ADC	HGLZE.W.ADC	SZLGE.W.ADC

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## Min.      :-0.7715   Min.      :-2.2768   Min.      :-1.3138   Min.      :-2.2818
## 1st Qu.: -0.6308   1st Qu.: -0.5090   1st Qu.: -0.6890   1st Qu.: -0.5025
## Median : -0.5511   Median :  0.1003   Median : -0.1561   Median :  0.1009
## Mean    :  0.0000   Mean    :  0.0000   Mean    :  0.0000   Mean    :  0.0000
## 3rd Qu.:  1.2120   3rd Qu.:  0.5570   3rd Qu.:  0.4104   3rd Qu.:  0.5705
## Max.    :  2.5306   Max.    :  2.4096   Max.    :  4.0870   Max.    :  2.1477
## SZHGE.W.ADC      LZLGE.W.ADC      LZHGE.W.ADC      GLNU_area.W.ADC
## Min.      :-1.3133   Min.      :-2.13651   Min.      :-1.3090   Min.      :-0.7321
## 1st Qu.: -0.6852   1st Qu.: -0.54372   1st Qu.: -0.7059   1st Qu.: -0.5915
## Median : -0.1610   Median :  0.08248   Median : -0.1803   Median : -0.3799
## Mean    :  0.0000   Mean    :  0.00000   Mean    :  0.0000   Mean    :  0.0000
## 3rd Qu.:  0.4095   3rd Qu.:  0.46969   3rd Qu.:  0.4200   3rd Qu.:  0.1598
## Max.    :  4.1196   Max.    :  4.04184   Max.    :  4.2178   Max.    :  6.6650
## ZSNU.W.ADC       ZSP.W.ADC       GLNU_norm.W.ADC   ZSNU_norm.W.ADC
## Min.      :-0.6841   Min.      :-0.8076   Min.      :-2.2549   Min.      :-0.8857
## 1st Qu.: -0.5457   1st Qu.: -0.5855   1st Qu.: -0.4805   1st Qu.: -0.6034
## Median : -0.3904   Median : -0.5378   Median :  0.0624   Median : -0.5320
## Mean    :  0.0000   Mean    :  0.0000   Mean    :  0.0000   Mean    :  0.0000
## 3rd Qu.:  0.1352   3rd Qu.:  1.4251   3rd Qu.:  0.5381   3rd Qu.:  1.2603
## Max.    :  6.6729   Max.    :  1.8574   Max.    :  2.2114   Max.    :  2.0579
## GLVAR_area.W.ADC  ZSVAR.W.ADC      Entropy_area.W.ADC
## Min.      :-1.1391   Min.      :-1.6945   Min.      :-0.9756
## 1st Qu.: -0.7273   1st Qu.: -0.5990   1st Qu.: -0.6280
## Median : -0.1741   Median : -0.1693   Median : -0.4946
## Mean    :  0.0000   Mean    :  0.0000   Mean    :  0.0000
## 3rd Qu.:  0.2387   3rd Qu.:  0.4701   3rd Qu.:  0.8891
## Max.    :  4.2228   Max.    :  4.5022   Max.    :  2.2949
```

Model building starts with $k = 2$ and result plotting

```
k2 <- kmeans(x_train, centers = 2, nstart = 25)
str(k2)
```

```
## List of 9
## $ cluster      : Named int [1:197] 1 1 1 1 1 1 1 1 1 1 ...
##   ..- attr(*, "names")= chr [1:197] "1" "2" "3" "4" ...
## $ centers       : num [1:2, 1:430] -0.537727 1.580918 0.000501 -0.001473 -0.016481 ...
##   ..- attr(*, "dimnames")=List of 2
##     ..$ : chr [1:2] "1" "2"
##     ..$ : chr [1:430] "Institution" "Failure" "Entropy_cooc.W.ADC" "GLNU_align.H.PET" ...
## $ totss        : num 84280
## $ withinss     : num [1:2] 23827 21069
## $ tot.withinss : num 44895
## $ betweenss    : num 39385
## $ size         : int [1:2] 147 50
## $ iter         : int 1
## $ ifault       : int 0
## - attr(*, "class")= chr "kmeans"
```

```
# Result plotting
fviz_cluster(k2, data = x_train)
```



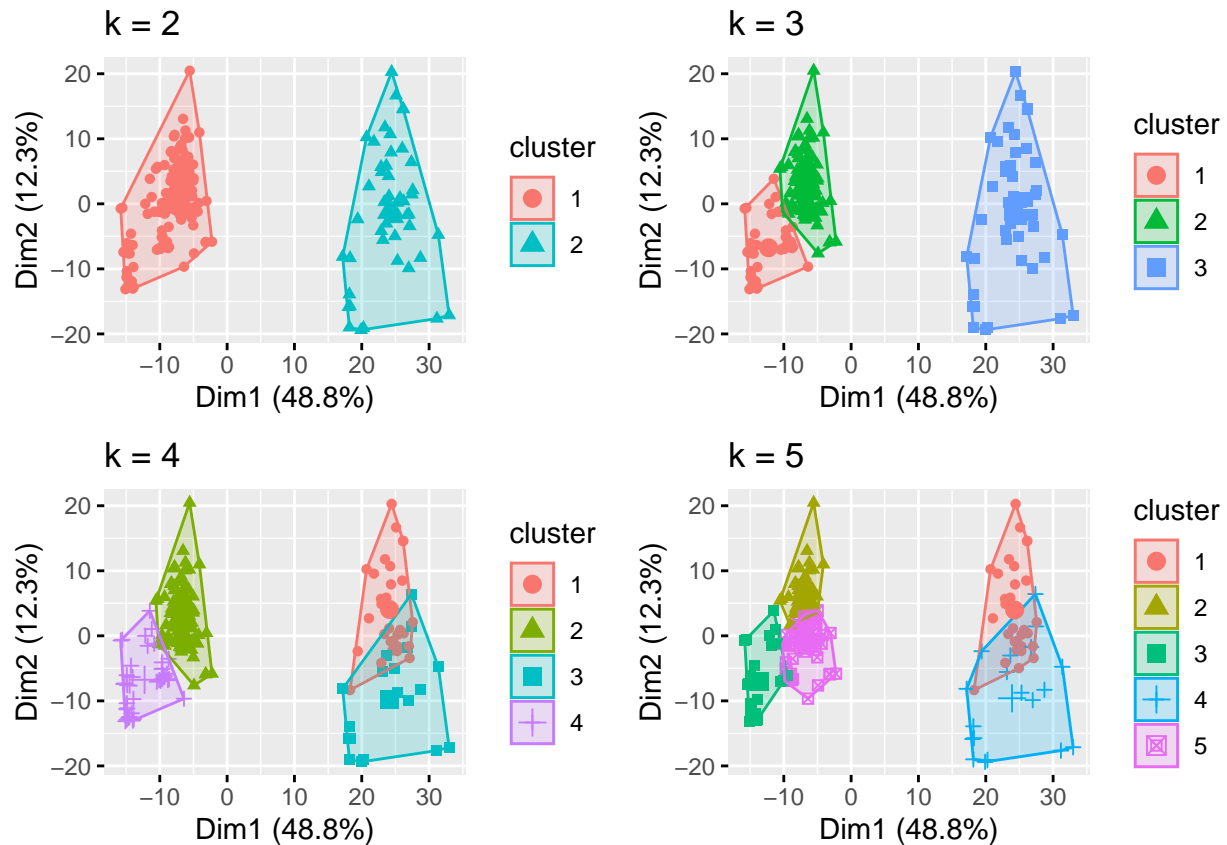
Model building experiments with different k values

```
k3 <- kmeans(x_train, centers = 3, nstart = 25)
k4 <- kmeans(x_train, centers = 4, nstart = 25)
k5 <- kmeans(x_train, centers = 5, nstart = 25)
```

Plot the results with different k values

```
p1 <- fviz_cluster(k2, geom = "point", data = x_train) + ggtitle("k = 2")
p2 <- fviz_cluster(k3, geom = "point", data = x_train) + ggtitle("k = 3")
p3 <- fviz_cluster(k4, geom = "point", data = x_train) + ggtitle("k = 4")
p4 <- fviz_cluster(k5, geom = "point", data = x_train) + ggtitle("k = 5")

grid.arrange(p1, p2, p3, p4, nrow = 2)
```

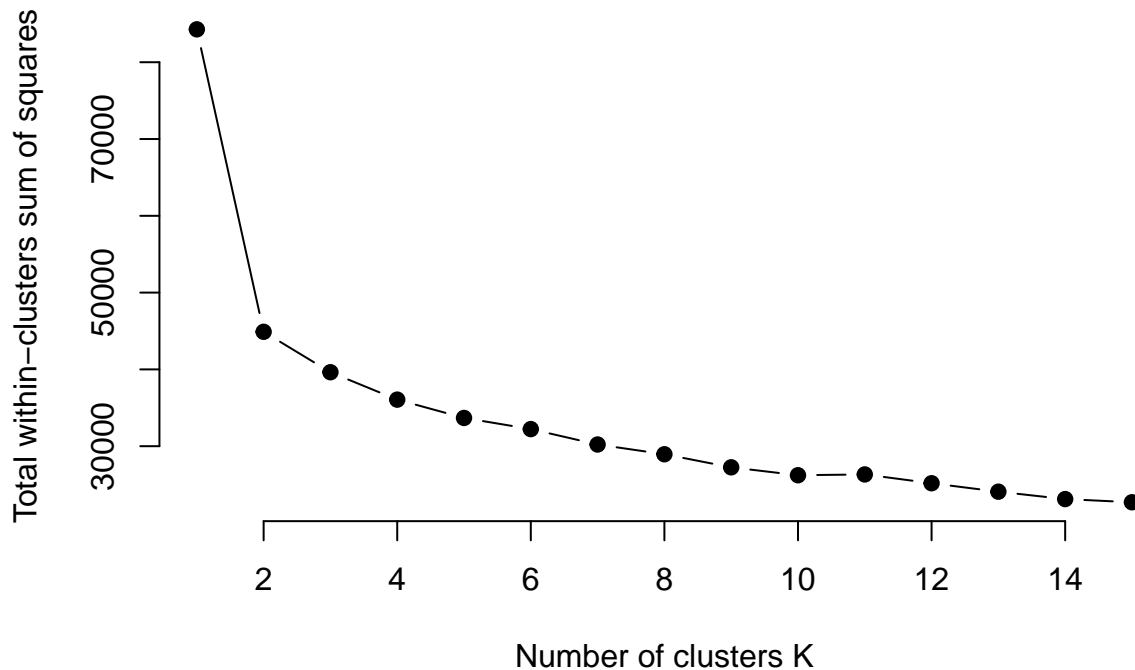
Finding the Optimal k value by computing total within-cluster sum of square

```
set.seed(123)
wss <- function(k) {
  kmeans(x_train, k, nstart = 10)$tot.withinss
}
```

Compute and plot wss for $k = 1$ to $k = 15$

```
k.values <- 1:15
wss_values <- map_dbl(k.values, wss)

plot(k.values, wss_values,
     type="b", pch = 19, frame = FALSE,
     xlab="Number of clusters K",
     ylab="Total within-clusters sum of squares")
```



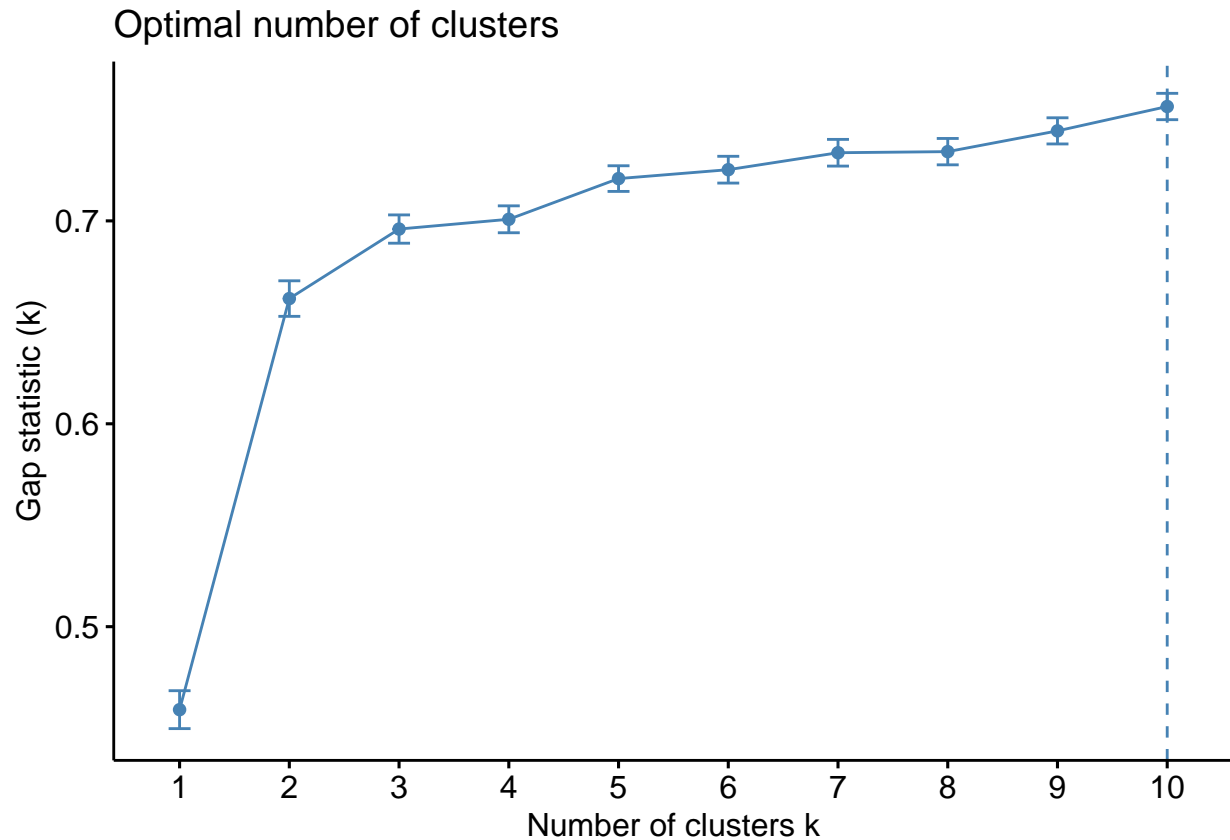
Compute gap statistic

```
set.seed(123)
gap_stat <- clusGap(x_train, FUN = kmeans, nstart = 25,
                    K.max = 10, B = 50)

print(gap_stat, method = "firstmax")
```

```
## Clustering Gap statistic ["clusGap"] from call:
## clusGap(x = x_train, FUNcluster = kmeans, K.max = 10, B = 50, nstart = 25)
## B=50 simulated reference sets, k = 1..10; spaceH0="scaledPCA"
## --> Number of clusters (method 'firstmax'): 10
##      logW      E.logW      gap      SE.sim
## [1,] 7.172238 7.631343 0.4591050 0.009344722
## [2,] 6.879860 7.541570 0.6617097 0.008762466
## [3,] 6.799071 7.495045 0.6959738 0.006975238
## [4,] 6.760250 7.461038 0.7007876 0.006630901
## [5,] 6.715751 7.436595 0.7208444 0.006319998
## [6,] 6.689678 7.414915 0.7252363 0.006598069
## [7,] 6.661851 7.395440 0.7335893 0.006576344
## [8,] 6.643375 7.377503 0.7341279 0.006496770
## [9,] 6.616695 7.361058 0.7443634 0.006441963
## [10,] 6.589169 7.345537 0.7563681 0.006495757
```

```
fviz_gap_stat(gap_stat)
```



The final k value is determined to be 2 based on the above experiments and considering that the dataset has binary labels.

```
set.seed(123)
final <- kmeans(x_train, 2, nstart = 25)
print(final)
```

```
## K-means clustering with 2 clusters of sizes 50, 147
##
## Cluster means:
##   Institution      Failure Entropy_cooc.W.ADC GLNU_align.H.PET Min_hist.PET
## 1  1.5809179 -0.0014733768      0.04845450      -0.07901100      0.9204612
## 2 -0.5377272  0.0005011486      -0.01648112      0.02687449      -0.3130820
##   Max_hist.PET Mean_hist.PET Variance_hist.PET Standard_Deviation_hist.PET
## 1  0.9468341  0.9216792      0.4594337      0.9319222
## 2 -0.3220524 -0.3134963      -0.1562700      -0.3169804
##   Skewness_hist.PET Kurtosis_hist.PET Energy_hist.PET Entropy_hist.PET
## 1  0.9115602      0.25274217      0.6864958      1.5003007
## 2 -0.3100545      -0.08596673      -0.2335020      -0.5103064
##   AUC_hist.PET H_suv.PET Volume.PET X3D_surface.PET ratio_3ds_vol.PET
## 1  1.6957546  0.9652219  0.5900077      0.3802612      0.9436984
## 2 -0.5767873 -0.3283068 -0.2006829      -0.1293406      -0.3209858
##   ratio_3ds_vol_norm.PET irregularity.PET tumor_length.PET Compactness_v1.PET
```

```

## 1          0.9622506          1.6522842          1.0256292          0.8807232
## 2          -0.3272961          -0.5620014          -0.3488535          -0.2995657
## Compactness_v2.PET Spherical_disproportion.PET Sphericity.PET Asphericity.PET
## 1          0.4324058          0.9622506          0.4460709          0.9240341
## 2          -0.1470768          -0.3272961          -0.1517248          -0.3142973
## Center_of_mass.PET Max_3D_diam.PET Major_axis_length.PET
## 1          0.6358358          0.8259982          0.8904297
## 2          -0.2162707          -0.2809518          -0.3028672
## Minor_axis_length.PET Least_axis_length.PET Elongation.PET Flatness.PET
## 1          1.1433164          0.9772289          1.4563692          1.3553445
## 2          -0.3888831          -0.3323908          -0.4953637          -0.4610015
## Max_cooc.L.PET Average_cooc.L.PET Variance_cooc.L.PET Entropy_cooc.L.PET
## 1          0.7290795          1.389215          1.1041050          1.6813985
## 2          -0.2479862          -0.472522          -0.3755459          -0.5719043
## DAVE_cooc.L.PET DVAR_cooc.L.PET DENT_cooc.L.PET SAVE_cooc.L.PET
## 1          1.2936781          1.1366603          1.6603800          1.3889879
## 2          -0.4400266          -0.3866192          -0.5647551          -0.4724449
## SVAR_cooc.L.PET SENT_cooc.L.PET ASM_cooc.L.PET Contrast_cooc.L.PET
## 1          1.1209781          1.6614758          0.6775498          0.9285775
## 2          -0.3812851          -0.5651278          -0.2304591          -0.3158427
## Dissimilarity_cooc.L.PET Inv_diff_cooc.L.PET Inv_diff_norm_cooc.L.PET
## 1          1.2936781          1.443028          1.6979660
## 2          -0.4400266          -0.490826          -0.5775395
## IDM_cooc.L.PET IDM_norm_cooc.L.PET Inv_var_cooc.L.PET Correlation_cooc.L.PET
## 1          1.2814891          1.7046571          1.2896785          1.123648
## 2          -0.4358807          -0.5798153          -0.4386661          -0.382193
## Autocorrelation_cooc.L.PET Tendency_cooc.L.PET Shade_cooc.L.PET
## 1          1.0338012          1.1209781          0.5578271
## 2          -0.3516331          -0.3812851          -0.1897371
## Prominence_cooc.L.PET IC1_.L.PET IC2_.L.PET Coarseness_vdif_.L.PET
## 1          0.7889007 -0.6341334 1.5273752          0.7537450
## 2          -0.2683336 0.2156916 -0.5195154          -0.2563758
## Contrast_vdif_.L.PET Busyness_vdif_.L.PET Complexity_vdif_.L.PET
## 1          0.3878173          0.5565230          1.2153015
## 2          -0.1319107          -0.1892936          -0.4133678
## Strength_vdif_.L.PET SRE_align.L.PET LRE_align.L.PET GLNU_align.L.PET
## 1          0.4934069          1.706523          1.6948229          0.4587983
## 2          -0.1678255          -0.580450          -0.5764704          -0.1560539
## RLNU_align.L.PET RP_align.L.PET LGRE_align.L.PET HGRE_align.L.PET
## 1          0.4189336          1.7061400          1.0408063          1.0700373
## 2          -0.1424944          -0.5803197          -0.3540158          -0.3639583
## LGSRE_align.L.PET HGSRE_align.L.PET LGHRE_align.L.PET HGLRE_align.L.PET
## 1          1.048281          1.0672364          1.0052958          1.078233
## 2          -0.356558          -0.3630056          -0.3419373          -0.366746
## GLNU_norm_align.L.PET RLNU_norm_align.L.PET GLVAR_align.L.PET
## 1          1.1041018          1.7034139          1.1510468
## 2          -0.3755448          -0.5793925          -0.3915125
## RLVAR_align.L.PET Entropy_align.L.PET SZSE.L.PET LZSE.L.PET LGLZE.L.PET
## 1          1.0474522          1.6880661 1.6676802 1.1852630 1.0601400
## 2          -0.3562762          -0.5741722 -0.5672382 -0.4031507 -0.3605919
## HGLZE.L.PET SZLGE.L.PET SHZGE.L.PET LZLGE.L.PET LZHGE.L.PET GLNU_area.L.PET
## 1 1.0866745 1.0735299 1.0776043 0.8457163 0.8914749 0.4621309
## 2 -0.3696172 -0.3651462 -0.3665321 -0.2876586 -0.3032228 -0.1571874
## ZSNU.L.PET ZSP.L.PET GLNU_norm.L.PET ZSNU_norm.L.PET GLVAR_area.L.PET

```

```

## 1 0.4218710 1.679008 1.1042309 1.681848 1.1694826
## 2 -0.1434935 -0.571091 -0.3755887 -0.572057 -0.3977832
## ZSVAR.L.PET Entropy_area.L.PET Max_cooc.H.PET Average_cooc.H.PET
## 1 0.7548095 1.6893793 0.5052232 1.6652563
## 2 -0.2567379 -0.5746188 -0.1718446 -0.5664137
## Variance_cooc.H.PET Entropy_cooc.H.PET DAVE_cooc.H.PET DVAR_cooc.H.PET
## 1 1.4721984 1.4404122 1.5079528 1.4645709
## 2 -0.5007478 -0.4899361 -0.5129091 -0.4981534
## DENT_cooc.H.PET SAVE_cooc.H.PET SVAR_cooc.H.PET SENT_cooc.H.PET
## 1 1.3368883 1.6782221 1.4484331 1.1582831
## 2 -0.4547239 -0.5708239 -0.4926643 -0.3939739
## ASM_cooc.H.PET Contrast_cooc.H.PET Dissimilarity_cooc.H.PET
## 1 0.4701159 1.344935 1.5079528
## 2 -0.1599034 -0.457461 -0.5129091
## Inv_diff_cooc.H.PET Inv_diff_norm_cooc.H.PET IDM_cooc.H.PET
## 1 1.1377441 1.6996628 0.9576980
## 2 -0.3869878 -0.5781166 -0.3257476
## IDM_norm_cooc.H.PET Inv_var_cooc.H.PET Correlation_cooc.H.PET
## 1 1.7052806 0.9554037 1.1365587
## 2 -0.5800274 -0.3249672 -0.3865846
## Autocorrelation_cooc.H.PET Tendency_cooc.H.PET Shade_cooc.H.PET
## 1 1.5649714 1.4092944 -0.7124616
## 2 -0.5323032 -0.4793518 0.2423339
## Prominence_cooc.H.PET IC1_d.H.PET IC2_d.H.PET Coarseness_vdif.H.PET
## 1 1.0427158 -0.23095606 1.3345708 0.6663547
## 2 -0.3546653 0.07855648 -0.4539356 -0.2266512
## Contrast_vdif.H.PET Busyness_vdif.H.PET Complexity_vdif.H.PET
## 1 0.4860224 0.25301766 1.0958360
## 2 -0.1653138 -0.08606043 -0.3727333
## Strength_vdif.H.PET SRE_align.H.PET LRE_align.H.PET RLNU_align.H.PET
## 1 0.03112072 1.6638495 1.0890098 0.4166644
## 2 -0.01058528 -0.5659352 -0.3704115 -0.1417226
## RP_align.H.PET LGRE_align.H.PET HGRE_align.H.PET LGSRE_align.H.PET
## 1 1.6436641 0.7082866 1.5743684 0.7040204
## 2 -0.5590694 -0.2409138 -0.5354994 -0.2394627
## HGSRE_align.H.PET LGHRE_align.H.PET HGLRE_align.H.PET GLNU_norm_align.H.PET
## 1 1.6533952 0.7311054 0.7453460 0.8572435
## 2 -0.5623793 -0.2486753 -0.2535191 -0.2915794
## RLNU_norm_align.H.PET GLVAR_align.H.PET RLVAR_align.H.PET Entropy_align.H.PET
## 1 1.5584253 1.4161797 0.4776867 1.550297
## 2 -0.5300766 -0.4816938 -0.1624785 -0.527312
## SZSE.H.PET LZSE.H.PET LGLZE.H.PET HGLZE.H.PET SZLGE.H.PET SZHGE.H.PET
## 1 1.4671263 -0.09759617 0.7096710 1.4890573 0.6984264 1.4294579
## 2 -0.4990226 0.03319598 -0.2413847 -0.5064821 -0.2375600 -0.4862102
## LZLGE.H.PET LZHGE.H.PET GLNU_area.H.PET ZSNU.H.PET ZSP.H.PET
## 1 0.001044652 -0.08592571 0.4835029 0.3648643 1.1565208
## 2 -0.000355324 0.02922643 -0.1644568 -0.1241035 -0.3933744
## GLNU_norm.H.PET ZSNU_norm.H.PET GLVAR_area.H.PET ZSVAR.H.PET
## 1 0.8791603 1.2441418 1.3802703 -0.09449223
## 2 -0.2990341 -0.4231775 -0.4694797 0.03214021
## Entropy_area.H.PET Max_cooc.W.PET Average_cooc.W.PET Variance_cooc.W.PET
## 1 1.6279234 0.5502762 0.9151412 0.4579807
## 2 -0.5537154 -0.1871688 -0.3112725 -0.1557757
## Entropy_cooc.W.PET DAVE_cooc.W.PET DVAR_cooc.W.PET DENT_cooc.W.PET

```

```

## 1      1.4784780      0.9564701      0.5165571      1.450023
## 2      -0.5028837      -0.3253300      -0.1756997      -0.493205
## SAVE_cooc.W.PET SVAR_cooc.W.PET SENT_cooc.W.PET ASM_cooc.W.PET
## 1      0.9140050      0.4135667      1.5336398      0.5955603
## 2      -0.3108861      -0.1406689      -0.5216462      -0.2025715
## Contrast_cooc.W.PET Dissimilarity_cooc.W.PET Inv_diff_cooc.W.PET
## 1      0.5325478      0.9564701      1.2750883
## 2      -0.1811387      -0.3253300      -0.4337035
## Inv_diff_norm_cooc.W.PET IDM_cooc.W.PET IDM_norm_cooc.W.PET
## 1      1.6983343      1.044167      1.7048157
## 2      -0.5776647      -0.355159      -0.5798693
## Inv_var_cooc.W.PET Correlation_cooc.W.PET Autocorrelation_cooc.W.PET
## 1      1.1637708      1.1228422      0.4576739
## 2      -0.3958404      -0.3819191      -0.1556714
## Tendency_cooc.W.PET Shade_cooc.W.PET Prominence_cooc.W.PET IC1_d.W.PET
## 1      0.4135667      0.07642004      0.022900737 -0.26887955
## 2      -0.1406689      -0.02599321      -0.007789366 0.09145563
## IC2_d.W.PET Coarseness_vdif.W.PET Contrast_vdif.W.PET Busyness_vdif.W.PET
## 1      1.4455561      0.7071892      0.8252351      0.4153574
## 2      -0.4916858      -0.2405405      -0.2806922      -0.1412780
## Complexity_vdif.W.PET Strength_vdif.W.PET SRE_align.W.PET LRE_align.W.PET
## 1      0.2991726      0.4249851      1.697315      1.4801473
## 2      -0.1017594      -0.1445527      -0.577318      -0.5034515
## GLNU_align.W.PET RLNU_align.W.PET RP_align.W.PET LGRE_align.W.PET
## 1      0.4738278      0.4182280      1.6901986      0.8300003
## 2      -0.1611659      -0.1422544      -0.5748975      -0.2823130
## HGRE_align.W.PET LGSRE_align.W.PET HGSRE_align.W.PET LGHRE_align.W.PET
## 1      0.4630749      0.8904857      0.4557129      0.5563026
## 2      -0.1575085      -0.3028863      -0.1550044      -0.1892186
## HGLRE_align.W.PET GLNU_norm_align.W.PET RLNU_norm_align.W.PET
## 1      0.4921754      0.8494549      1.658483
## 2      -0.1674066      -0.2889302      -0.564110
## GLVAR_align.W.PET RLVAR_align.W.PET Entropy_align.W.PET SZSE.W.PET
## 1      0.4593218      0.5957178      1.5543465 1.6121174
## 2      -0.1562319      -0.2026251      -0.5286893 -0.5483392
## LZSE.W.PET LGLZE.W.PET HGLZE.W.PET SZLGE.W.PET SZHGE.W.PET LZLGE.W.PET
## 1 0.21517025 0.8709408 0.4690713 0.9938480 0.4481637 -0.004326372
## 2 -0.07318716 -0.2962384 -0.1595481 -0.3380435 -0.1524366 0.001471555
## LZHGE.W.PET GLNU_area.W.PET ZSNU.W.PET ZSP.W.PET GLNU_norm.W.PET
## 1 0.5263985 0.4910918 0.3971868 1.4948131 0.8826796
## 2 -0.1790471 -0.1670380 -0.1350976 -0.5084398 -0.3002311
## ZSNU_norm.W.PET GLVAR_area.W.PET ZSVAR.W.PET Entropy_area.W.PET Min_hist.ADC
## 1 1.4869647 0.4655759 0.06408427 1.6167770 0.5724098
## 2 -0.5057703 -0.1583592 -0.02179737 -0.5499242 -0.1946972
## Max_hist.ADC Mean_hist.ADC Variance_hist.ADC Standard_Deviation_hist.ADC
## 1 1.5075750 1.4864908 0.7599395 1.2359485
## 2 -0.5127806 -0.5056091 -0.2584828 -0.4203906
## Skewness_hist.ADC Kurtosis_hist.ADC Energy_hist.ADC Entropy_hist.ADC
## 1 0.3899909 0.4662845 0.7015053 1.6284344
## 2 -0.1326500 -0.1586002 -0.2386073 -0.5538893
## AUC_hist.ADC Volume.ADC X3D_surface.ADC ratio_3ds_vol.ADC
## 1 1.6655300 0.5687484 0.7349831 1.1042095
## 2 -0.5665068 -0.1934518 -0.2499942 -0.3755815
## ratio_3ds_vol_norm.ADC irregularity.ADC Compactness_v1.ADC Compactness_v2.ADC

```

```

## 1          1.6106322          1.6397737          1.1221987          1.3007130
## 2          -0.5478341          -0.5577462          -0.3817002          -0.4424194
## Spherical_disproportion.ADC Sphericity.ADC Asphericity.ADC Center_of_mass.ADC
## 1          1.6106322          1.6242350          1.1989866          0.5373920
## 2          -0.5478341          -0.5524609          -0.4078186          -0.1827864
## Max_3D_diam.ADC Major_axis_length.ADC Minor_axis_length.ADC
## 1          1.0866100          1.2316275          1.1312333
## 2          -0.3695952          -0.4189209          -0.3847732
## Least_axis_length.ADC Elongation.ADC Flatness.ADC Max_cooc.L.ADC
## 1          1.0417403          1.4824827          1.4052040          0.8250964
## 2          -0.3543334          -0.5042458          -0.4779606          -0.2806450
## Average_cooc.L.ADC Variance_cooc.L.ADC Entropy_cooc.L.ADC DAVE_cooc.L.ADC
## 1          1.456079          0.9533869          1.6827114          1.2819538
## 2          -0.495265          -0.3242813          -0.5723508          -0.4360387
## DVAR_cooc.L.ADC DENT_cooc.L.ADC SAVE_cooc.L.ADC SVAR_cooc.L.ADC
## 1          0.9295089          1.6521421          1.4558899          0.9317704
## 2          -0.3161595          -0.5619531          -0.4952006          -0.3169287
## SENT_cooc.L.ADC ASM_cooc.L.ADC Contrast_cooc.L.ADC Dissimilarity_cooc.L.ADC
## 1          1.2584756          0.7127202          0.8811662          1.2819538
## 2          -0.4280529          -0.2424218          -0.2997164          -0.4360387
## Inv_diff_cooc.L.ADC Inv_diff_norm_cooc.L.ADC IDM_cooc.L.ADC
## 1          1.5058302          1.7039344          1.3642322
## 2          -0.5121871          -0.5795695          -0.4640245
## IDM_norm_cooc.L.ADC Inv_var_cooc.L.ADC Correlation_cooc.L.ADC
## 1          1.7073272          1.379898          1.2216811
## 2          -0.5807235          -0.469353          -0.4155378
## Autocorrelation_.L.ADC Tendency_cooc.L.ADC Shade_.L.ADC Prominence_cooc.L.ADC
## 1          1.1050198          0.9317704          0.29259000          0.5515288
## 2          -0.3758571          -0.3169287          -0.09952041          -0.1875948
## IC1_.L.ADC IC2_.L.ADC Coarseness_vdif_.L.ADC Contrast_vdif_.L.ADC
## 1 -0.6732168  1.5121032          0.6939723          0.6587722
## 2  0.2289853 -0.5143208          -0.2360450          -0.2240722
## Busyness_vdif_.L.ADC Complexity_vdif_.L.ADC Strength_vdif_.L.ADC
## 1          0.6475886          1.2753146          0.4214397
## 2          -0.2202682          -0.4337805          -0.1433468
## SRE_align.L.ADC LRE_align.L.ADC GLNU_align.L.ADC RLNU_align.L.ADC
## 1          1.7052408          1.6811893          0.5682374          0.5910147
## 2          -0.5800139          -0.5718331          -0.1932780          -0.2010254
## RP_align.L.ADC LGRE_align.L.ADC HGRE_align.L.ADC LGSRE_align.L.ADC
## 1          1.7034645          0.7243458          1.2086645          0.7235521
## 2          -0.5794097          -0.2463761          -0.4111104          -0.2461061
## HGSRE_align.L.ADC LGHRE_align.L.ADC HGLRE_align.L.ADC GLNU_norm_align.L.ADC
## 1          1.2124123          0.7234431          1.1801466          1.2291014
## 2          -0.4123852          -0.2460691          -0.4014104          -0.4180617
## RLNU_norm_align.L.ADC GLVAR_align.L.ADC RLVAR_align.L.ADC Entropy_align.L.ADC
## 1          1.6955541          0.9930121          1.1385331          1.6982212
## 2          -0.5767191          -0.3377592          -0.3872562          -0.5776262
## SZSE.L.ADC LZSE.L.ADC LGLZE.L.ADC HGLZE.L.ADC SZLGE.L.ADC SZHGE.L.ADC
## 1  1.6968578  1.3430968  0.7262967  1.2295659  0.7219542  1.2399482
## 2 -0.5771625 -0.4568356 -0.2470397 -0.4182197 -0.2455627 -0.4217511
## LZLGE.L.ADC LZHGE.L.ADC GLNU_area.L.ADC ZSNU.L.ADC ZSP.L.ADC GLNU_norm.L.ADC
## 1  0.6651854  1.077189          0.5782984  0.5919629  1.6748354          1.2251432
## 2 -0.2262535 -0.366391          -0.1967001 -0.2013479 -0.5696719          -0.4167154
## ZSNU_norm.L.ADC GLVAR_area.L.ADC ZSVAR.L.ADC Entropy_area.L.ADC

```

```

## 1      1.6570978      1.012871      0.6758567      1.7010816
## 2      -0.5636387      -0.344514      -0.2298832      -0.5785992
## Max_cooc.H.ADC Average_cooc.H.ADC Variance_cooc.H.ADC Entropy_cooc.H.ADC
## 1      0.7039103      1.6967547      1.7053247      1.7011475
## 2      -0.2394253      -0.5771274      -0.5800424      -0.5786216
## DAVE_cooc.H.ADC DVAR_cooc.H.ADC DENT_cooc.H.ADC SAVE_cooc.H.ADC
## 1      1.5698813      1.4861394      1.7017575      1.6967573
## 2      -0.5339732      -0.5054896      -0.5788291      -0.5771283
## SVAR_cooc.H.ADC SENT_cooc.H.ADC ASM_cooc.H.ADC Contrast_cooc.H.ADC
## 1      1.6206816      1.6803084      0.6607170      1.3858879
## 2      -0.5512522      -0.5715335      -0.2247337      -0.4713904
## Dissimilarity_cooc.H.ADC Inv_diff_cooc.H.ADC Inv_diff_norm_cooc.H.ADC
## 1      1.5698813      1.5546888      1.7028145
## 2      -0.5339732      -0.5288057      -0.5791886
## IDM_cooc.H.ADC IDM_norm_cooc.H.ADC Inv_var_cooc.H.ADC Correlation_cooc.H.ADC
## 1      1.4136874      1.7054539      1.4364367      1.1993586
## 2      -0.4808461      -0.5800864      -0.4885839      -0.4079451
## Autocorrelation_cooc.H.ADC Tendency_cooc.H.ADC Shade_cooc.H.ADC
## 1      1.6722184      1.6206816      0.3887230
## 2      -0.5687818      -0.5512522      -0.1322187
## Prominence_cooc.H.ADC IC1_d.H.ADC IC2_d.H.ADC Coarseness_vdif.H.ADC
## 1      1.5404751      -0.5455177      1.5085932      0.6780216
## 2      -0.5239711      0.1855502      -0.5131269      -0.2306196
## Contrast_vdif.H.ADC Busyness_vdif.H.ADC Complexity_vdif.H.ADC
## 1      1.5316725      0.6153610      1.503704
## 2      -0.5209771      -0.2093065      -0.511464
## Strength_vdif.H.ADC SRE_align.H.ADC LRE_align.H.ADC GLNU_align.H.ADC
## 1      0.3677298      1.7071497      1.7038845      0.5901231
## 2      -0.1250782      -0.5806632      -0.5795526      -0.2007222
## RLNU_align.H.ADC RP_align.H.ADC LGRE_align.H.ADC HGRE_align.H.ADC
## 1      0.5924412      1.706814      1.0946139      1.7100780
## 2      -0.2015106      -0.580549      -0.3723177      -0.5816592
## LGSRE_align.H.ADC HGSRE_align.H.ADC LGHRE_align.H.ADC HGLRE_align.H.ADC
## 1      1.0760014      1.7093907      1.1710039      1.7053139
## 2      -0.3659869      -0.5814254      -0.3983006      -0.5800387
## GLNU_norm_align.H.ADC RLNU_norm_align.H.ADC GLVAR_align.H.ADC
## 1      0.9735389      1.7053279      1.7100152
## 2      -0.3311357      -0.5800435      -0.5816378
## RLVAR_align.H.ADC Entropy_align.H.ADC SZSE.H.ADC LZSE.H.ADC LGLZE.H.ADC
## 1      1.0687509      1.7093530      1.7049082      1.6336887      1.0589022
## 2      -0.3635207      -0.5814126      -0.5799008      -0.5556764      -0.3601708
## HGLZE.H.ADC SZLGE.H.ADC SZHGE.H.ADC LZLGE.H.ADC LZHGE.H.ADC GLNU_area.H.ADC
## 1      1.709075      1.0114862      1.7031396      1.0813161      1.5698347      0.5919958
## 2      -0.581318      -0.3440429      -0.5792992      -0.3677946      -0.5339574      -0.2013591
## ZSNU.H.ADC ZSP.H.ADC GLNU_norm.H.ADC ZSNU_norm.H.ADC GLVAR_area.H.ADC
## 1      0.5972096      1.7013318      0.9745507      1.692802      1.7072803
## 2      -0.2031325      -0.5786843      -0.3314798      -0.575783      -0.5807076
## ZSVAR.H.ADC Entropy_area.H.ADC Max_cooc.W.ADC Average_cooc.W.ADC
## 1      0.8431301      1.7066118      0.6868122      1.199285
## 2      -0.2867790      -0.5804802      -0.2336096      -0.407920
## Variance_cooc.W.ADC DAVE_cooc.W.ADC DVAR_cooc.W.ADC DENT_cooc.W.ADC
## 1      0.7283676      1.3033631      0.7679414      1.6768624
## 2      -0.2477441      -0.4433208      -0.2612045      -0.5703613
## SAVE_cooc.W.ADC SVAR_cooc.W.ADC SENT_cooc.W.ADC ASM_cooc.W.ADC

```



```

## 1      1.1909017      0.6843706      1.2023295      0.6601442
## 2      -0.4050686      -0.2327791      -0.4089556      -0.2245389
## Contrast_cooc.W.ADC Dissimilarity_cooc.W.ADC Inv_diff_cooc.W.ADC
## 1      0.7994120      1.3033631      1.3827605
## 2      -0.2719088      -0.4433208      -0.4703267
## Inv_diff_norm_cooc.W.ADC IDM_cooc.W.ADC IDM_norm_cooc.W.ADC
## 1      1.7038802      1.3112119      1.7073083
## 2      -0.5795511      -0.4459904      -0.5807171
## Inv_var_cooc.W.ADC Correlation_cooc.W.ADC Autocorrelation_cooc.W.ADC
## 1      1.3074526      1.2225367      0.8447953
## 2      -0.4447118      -0.4158288      -0.2873453
## Tendency_cooc.W.ADC Shade_cooc.W.ADC Prominence_cooc.W.ADC IC1_d.W.ADC
## 1      0.6843706      0.2567335      0.3775512 -0.6756692
## 2      -0.2327791      -0.0873243      -0.1284188 0.2298194
## IC2_d.W.ADC Coarseness_vdif.W.ADC Contrast_vdif.W.ADC Busyness_vdif.W.ADC
## 1      1.6012140      0.7114542      0.6249552      1.0116700
## 2      -0.5446306      -0.2419912      -0.2125698      -0.3441054
## Complexity_vdif.W.ADC Strength_vdif.W.ADC SRE_align.W.ADC LRE_align.W.ADC
## 1      0.6003182      0.5784705      1.7073214      1.7065667
## 2      -0.2041899      -0.1967587      -0.5807216      -0.5804649
## GLNU_align.W.ADC RLNU_align.W.ADC RP_align.W.ADC LGRE_align.W.ADC
## 1      0.6326468      0.5857336      1.7071535      0.6918953
## 2      -0.2151860      -0.1992291      -0.5806645      -0.2353386
## HGRE_align.W.ADC LGSRE_align.W.ADC HGSRE_align.W.ADC LGHRE_align.W.ADC
## 1      0.8626770      0.6918084      0.8616174      0.6894568
## 2      -0.2934276      -0.2353090      -0.2930672      -0.2345091
## HGLRE_align.W.ADC GLNU_norm_align.W.ADC RLNU_norm_align.W.ADC
## 1      0.866512      0.9154487      1.7063312
## 2      -0.294732      -0.3113771      -0.5803848
## GLVAR_align.W.ADC RLVAR_align.W.ADC Entropy_align.W.ADC SZSE.W.ADC LZSE.W.ADC
## 1      0.7640782      0.9834635      1.661714 1.7066974 1.6823970
## 2      -0.2598905      -0.3345114      -0.565209 -0.5805093 -0.5722439
## LGLZE.W.ADC HGLZE.W.ADC SZLGE.W.ADC SZHGE.W.ADC LZLGE.W.ADC LZHGE.W.ADC
## 1      0.6918923 0.8639228 0.6899145 0.8602645 0.6450074 0.8755515
## 2      -0.2353375 -0.2938513 -0.2346648 -0.2926070 -0.2193903 -0.2978066
## GLNU_area.W.ADC ZSNU.W.ADC ZSP.W.ADC GLNU_norm.W.ADC ZSNU_norm.W.ADC
## 1      0.6327545 0.5822861 1.7050925 0.9137899 1.699026
## 2      -0.2152226 -0.1980565 -0.5799634 -0.3108129 -0.577900
## GLVAR_area.W.ADC ZSVAR.W.ADC Entropy_area.W.ADC
## 1      0.7713592 1.0785430 1.672228
## 2      -0.2623671 -0.3668514 -0.568785
##
## Clustering vector:
## 1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20
## 2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
## 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
## 2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
## 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
## 2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
## 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
## 2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
## 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100
## 2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
## 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120

```

```
## 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
## 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140
## 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
## 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160
## 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1
## 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180
## 1 1 1 1 1 1 1 1 1 1 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
## 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
##
## Within cluster sum of squares by cluster:
## [1] 21068.8 23826.7
## (between_SS / total_SS = 46.7 %)
##
## Available components:
##
## [1] "cluster" "centers" "totss" "withinss" "tot.withinss"
## [6] "betweenss" "size" "iter" "ifault"
```

```
fviz_cluster(final, data = x_train)
```



Hierarchical

Helper packages

```
library(dplyr)
library(ggplot2)

# Modeling packages
library(cluster)
library(factoextra)
```

Compute euclidean distance

```
set.seed(123)
distance <- dist(x_train, method = "euclidean")
```

Hierarchical clustering using Complete Linkage

```
hc1 <- hclust(distance, method = "complete" )
```

Compute complete linkage clustering with agnes and print the Agglomerative coefficient

```
set.seed(123)
hc2 <- agnes(x_train, method = "complete")

# Agglomerative coefficient
hc2$ac
```

```
## [1] 0.8488437
```

Different methods to evaluate

```
m <- c( "average", "single", "complete", "ward")
names(m) <- c( "average", "single", "complete", "ward")
```

Create function to compute coefficient and obtain the coefficient for each linkage method

```
ac <- function(x) {
  agnes(x_train, method = x)$ac
}

# get agglomerative coefficient for each linkage method
purrr::map_dbl(m, ac)
```

```
##   average   single  complete    ward
## 0.7618315 0.7097208 0.8488437 0.9655196
```

Compute divisive hierarchical clustering and print the Divise coefficient

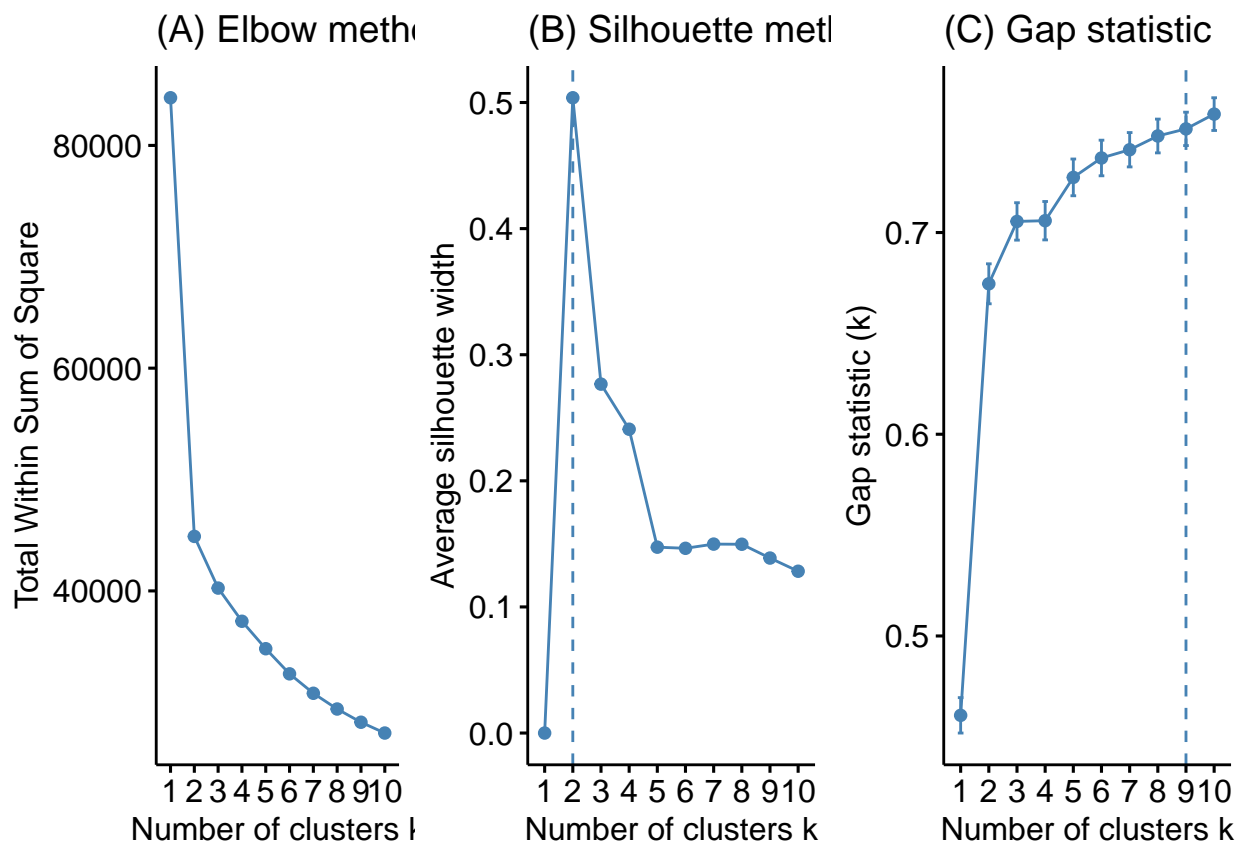
```
hc3 <- diana(x_train)

# Divise coefficient; amount of clustering structure found
hc3$dc
```

```
## [1] 0.8427741
```

Plot cluster results

```
p1 <- fviz_nbclust(x_train, FUN = hcut, method = "wss",  
                  k.max = 10) +  
  ggtitle("(A) Elbow method")  
p2 <- fviz_nbclust(x_train, FUN = hcut, method = "silhouette",  
                  k.max = 10) +  
  ggtitle("(B) Silhouette method")  
p3 <- fviz_nbclust(x_train, FUN = hcut, method = "gap_stat",  
                  k.max = 10) +  
  ggtitle("(C) Gap statistic")  
  
gridExtra::grid.arrange(p1, p2, p3, nrow = 1)
```



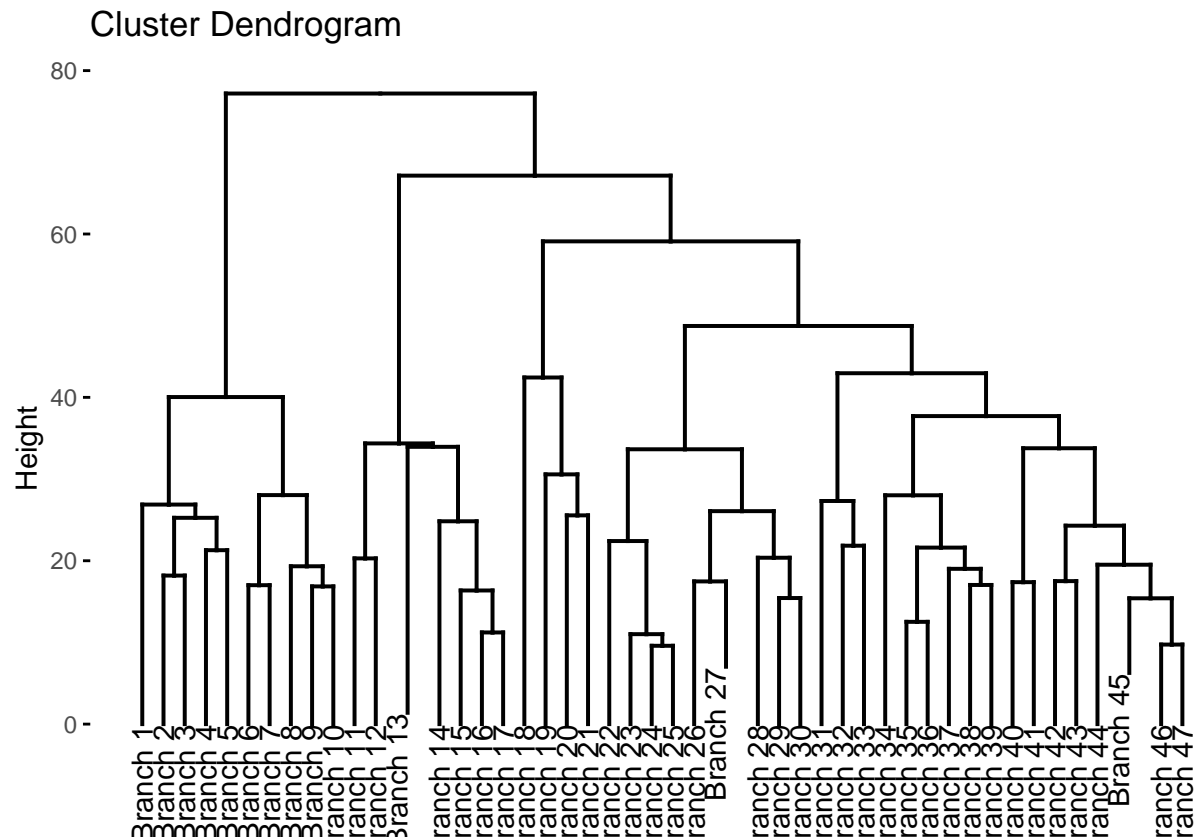
Construct dendrogram

```
hc4 <- hclust(distance, method = "ward.D2" )  
dend_plot <- fviz_dend(hc4)
```

```
## Warning: 'guides(<scale> = FALSE)' is deprecated. Please use 'guides(<scale> =  
## "none")' instead.
```

```
dend_data <- attr(dend_plot, "dendrogram")
dend_cuts <- cut(dend_data, h = 8)
fviz_dend(dend_cuts$upper[[1]])
```

```
## Warning: 'guides(<scale> = FALSE)' is deprecated. Please use 'guides(<scale> =
## "none")' instead.
```



Hierarchical clustering using using Ward's method

```
hc4 <- hclust(distance, method = "ward.D2" )
```

Cut tree into 4 groups

```
sub_grp <- cutree(hc4, k = 8)
```

Number of members in each cluster

```
table(sub_grp)
```

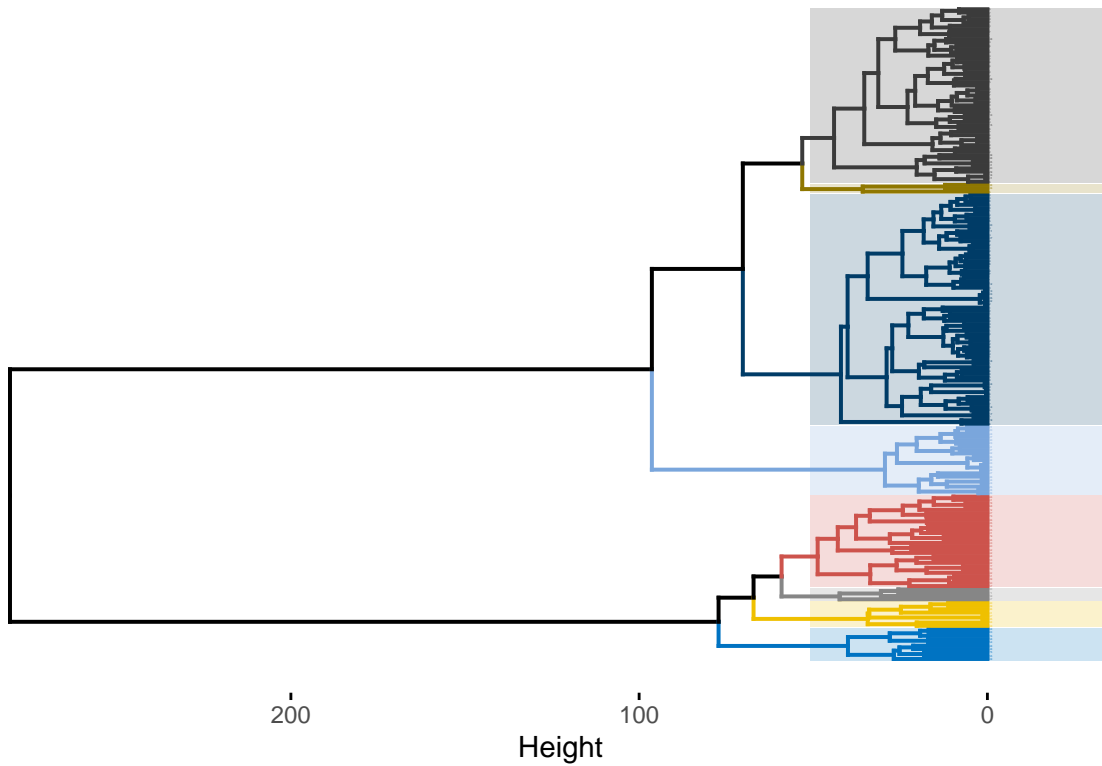
```
## sub_grp
## 1 2 3 4 5 6 7 8
## 70 53 3 21 10 28 4 8
```

Plot the full dendrogram

```
fviz_dend(  
  hc4,  
  k = 8,  
  horiz = TRUE,  
  rect = TRUE,  
  rect_fill = TRUE,  
  rect_border = "jco",  
  k_colors = "jco",  
  cex = 0.1  
)
```

```
## Warning: 'guides(<scale> = FALSE)' is deprecated. Please use 'guides(<scale> =  
## "none")' instead.
```

Cluster Dendrogram



```
# create full dendrogram  
dend_plot <- fviz_dend(hc4)
```

```
## Warning: 'guides(<scale> = FALSE)' is deprecated. Please use 'guides(<scale> =  
## "none")' instead.
```

```
# extract plot info  
dend_data <- attr(dend_plot, "dendrogram")
```

```
# cut the dendrogram
dend_cuts <- cut(dend_data, h = 70.5)
```

Designated height Create sub dendrogram plots

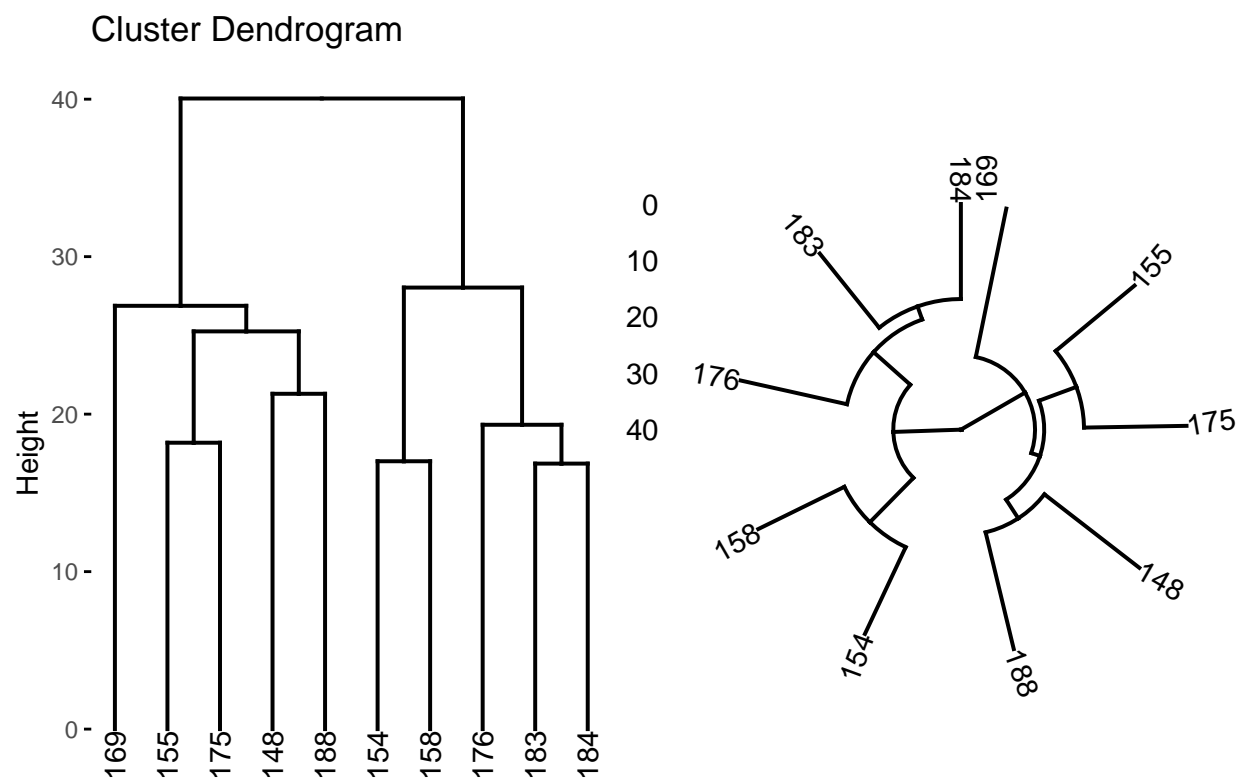
```
p1 <- fviz_dend(dend_cuts$lower[[1]])
```

```
## Warning: 'guides(<scale> = FALSE)' is deprecated. Please use 'guides(<scale> =  
## "none")' instead.
```

```
p2 <- fviz_dend(dend_cuts$lower[[1]], type = 'circular')
```

```
## Warning: 'guides(<scale> = FALSE)' is deprecated. Please use 'guides(<scale> =  
## "none")' instead.
```

```
gridExtra::grid.arrange(p1, p2, nrow = 1)
```



Modelbased

Helper packages

```
library(dplyr)
library(ggplot2)
```

```
# Modeling packages
library(mclust)
```

```
## Warning: package 'mclust' was built under R version 4.2.2
```

```
## 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
```

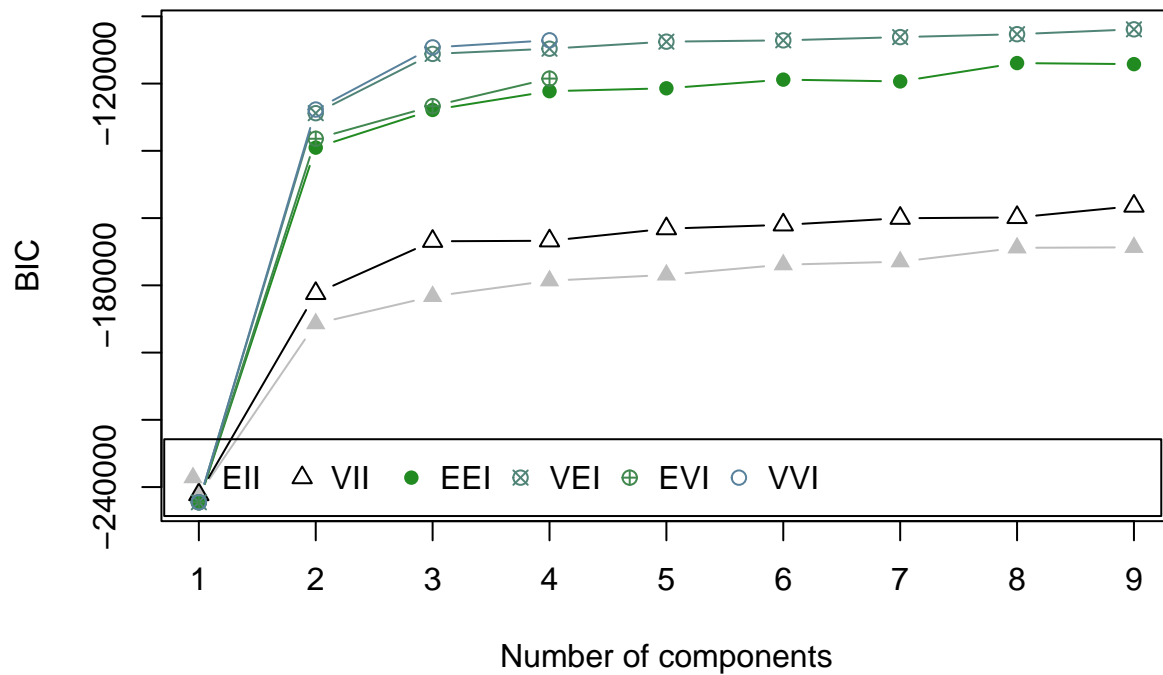
Load the dataset

```
mydata_mc <- Mclust(x_train)

summary(mydata_mc)
```

```
## -----
## Gaussian finite mixture model fitted by EM algorithm
## -----
##
## Mclust VEI (diagonal, equal shape) model with 9 components:
##
## log-likelihood  n  df      BIC      ICL
##    -40533.33 197 4316 -103869 -103869
##
## Clustering table:
##   1  2  3  4  5  6  7  8  9
## 110 20  3  2 12 10 25  9  6
```

```
plot(mydata_mc, what = 'BIC',
      legendArgs = list(x = "bottomright", ncol = 9))
```

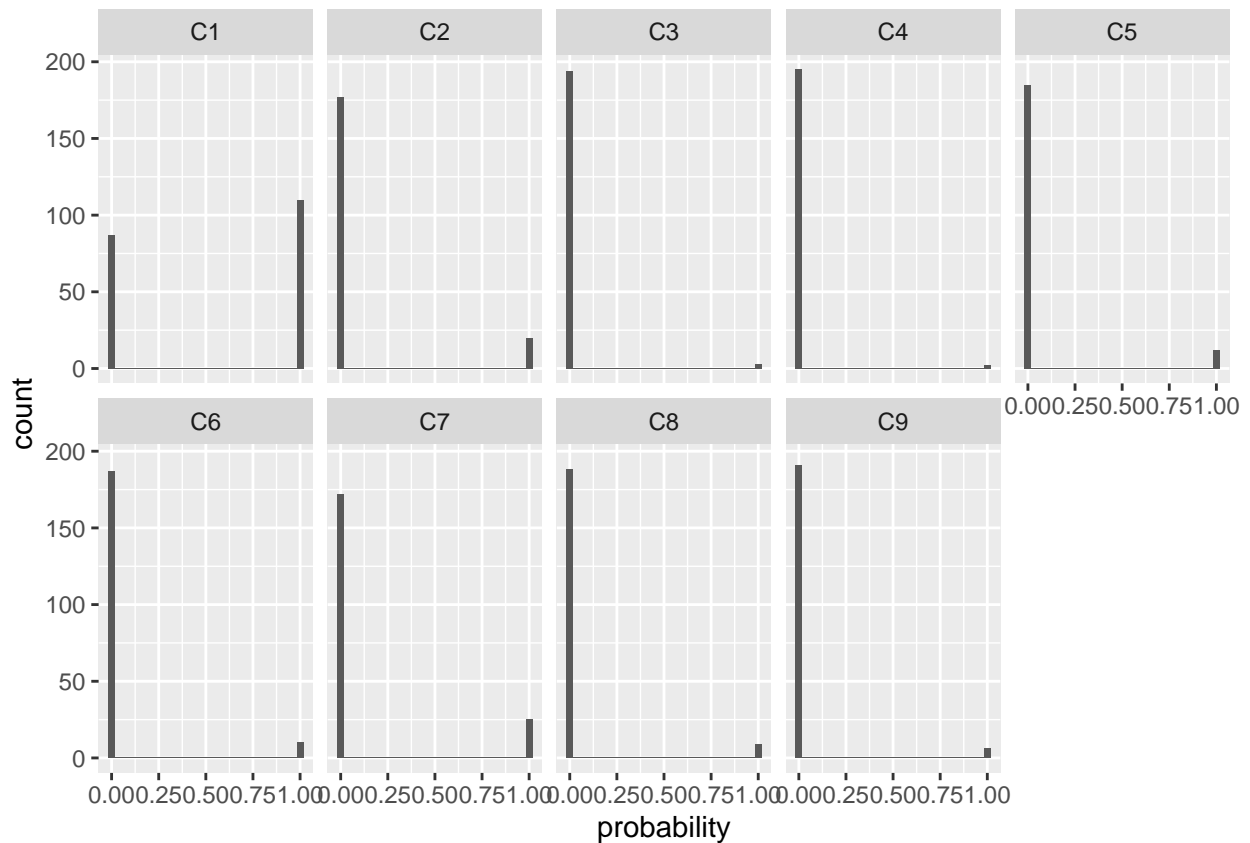
Compute the probabilities

```
probabilities <- mydata_mc$z
colnames(probabilities) <- paste0('C', 1:9)
```

```
probabilities <- probabilities %>%
  as.data.frame() %>%
  mutate(id = row_number()) %>%
  tidyr::gather(cluster, probability, -id)
```

```
ggplot(probabilities, aes(probability)) +
  geom_histogram() +
  facet_wrap(~ cluster, nrow = 2)
```

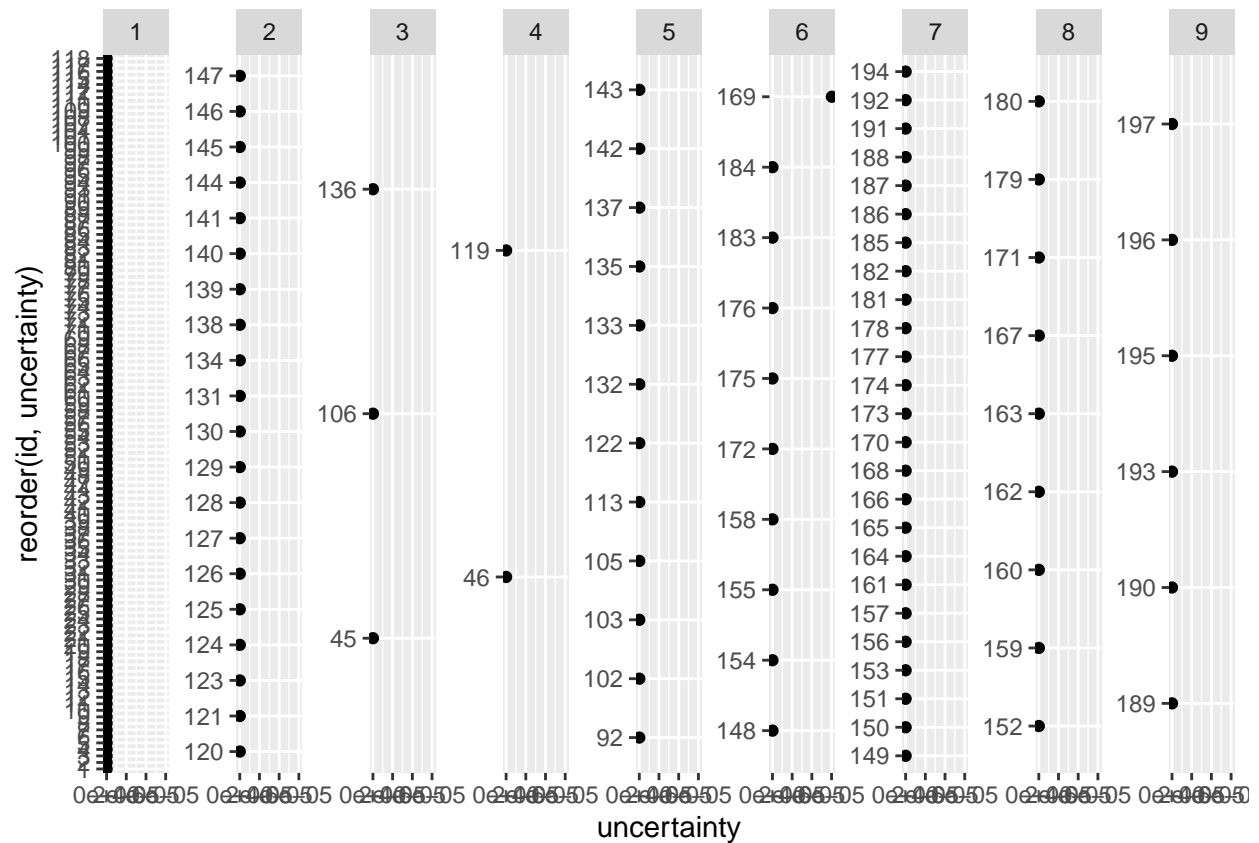
'stat_bin()' using 'bins = 30'. Pick better value with 'binwidth'.



Compute the uncertainty

```
uncertainty <- data.frame(
  id = 1:nrow(x_train),
  cluster = mydata_mc$classification,
  uncertainty = mydata_mc$uncertainty
)
```

```
uncertainty %>%
  group_by(cluster) %>%
  filter(uncertainty > -0.25) %>%
  ggplot(aes(uncertainty, reorder(id, uncertainty))) +
  geom_point() +
  facet_wrap(~ cluster, scales = 'free_y', nrow = 1)
```



Visualize the cluster 6

```
cluster <- x_train %>%
  scale() %>%
  as.data.frame() %>%
  mutate(cluster = mydata_mc$classification) %>%
  filter(cluster == 6) %>%
  select(-cluster)
```

```
cluster %>%
  tidyr::gather(product, std_count) %>%
  group_by(product) %>%
  summarize(avg = mean(std_count)) %>%
  ggplot(aes(avg, reorder(product, avg))) +
  geom_point() +
  labs(x = "Average standardized consumption", y = NULL) +
  theme(axis.text.y=element_blank())
```

