Model 3

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#K-means Clustering

```
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 4.2.2
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 4.2.2
library(stringr)
```

```
## Warning: package 'stringr' was built under R version 4.2.2
library(gridExtra)
```

```
## Warning: package 'gridExtra' was built under R version 4.2.2
library(factoextra)
```

```
## Warning: package 'factoextra' was built under R version 4.2.2
library(tidyverse)
```

```
## Warning: package 'tidyverse' was built under R version 4.2.2
## Warning: package 'tibble' was built under R version 4.2.2
## Warning: package 'tidyr' was built under R version 4.2.2
## Warning: package 'readr' was built under R version 4.2.2
## Warning: package 'purrr' was built under R version 4.2.2
## Warning: package 'forcats' was built under R version 4.2.2
library(cluster)
library(readr)
library(mclust)
```

```
## Warning: package 'mclust' was built under R version 4.2.2
library(tidyr)
library(tibble)
library(purrr)
library(utils)
```

```
radiomics_completedata <- read_csv("C:/STAT 371/Final Project/radiomics_completedata.csv")
 View(radiomics_completedata)
 Rad<-radiomics_completedata
```

To remove any missing value that might be present in the data, type this:

```
Rad <- na.omit(Rad)
```

we start by scaling/standardizing the data

```
Rad <- scale(Rad[,-c(1,2)])
head(Rad)
```

```
##         Failure Entropy_cooc.W.ADC GLNU_align.H.PET Min_hist.PET Max_hist.PET
## [1,]  1.1985789        0.55290547      -0.57063689   -0.4541408   -0.4361311
## [2,] -0.7212472       -0.06486729      -0.78903636    0.4998369    0.1486951
## [3,]  2.7926271        0.45990825      -0.06024275   -1.1504338   -1.1768823
## [4,] -0.4442487        1.14318298       2.67468822   -0.4446190   -0.1516658
## [5,]  0.6898772        0.34499368      -0.06740573   -0.9887407   -1.1061760
## [6,] -1.1289054        0.84917904       0.07354603   -1.1864923   -1.2223057
##      Mean_hist.PET Variance_hist.PET Standard_Deviation_hist.PET
## [1,]   -0.4204856        -0.2625994                  -0.2362506
## [2,]    0.3153953         0.3949731                   0.2970175
## [3,]   -1.1362283        -0.8957972                  -1.1289710
## [4,]   -0.3486295        -0.2802885                  -0.2534091
## [5,]   -1.1155134        -0.9335606                  -1.2398300
## [6,]   -1.2048611        -0.9289185                  -1.2246350
##      Skewness_hist.PET Kurtosis_hist.PET Energy_hist.PET Entropy_hist.PET
## [1,]       -0.3229376        -0.2730969      0.05021980       -0.3798553
## [2,]       -0.1769772        -0.2664840      0.09191129       -0.7468252
## [3,]       -0.9586986        -0.4718456      0.04744499       -0.3704894
## [4,]       -0.1155757         0.1199784     -0.01242149       -0.1570421
## [5,]        0.9580073         0.9071980      0.15326924       -0.8531740
## [6,]       -0.4355546        -0.1910724      0.05514509       -0.1536498
##      AUC_hist.PET  H_suv.PET  Volume.PET X3D_surface.PET ratio_3ds_vol.PET
## [1,]   -0.5675836 -0.1211439 -0.77134265      -0.5201102        -0.2282413
## [2,]   -0.5634659  0.9495392 -0.86978222      -0.4310874         0.4221576
## [3,]   -0.5814501 -1.0718855 -0.48494090      -0.1551558        -0.2483619
## [4,]   -0.4067915 -0.3934530  0.05871532       0.2442709        -0.7007345
## [5,]   -0.4082919 -1.2107989 -0.42285136      -0.4502135         0.4091793
## [6,]   -0.5643056 -1.1009679 -0.76048331      -0.3917880        -0.0350387
##      ratio_3ds_vol_norm.PET irregularity.PET tumor_length.PET
## [1,]           -0.376749051       -0.4041462       -0.4993850
## [2,]            0.001181975       -0.2594920       -0.6246547
## [3,]           -0.113559448       -0.5006828       -0.3144097
## [4,]           -0.069268090       -0.7786312        0.3678334
## [5,]           -0.004442091       -0.3960864       -0.6910089
## [6,]           -0.185715505       -0.4839717       -0.4467293
##      Compactness_v1.PET Compactness_v2.PET Spherical_disproportion.PET
## [1,]         -0.07197872         -0.4249126                 -0.376749051
## [2,]         -0.08449944         -0.4265812                  0.001181975
## [3,]         -0.08158664         -0.4262617                 -0.113559448
## [4,]         -0.08276045         -0.4263918                 -0.069268090
## [5,]         -0.08436902         -0.4265693                 -0.004442091
## [6,]         -0.07941290         -0.4259895                 -0.185715505
```

```
##      Sphericity.PET Asphericity.PET Center_of_mass.PET Max_3D_diam.PET
## [1,]     -0.4428932     -0.36463396        -0.03050325     -0.66406536
## [2,]     -0.5051973      0.02005061        -0.32639266     -0.75236400
## [3,]     -0.4897787     -0.09674122        -0.58411455     -0.53368216
## [4,]     -0.4960147     -0.05165838         0.04330285     -0.05279069
## [5,]     -0.5044949      0.01432605        -0.40817644     -0.79913502
## [6,]     -0.4787394     -0.17018669        -0.69694662     -0.62695008
##      Major_axis_length.PET Minor_axis_length.PET Least_axis_length.PET
## [1,]           -0.77986887            -0.8104678            -0.5530902
## [2,]           -0.76712458            -0.7488362            -0.7395741
## [3,]           -0.45235010            -0.6156914            -0.4296651
## [4,]           -0.06489845             0.4300517             0.7399041
## [5,]           -0.74622189            -0.8991212            -0.7280052
## [6,]           -0.57774168            -0.5623790            -0.9903323
##      Elongation.PET Flatness.PET Max_cooc.L.PET Average_cooc.L.PET
## [1,]     -0.3767912    0.0388863     0.01907240        -0.38679684
## [2,]     -0.3002178   -0.3471572     0.13070498        -0.47577094
## [3,]     -0.6833310   -0.4444301     0.01953020         0.01393894
## [4,]     -0.1112560    0.3031255     0.05256218        -0.85110310
## [5,]     -0.6012065   -0.3723581     0.10827282        -1.07572238
## [6,]     -0.4089789   -1.0862675     0.03231337        -0.34383121
##      Variance_cooc.L.PET Entropy_cooc.L.PET DAVE_cooc.L.PET DVAR_cooc.L.PET
## [1,]         -0.10747089         -0.4982927     -0.32209112      -0.4376118
## [2,]          0.09064602         -0.5860237      0.01715114       0.2839811
## [3,]         -0.07644599         -0.4564828     -0.25478670      -0.4201798
## [4,]         -1.08067728         -0.5975811     -1.01842876      -1.0814113
## [5,]         -0.70694040         -0.6879367     -0.57943763      -0.5145756
## [6,]         -0.33459330         -0.4952102     -0.35338811      -0.3880621
##      DENT_cooc.L.PET SAVE_cooc.L.PET SVAR_cooc.L.PET SENT_cooc.L.PET
## [1,]      -0.4886194     -0.38709402     -0.02670287      -0.4370125
## [2,]      -0.3924968     -0.47610489     -0.05030249      -0.4522504
## [3,]      -0.4853888      0.01380756      0.01642425      -0.4160760
## [4,]      -0.7736715     -0.85159235     -1.03759534      -0.5918277
## [5,]      -0.5799860     -1.07630456     -0.76817505      -0.6137263
## [6,]      -0.5037470     -0.34411057     -0.33550372      -0.4628880
##      ASM_cooc.L.PET Contrast_cooc.L.PET Dissimilarity_cooc.L.PET
## [1,]     0.08567996          -0.2213217              -0.32209112
## [2,]     0.09647507           0.3022677               0.01715114
## [3,]     0.08186129          -0.2136907              -0.25478670
## [4,]     0.09955938          -1.0037577              -1.01842876
## [5,]     0.11134587          -0.5146244              -0.57943763
## [6,]     0.08443155          -0.2881716              -0.35338811
##      Inv_diff_cooc.L.PET Inv_diff_norm_cooc.L.PET IDM_cooc.L.PET
## [1,]         -0.56676432               -0.5763209     -0.5299735
## [2,]         -0.65677272               -0.6263249     -0.5765204
## [3,]         -0.67304907               -0.5908391     -0.6595578
## [4,]          0.01529491               -0.4583262      0.1580695
## [5,]         -0.35540218               -0.5329963     -0.2767734
## [6,]         -0.55940955               -0.5726633     -0.5141966
##      IDM_norm_cooc.L.PET Inv_var_cooc.L.PET Correlation_cooc.L.PET
## [1,]          -0.5673986         -0.5326148             -0.2395619
## [2,]          -0.6053420         -0.5811335             -0.8363785
## [3,]          -0.5704381         -0.6177360             -0.2158561
## [4,]          -0.5056711          0.2132500              0.1061216
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## [5,]        -0.5441814       -0.2387626            -0.5520434
## [6,]        -0.5628242       -0.5072913            -0.4179359
##      Autocorrelation_cooc.L.PET Tendency_cooc.L.PET Shade_cooc.L.PET
## [1,]                -0.2329996         -0.02670287        0.1671657
## [2,]                -0.4242598         -0.05030249       -0.2480649
## [3,]                 0.3938654          0.01642425       -1.0691758
## [4,]                -0.9158615         -1.03759534       -0.4177156
## [5,]                -1.1530657         -0.76817505        0.7271944
## [6,]                -0.2233890         -0.33550372       -0.3600608
##      Prominence_cooc.L.PET IC1_.L.PET IC2_.L.PET Coarseness_vdif_.L.PET
## [1,]            0.03098815 0.28708958 -0.3388377            0.006376387
## [2,]           -0.09787370 0.07137519 -0.2700784            0.002781345
## [3,]           -0.10490242 0.48311676 -0.4270856            0.062882324
## [4,]           -0.99146297 0.85653165 -0.7163131           -0.265687089
## [5,]           -0.21532057 0.51165900 -0.5122657            0.091004827
## [6,]           -0.28337792 0.45766703 -0.4241077            0.056388055
##      Contrast_vdif_.L.PET Busyness_vdif_.L.PET Complexity_vdif_.L.PET
## [1,]          -0.20028108          -0.5370115             -0.2662241
## [2,]           0.04845588          -0.5588516              0.1658987
## [3,]          -0.20399173          -0.6279787             -0.4553060
## [4,]          -0.56421930           0.3930587             -0.9080359
## [5,]          -0.28542101          -0.5535294             -0.2924139
## [6,]          -0.26453325          -0.5919696             -0.4582705
##      Strength_vdif_.L.PET SRE_align.L.PET LRE_align.L.PET GLNU_align.L.PET
## [1,]          -0.26986044      -0.5491186      -0.6008961       -0.5518738
## [2,]          -0.08939775      -0.5417070      -0.6286505       -0.5804090
## [3,]          -0.33357336      -0.5429081      -0.6287202       -0.5689426
## [4,]          -0.74161019      -0.5790227      -0.4805041        0.8278520
## [5,]           0.36980693      -0.5500234      -0.6039683       -0.5451300
## [6,]          -0.29834594      -0.5507824      -0.6004473       -0.5535866
##      RLNU_align.L.PET RP_align.L.PET LGRE_align.L.PET HGRE_align.L.PET
## [1,]       -0.5464275     -0.5474571       -0.1363764       -0.2927891
## [2,]       -0.6108530     -0.5377614       -0.1015623       -0.3788537
## [3,]       -0.5406625     -0.5385648       -0.5363455        0.2550858
## [4,]        0.8204210     -0.5874610       -0.3920716       -0.8757658
## [5,]       -0.6113202     -0.5474295        0.3215672       -1.1367241
## [6,]       -0.5389372     -0.5485107       -0.3905515       -0.1862284
##      LGSRE_align.L.PET HGSRE_align.L.PET LGHRE_align.L.PET HGLRE_align.L.PET
## [1,]        -0.1309227        -0.2892810        -0.1586271        -0.3027382
## [2,]        -0.1020941        -0.3648331        -0.1043141        -0.4335426
## [3,]        -0.5281412         0.2543553        -0.5656372         0.2540986
## [4,]        -0.3977173        -0.8798431        -0.3696846        -0.8559685
## [5,]         0.3336016        -1.1252892         0.2682880        -1.1814830
## [6,]        -0.3835794        -0.1800162        -0.4177003        -0.2110612
##      GLNU_norm_align.L.PET RLNU_norm_align.L.PET GLVAR_align.L.PET
## [1,]           -0.23873077           -0.5367407       -0.10514870
## [2,]           -0.09112146           -0.5172827        0.02719377
## [3,]           -0.32104774           -0.5210072        0.04708212
## [4,]           -0.12102818           -0.6136212       -1.05093564
## [5,]            0.11402955           -0.5396152       -0.91313817
## [6,]           -0.27069541           -0.5414162       -0.24895053
##      RLVAR_align.L.PET Entropy_align.L.PET SZSE.L.PET LZSE.L.PET LGLZE.L.PET
## [1,]        -0.2613329          -0.5213924 -0.5416124 -0.4480602  -0.1553823
## [2,]        -0.3774656          -0.6055192 -0.4622829 -0.6146387  -0.1132355
```

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```
## [3,]        -0.3933670         -0.4724149 -0.4319895 -0.7703556  -0.5185679
## [4,]         0.2721998         -0.5657969 -0.5905909 -0.1684870  -0.3934762
## [5,]        -0.2978019         -0.7451479 -0.4515025 -0.7298394   0.3609374
## [6,]        -0.2810142         -0.5060910 -0.5189079 -0.5211468  -0.4243495
##       HGLZE.L.PET SZLGE.L.PET SZHGE.L.PET LZLGE.L.PET LZHGE.L.PET
## [1,]  -0.2984560 -0.17106728  -0.2942719 -0.15397307 -0.18606625
## [2,]  -0.3730995 -0.09242262  -0.3163762 -0.18984205 -0.54236685
## [3,]   0.2138548 -0.44960709   0.2507497 -0.67073190 -0.04279253
## [4,]  -0.8741513 -0.39730122  -0.8709436 -0.29205659 -0.65872610
## [5,]  -1.1420153  0.44865547  -1.0646965 -0.02980072 -1.18830026
## [6,]  -0.2275594 -0.43201249  -0.2525831 -0.40630438 -0.17656210
##       GLNU_area.L.PET ZSNU.L.PET   ZSP.L.PET GLNU_norm.L.PET ZSNU_norm.L.PET
## [1,]       -0.5527994 -0.5530418 -0.5621738     -0.23689556     -0.6190040
## [2,]       -0.5773325 -0.5984956 -0.4628174     -0.09957407     -0.4177144
## [3,]       -0.5580437 -0.5054842 -0.4019440     -0.31340711     -0.3386244
## [4,]        0.7972658  0.7243773 -0.6566870     -0.11705626     -0.7292502
## [5,]       -0.5331460 -0.5925559 -0.4268835      0.12451086     -0.3925193
## [6,]       -0.5487210 -0.5364744 -0.5302461     -0.25610439     -0.5629950
##       GLVAR_area.L.PET ZSVAR.L.PET Entropy_area.L.PET Max_cooc.H.PET
## [1,]     -0.121204529  -0.2226564         -0.5000553     -0.5622647
## [2,]      0.000753596  -0.4137605         -0.6362274     -0.4644195
## [3,]      0.026274426  -0.8362779         -0.5442329      0.5340130
## [4,]     -1.045590634   0.4721232         -0.4937376     -0.4910382
## [5,]     -0.907213368  -0.7751321         -0.7925323      2.5493588
## [6,]     -0.293935425  -0.3715063         -0.5139189      0.9182000
##       Average_cooc.H.PET Variance_cooc.H.PET Entropy_cooc.H.PET DAVE_cooc.H.PET
## [1,]        -0.62173115         -0.3926613         -0.4405901      -0.4245348
## [2,]        -0.65760120         -0.3614375         -0.1978581      -0.2002922
## [3,]        -0.34277170         -0.6153275         -1.2304855      -0.6542876
## [4,]        -0.71683325         -0.2257862         -0.4815188      -0.5565737
## [5,]        -0.09109055         -1.8853813         -1.4739615      -1.4624814
## [6,]        -0.26774039         -1.0272260         -1.3894649      -0.9100846
##       DVAR_cooc.H.PET DENT_cooc.H.PET SAVE_cooc.H.PET SVAR_cooc.H.PET
## [1,]       -0.5066538      0.08192889     -0.57021320     -0.21121323
## [2,]       -0.3071158     -0.83264259     -0.69322153     -0.51771839
## [3,]       -0.3422576     -0.01496272     -0.28179187     -0.04897359
## [4,]       -0.5352219     -0.06855070     -0.66854100     -0.06049054
## [5,]       -1.5091037     -0.27142899     -0.02157412     -0.22370520
## [6,]       -0.4729899     -1.36710074     -0.20421566     -1.12758322
##       SENT_cooc.H.PET ASM_cooc.H.PET Contrast_cooc.H.PET
## [1,]       0.07030056     -0.4257044          -0.4150674
## [2,]       0.21849474     -0.4923348          -0.1059010
## [3,]      -0.73909827      0.5293038          -0.5606912
## [4,]       0.03408701     -0.3939640          -0.5503855
## [5,]      -0.99227968      2.2056453          -1.5501224
## [6,]      -0.90558682      1.1479491          -0.8152598
##       Dissimilarity_cooc.H.PET Inv_diff_cooc.H.PET Inv_diff_norm_cooc.H.PET
## [1,]                -0.4245348          -0.6699941               -0.5752921
## [2,]                -0.2002922          -0.8857913               -0.6152984
## [3,]                -0.6542876           0.3565728               -0.5209539
## [4,]                -0.5565737          -0.4667711               -0.5490693
## [5,]                -1.4624814           1.0615198               -0.3715120
## [6,]                -0.9100846           0.7501870               -0.4686586
##       IDM_cooc.H.PET IDM_norm_cooc.H.PET Inv_var_cooc_.H.PET
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```
## [1,]      -0.6523898        -0.5628068         0.1245932
## [2,]      -0.8819195        -0.5876552         0.1626292
## [3,]       0.5268363        -0.5524530        -0.4195061
## [4,]      -0.4271592        -0.5507795         0.1827693
## [5,]       1.2525912        -0.4665595        -0.1515276
## [6,]       0.9497298        -0.5320201        -0.4759560
##       Correlation_cooc.H.PET Autocorrelation_cooc.H.PET Tendency_cooc.H.PET
## [1,]            -0.2531664                -0.63574265         -0.34548858
## [2,]            -0.7097902                -0.72995330         -0.46719366
## [3,]            -0.3204338                -0.12798663         -0.58987505
## [4,]             0.1572312                -0.75877292         -0.03028623
## [5,]            -0.8038649                 0.31634762         -1.89802896
## [6,]            -0.5377799                -0.01075648         -1.04995447
##       Shade_cooc.H.PET Prominence_cooc.H.PET IC1_d.H.PET IC2_d.H.PET
## [1,]        0.56115327           -0.2771646  0.45844723 -0.34880559
## [2,]       -0.03213742           -0.3832531  0.84097312 -0.70922702
## [3,]       -0.06440384           -0.7224845  0.08064715 -0.49617333
## [4,]       -0.39054358            0.3271375 -0.02579697  0.03019033
## [5,]        1.54978365           -1.7264583  0.44273864 -0.93060958
## [6,]        0.53842843           -1.2412690  0.22017194 -0.70937241
##       Coarseness_vdif.H.PET Contrast_vdif.H.PET Busyness_vdif.H.PET
## [1,]            0.09720863          -0.4274453          -0.3638887
## [2,]            0.12838981          -0.5671546          -0.3703971
## [3,]            0.06302159           0.7225133          -0.3477636
## [4,]            0.04310330          -0.4836185          -0.2468294
## [5,]            0.08210694          -0.5418056          -0.3667598
## [6,]            0.05664774           1.0600966          -0.3404997
##       Complexity_vdif.H.PET Strength_vdif.H.PET SRE_align.H.PET LRE_align.H.PET
## [1,]           -0.10931813         -0.13025494      -0.4307026      -0.7195651
## [2,]            0.06155045         -0.09260654      -0.3447791      -0.9067290
## [3,]           -0.19946129         -0.11406009      -0.7812458       0.3824637
## [4,]           -0.23521590         -0.23919622      -0.5220265      -0.4651246
## [5,]           -0.72923006          0.08722946      -0.8618153       0.6020573
## [6,]           -0.27546607         -0.11599525      -0.9130679       1.0286387
##       RLNU_align.H.PET RP_align.H.PET LGRE_align.H.PET HGRE_align.H.PET
## [1,]        -0.4971654     -0.4065909       0.06392089      -0.698132947
## [2,]        -0.5420981     -0.2896583       0.06421447      -0.740884690
## [3,]        -0.5852595     -0.8520852       0.03404939      -0.378161662
## [4,]         0.7194380     -0.5294515       0.10054467      -0.674598529
## [5,]        -0.6316801     -0.9156443       0.01379255       0.456615365
## [6,]        -0.6029308     -0.9873040       0.02311363      -0.008001338
##       LGSRE_align.H.PET HGSRE_align.H.PET LGHRE_align.H.PET HGLRE_align.H.PET
## [1,]         0.06778299       -0.59041968       0.037835342        -0.6802823
## [2,]         0.06870144       -0.53088745       0.033125985        -0.8573161
## [3,]         0.03611506       -0.76247426       0.027942041         0.6873551
## [4,]         0.09794468       -0.65688536       0.117419836        -0.4979682
## [5,]         0.01822378        0.09512599      -0.005644076         1.0274090
## [6,]         0.02524069       -0.48738896       0.028964227         1.2343204
##       GLNU_norm_align.H.PET RLNU_norm_align.H.PET GLVAR_align.H.PET
## [1,]            -0.5712362            -0.3120397        -0.3721453
## [2,]            -0.7030578            -0.1079673        -0.4355544
## [3,]             0.5316701            -0.9704621        -0.6625075
## [4,]            -0.6317852            -0.5049737        -0.1576847
## [5,]             1.5299799            -1.0850209        -1.8601022
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## [6,]             0.9385123              -1.1496499          -0.9735944
##       RLVAR_align.H.PET Entropy_align.H.PET   SZSE.H.PET   LZSE.H.PET LGLZE.H.PET
## [1,]        -0.5834915          -0.4736414 -0.34821000 -0.20713789 0.054010198
## [2,]        -0.8037182          -0.3905964  0.08296996 -0.21972745 0.057224946
## [3,]         0.7441584          -0.8867673 -0.85184571 -0.11558937 0.031689625
## [4,]        -0.2617379          -0.2985495 -0.46659449 -0.14463396 0.093281256
## [5,]         0.9596641          -1.0911927 -0.98364474  0.01824329 0.007396366
## [6,]         1.4877490          -0.8924170 -0.98401691  0.20956309 0.019378605
##       HGLZE.H.PET SZLGE.H.PET   SZHGE.H.PET LZLGE.H.PET LZHGE.H.PET
## [1,] -0.2901933 0.06374556 -3.657487e-01  -0.2540270 -0.233853915
## [2,] -0.7831293 0.07546816 -9.234150e-02  -0.2869748 -0.243886393
## [3,] -0.3822321 0.04154588 -9.771746e-01  -0.2005686 -0.095484736
## [4,]  0.5268357 0.08796006 -5.579603e-01  -0.0380075 -0.186879336
## [5,]  0.7261377 0.02594017 -2.874186e-05  -0.1199001  0.006637164
## [6,] -0.1268240 0.03231433 -7.223679e-01   0.1643966  0.194571350
##       GLNU_area.H.PET ZSNU.H.PET   ZSP.H.PET GLNU_norm.H.PET ZSNU_norm.H.PET
## [1,]      -0.5444686 -0.4601965 -0.2248134      -0.5806037      -0.3162951
## [2,]      -0.5796658 -0.3824687  0.5127672      -0.6979911       0.5518249
## [3,]      -0.4288636 -0.5618607 -0.9285878       0.7417602      -1.0206540
## [4,]       0.5390657  0.1940260 -0.6128852      -0.6306111      -0.5107478
## [5,]      -0.5810817 -0.5874970 -1.1161831       0.8761277      -1.1255136
## [6,]      -0.5459613 -0.5864810 -1.2948336       1.0030056      -1.1804675
##       GLVAR_area.H.PET ZSVAR_H.PET Entropy_area.H.PET Max_cooc.W.PET
## [1,]        -0.4224700 -0.22265827         -0.4736178     -0.3461950
## [2,]        -0.4601605 -0.23141569         -0.6802143     -0.3036564
## [3,]        -0.7321688 -0.14238329         -0.7186979      0.2207037
## [4,]        -0.1013358 -0.15967750         -0.2259535     -0.3351671
## [5,]        -1.7481942 -0.01198442         -0.7802805      1.4412203
## [6,]        -0.8220885  0.15839447         -0.7566641      0.5149649
##       Average_cooc.W.PET Variance_cooc.W.PET Entropy_cooc.W.PET DAVE_cooc.W.PET
## [1,]        -0.31008562          -0.2564173         -0.3380333      -0.2540337
## [2,]         0.02683964           0.4493676         -0.1736199       0.5364988
## [3,]        -1.03175940          -0.8969181         -1.0345685      -1.1339433
## [4,]        -0.24731569          -0.3130037         -0.3440762      -0.4552820
## [5,]        -1.25206094          -0.9213654         -1.2576617      -1.2034308
## [6,]        -1.16802267          -0.9303583         -1.1793425      -1.2258890
##       DVAR_cooc.W.PET DENT_cooc.W.PET SAVE_cooc.W.PET SVAR_cooc.W.PET
## [1,]      -0.3193107    -0.342943902    -0.31038212     -0.2282020
## [2,]       0.6942880     0.002238598     0.02661683      0.3098894
## [3,]      -0.9433432    -1.093835590    -1.03221397     -0.8431674
## [4,]      -0.4197731    -0.444514652    -0.24759852     -0.2424063
## [5,]      -0.9378081    -1.135682315    -1.25256366     -0.8712021
## [6,]      -0.9628533    -1.208596176    -1.16850700     -0.8775841
##       SENT_cooc.W.PET ASM_cooc.W.PET Contrast_cooc.W.PET
## [1,]      -0.3159465     -0.2006869          -0.3075340
## [2,]      -0.1467601     -0.2333697           0.7742948
## [3,]      -0.9419763      0.3324825          -0.9576910
## [4,]      -0.3128799     -0.1888046          -0.4700373
## [5,]      -1.1559564      1.2294011          -0.9705620
## [6,]      -1.0917096      0.6973497          -0.9855880
##       Dissimilarity_cooc.W.PET Inv_diff_cooc.W.PET Inv_diff_norm_cooc.W.PET
## [1,]               -0.2540337          -0.6374300               -0.5764903
## [2,]                0.5364988          -0.9304053               -0.6353259
## [3,]               -1.1339433           0.2901524               -0.5694748
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## [4,]             -0.4552820             -0.4626158                 -0.4639086
## [5,]             -1.2034308              0.5487330                 -0.5218385
## [6,]             -1.2258890              0.5258770                 -0.5432064
##       IDM_cooc.W.PET IDM_norm_cooc.W.PET Inv_var_cooc.W.PET
## [1,]     -0.6315742         -0.5654455         -0.5757397
## [2,]     -0.9114075         -0.6095647         -0.9126200
## [3,]      0.5091234         -0.5606607          0.5282510
## [4,]     -0.4247365         -0.5072004         -0.3646175
## [5,]      0.8605536         -0.5446135          0.6301697
## [6,]      0.8382954         -0.5500768          0.7959910
##       Correlation_cooc.W.PET Autocorrelation_cooc.W.PET Tendency_cooc.W.PET
## [1,]             -0.2399351                -0.32079144          -0.2282020
## [2,]             -0.8269017                 0.03559253           0.3098894
## [3,]             -0.2251579                -0.85647530          -0.8431674
## [4,]              0.1173220                -0.25478504          -0.2424063
## [5,]             -0.6005036                -0.93362150          -0.8712021
## [6,]             -0.4364399                -0.90992639          -0.8775841
##       Shade_cooc.W.PET Prominence_cooc.W.PET IC1_d.W.PET IC2_d.W.PET
## [1,]      -0.19389610           -0.24361420   0.5027180  -0.4267892
## [2,]      -0.07709063           -0.06025639   0.4614179  -0.3295264
## [3,]      -0.38075702           -0.33892430   0.2495240  -0.5747430
## [4,]      -0.12206509           -0.20994984   0.1738307  -0.1890252
## [5,]      -0.36726449           -0.33872045   0.7187278  -1.0350664
## [6,]      -0.37810446           -0.33964929   0.4437719  -0.7867358
##       Coarseness_vdif.W.PET Contrast_vdif.W.PET Busyness_vdif.W.PET
## [1,]         -0.0550313004          -0.1846450          -0.6979653
## [2,]         -0.0353358511           0.9808822          -0.8409454
## [3,]          0.0153602863          -0.8804405           0.3359712
## [4,]         -0.3110467938          -0.8000340          -0.2967495
## [5,]          0.0257529944          -1.0090603           0.7166976
## [6,]          0.0007597987          -1.0067613           0.9729224
##       Complexity_vdif.W.PET Strength_vdif.W.PET SRE_align.W.PET LRE_align.W.PET
## [1,]          -0.39496588          -0.1487983      -0.4965600     -0.73910542
## [2,]           0.08320976           0.4339190      -0.4598340     -0.85727668
## [3,]          -0.66954127          -0.5979340      -0.6654328     -0.06739247
## [4,]          -0.23711930          -0.4828870      -0.5398142     -0.58157466
## [5,]          -0.66792434          -0.5191096      -0.6972780      0.02047286
## [6,]          -0.67367185          -0.6067205      -0.7279147      0.21868188
##       GLNU_align.W.PET RLNU_align.W.PET RP_align.W.PET LGRE_align.W.PET
## [1,]       -0.6559981       -0.5172076     -0.4802142       -0.4017177
## [2,]       -0.7533293       -0.5729297     -0.4299235       -0.5396006
## [3,]       -0.3788126       -0.5646645     -0.7036969        0.3462367
## [4,]        0.8307024        0.7825295     -0.5386015       -0.7522301
## [5,]       -0.3210012       -0.6191293     -0.7329976        1.5284294
## [6,]       -0.2465460       -0.5756284     -0.7771379        0.7543122
##       HGRE_align.W.PET LGSRE_align.W.PET HGSRE_align.W.PET LGHRE_align.W.PET
## [1,]      -0.34486770        -0.3723193       -0.33818074        -0.4632262
## [2,]       0.06469248        -0.5229899        0.08716306        -0.5574876
## [3,]      -0.87260946         0.3282319       -0.87478027         0.3281300
## [4,]      -0.22356683        -0.7627312       -0.23166000        -0.6670154
## [5,]      -0.93382896         1.4011158       -0.92610182         1.7315839
## [6,]      -0.91329204         0.6876126       -0.91131785         0.9541545
##       HGLRE_align.W.PET GLNU_norm_align.W.PET RLNU_norm_align.W.PET
## [1,]      -0.37252766           -0.5138900           -0.4173834
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## [2,]      -0.02056866         -0.6106199           -0.3241975
## [3,]      -0.85434001          0.4207051           -0.7968581
## [4,]      -0.18712885         -0.5748071           -0.5214981
## [5,]      -0.96930814          1.5193572           -0.8584130
## [6,]      -0.91848578          0.8671484           -0.9133916
##       GLVAR_align.W.PET RLVAR_align.W.PET Entropy_align.W.PET SZSE.W.PET
## [1,]        -0.2669606        -0.5628902          -0.4498174 -0.3984842
## [2,]         0.3757256        -0.7613964          -0.3576058 -0.2078345
## [3,]        -0.8976031         0.6493112          -0.9123703 -0.7071376
## [4,]        -0.2715007        -0.2778154          -0.3176612 -0.5128944
## [5,]        -0.9318581         0.7263114          -1.1552447 -0.8303329
## [6,]        -0.9287314         1.1021073          -0.9927288 -0.8940003
##        LZSE.W.PET LGLZE.W.PET HGLZE.W.PET SZLGE.W.PET SZHGE.W.PET LZLGE.W.PET
## [1,] -0.46022593  -0.4680080 -0.33029582  -0.4203553  -0.3108175  -0.2805442
## [2,] -0.54971957  -0.5314592  0.04470571  -0.3837420   0.0993072  -0.3230801
## [3,]  0.03171704   0.6608786 -0.88997048   0.7774380  -0.8762190  -0.1395594
## [4,] -0.28978468  -0.7610457 -0.19725000  -0.7649478  -0.2307742  -0.3033265
## [5,]  0.08014995   1.4982016 -0.93506566   1.1046276  -0.9059600   0.3616331
## [6,]  0.87001336   0.8734152 -0.92196939   0.8204223  -0.9076839   0.7265043
##        LZHGE.W.PET GLNU_area.W.PET ZSNU.W.PET    ZSP.W.PET GLNU_norm.W.PET
## [1,] -0.52340377      -0.6041965 -0.4721573 -0.30839336      -0.5218836
## [2,] -0.39643071      -0.6842908 -0.4825369 -0.02030225      -0.6162192
## [3,] -0.71605820      -0.3854504 -0.5551402 -0.83267422       0.5443641
## [4,]  0.08085406       0.7306191  0.4949157 -0.54623479      -0.5823999
## [5,] -1.09354081      -0.4252048 -0.6000846 -0.93920220       1.3583335
## [6,] -0.76011879      -0.4022340 -0.5913780 -1.18035989       0.9434539
##       ZSNU_norm.W.PET GLVAR_area.W.PET ZSVAR.W.PET Entropy_area.W.PET
## [1,]       -0.3200057      -0.2766605 -0.38203018         -0.5014727
## [2,]        0.1255877       0.3303703 -0.43457258         -0.5477755
## [3,]       -0.8898751      -0.8956246  0.03827969         -0.8589846
## [4,]       -0.5494782      -0.2378244 -0.23636331         -0.2711087
## [5,]       -1.0798617      -0.9244211  0.02117985         -0.9273561
## [6,]       -1.1754135      -0.9261313  0.79391402         -0.7747854
##       Min_hist.ADC Max_hist.ADC Mean_hist.ADC Variance_hist.ADC
## [1,]    0.4113126  -0.54142188    -0.3871858         0.03649101
## [2,]   -0.8657505  -0.59178935    -0.5187498        -0.35175571
## [3,]    0.6090364  -0.01830709    -0.3635494         1.08498263
## [4,]   -0.8657505  -0.01035433    -0.4584202         0.28753584
## [5,]   -0.8657505  -0.43450146    -0.7453425        -0.00565879
## [6,]   -0.8657505  -0.33818472    -0.2100562         2.18699161
##       Standard_Deviation_hist.ADC Skewness_hist.ADC Kurtosis_hist.ADC
## [1,]                -0.13239011         0.7601872        -0.3645347
## [2,]                -0.42773754        -1.3132101         0.3555531
## [3,]                 0.51133519         1.4014854         0.8837421
## [4,]                 0.03833017        -0.3335022        -0.4827438
## [5,]                -0.16242576        -0.2284111        -0.2927585
## [6,]                 1.05521496        -0.9234665        -1.3820906
##       Energy_hist.ADC Entropy_hist.ADC AUC_hist.ADC  Volume.ADC X3D_surface.ADC
## [1,]      0.17139759       -0.8808510   -0.5517312 -0.77171573     -0.83357781
## [2,]      0.08084621       -0.6160912   -0.6811442 -0.83529619     -0.72636952
## [3,]      0.05339560       -0.4708601   -0.3709215 -0.51840678     -0.56229596
## [4,]      0.03164901       -0.3251680   -0.5582428  0.05016931     -0.07719641
## [5,]      0.06337764       -0.5427299   -0.6274542 -0.48828960     -0.55940723
## [6,]      0.04876108       -0.4722479   -0.6852396 -0.73987664     -0.52085076
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##       ratio_3ds_vol.ADC ratio_3ds_vol_norm.ADC irregularity.ADC
## [1,]         0.40738565             -0.5102350       -0.3109450
## [2,]        -0.20351364             -0.7309093       -0.5307282
## [3,]        -0.51516250             -0.7887529       -0.7548838
## [4,]        -0.52782472             -0.3401354       -0.6841516
## [5,]        -0.47939174             -0.7465117       -0.7114444
## [6,]        -0.05784537             -0.2591402       -0.5710146
##       Compactness_v1.ADC Compactness_v2.ADC Spherical_disproportion.ADC
## [1,]        -0.159269319        -0.56541295                  -0.5102350
## [2,]        -0.015731983         0.01693002                  -0.7309093
## [3,]         0.029338740         0.21805452                  -0.7887529
## [4,]        -0.247114169        -0.87441235                  -0.3401354
## [5,]        -0.003961922         0.06881245                  -0.7465117
## [6,]        -0.283572652        -0.99205523                  -0.2591402
##       Sphericity.ADC Asphericity.ADC Center_of_mass.ADC Max_3D_diam.ADC
## [1,]      -0.5761452     -0.32810533         -0.1599647      -0.9223406
## [2,]      -0.3377117     -0.79595554         -0.1345429      -0.7388407
## [3,]      -0.2658503     -0.91858954          0.3122768      -0.6298715
## [4,]      -0.7287679      0.03252177          0.1652700      -0.2750518
## [5,]      -0.3187759     -0.82903405         -0.5223026      -0.7007593
## [6,]      -0.7938125      0.20423907          0.4204525      -0.5900804
##       Major_axis_length.ADC Minor_axis_length.ADC Least_axis_length.ADC
## [1,]            -0.6363554            -1.0694709            -1.04883852
## [2,]            -0.9347200            -0.7650734            -0.59483948
## [3,]            -0.7330537            -0.4762489            -0.49092760
## [4,]            -0.2806023            -0.2509627            -0.07836234
## [5,]            -0.8147554            -0.5239350            -0.25589410
## [6,]            -0.4516336            -0.5552712            -0.67678823
##       Elongation.ADC Flatness.ADC Max_cooc.L.ADC Average_cooc.L.ADC
## [1,]      -1.2658333   -1.2879681    0.171468447        -0.72089326
## [2,]      -0.2578859    0.0237260   -0.034142536        -0.04429305
## [3,]      -0.1144291   -0.1805273    0.040404448        -1.19070915
## [4,]      -0.4660035   -0.2184426    0.008852003        -0.58873748
## [5,]      -0.0340415    0.4388721   -0.001549901        -0.53186871
## [6,]      -0.6741211   -0.8646448   -0.110769901        -0.10171762
##       Variance_cooc.L.ADC Entropy_cooc.L.ADC DAVE_cooc.L.ADC DVAR_cooc.L.ADC
## [1,]           0.5592857         -0.6503058      0.10801881       1.3404697
## [2,]          -0.7145134         -0.6089983     -0.58519579      -0.6443482
## [3,]           0.9512078         -0.5126260     -0.21463352       0.9153432
## [4,]          -0.7749119         -0.6127855     -0.86737881      -0.9051946
## [5,]          -0.6271330         -0.5521907     -0.48832913      -0.5937073
## [6,]           1.2476170         -0.3423719      0.05653072       0.5625945
##       DENT_cooc.L.ADC SAVE_cooc.L.ADC SVAR_cooc.L.ADC SENT_cooc.L.ADC
## [1,]       -0.3378751      -0.7211984       0.4168868     -0.21422274
## [2,]       -0.6023649      -0.0444083      -0.7316081     -1.15215699
## [3,]       -0.4453804      -1.1911468       1.1761980      0.07552317
## [4,]       -0.7262579      -0.5890055      -0.6872803     -0.18692032
## [5,]       -0.5615696      -0.5321207      -0.6497936     -0.21904233
## [6,]       -0.3536147      -0.1018483       1.5473657     -0.82480441
##       ASM_cooc.L.ADC Contrast_cooc.L.ADC Dissimilarity_cooc.L.ADC
## [1,]      0.11178526           0.8024997               0.10801881
## [2,]      0.07978965          -0.5875537              -0.58519579
## [3,]      0.08346730           0.3370790              -0.21463352
## [4,]      0.08199624          -0.8708007              -0.86737881
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## [5,]      0.06728562          -0.4988646           -0.48832913
## [6,]      0.03933543           0.4319138            0.05653072
##       Inv_diff_cooc.L.ADC Inv_diff_norm_cooc.L.ADC IDM_cooc.L.ADC
## [1,]         -0.5144491               -0.6074400    -0.4025260
## [2,]         -0.4760492               -0.5436049    -0.4563809
## [3,]         -0.4172269               -0.5736895    -0.3203856
## [4,]         -0.2068187               -0.5106365    -0.1014070
## [5,]         -0.5230063               -0.5549202    -0.5010570
## [6,]         -0.7006237               -0.6088330    -0.6849128
##       IDM_norm_cooc.L.ADC Inv_var_cooc.L.ADC Correlation_cooc.L.ADC
## [1,]          -0.5963440         -0.4473741            -0.70471165
## [2,]          -0.5504203         -0.4239707            -0.51812159
## [3,]          -0.5792879         -0.3081512             0.09412942
## [4,]          -0.5395436         -0.1032327             0.06038360
## [5,]          -0.5542055         -0.4796230            -0.52975022
## [6,]          -0.5864250         -0.6883192             0.18917254
##       Autocorrelation_.L.ADC Tendency_cooc.L.ADC Shade_.L.ADC
## [1,]             -0.6998238           0.4168868    1.5643914
## [2,]              0.2354008          -0.7316081   -0.8436388
## [3,]             -1.1120988           1.1761980    4.1522294
## [4,]             -0.5602964          -0.6872803   -0.3582556
## [5,]             -0.4952326          -0.6497936   -0.3648893
## [6,]              0.2695015           1.5473657   -1.0298872
##       Prominence_cooc.L.ADC IC1_.L.ADC   IC2_.L.ADC Coarseness_vdif_.L.ADC
## [1,]             0.9559151 -0.6883999  0.02448574           0.301907443
## [2,]            -0.6151097  0.5967581 -0.55782502           0.056613103
## [3,]             3.9832025  0.1773429 -0.27185532          -0.075963314
## [4,]            -0.7096757  0.3808910 -0.41652989          -0.139734248
## [5,]            -0.6136209  0.6439494 -0.57515917           0.008225508
## [6,]             1.2401564 -0.1924172 -0.05807723          -0.003801467
##       Contrast_vdif_.L.ADC Busyness_vdif_.L.ADC Complexity_vdif_.L.ADC
## [1,]            0.6409048          -0.6365437              0.2240702
## [2,]           -0.4518571          -0.6250681             -0.8182427
## [3,]           -0.0702796          -0.1905094              0.5372433
## [4,]           -0.6427148          -0.2282567             -0.9070155
## [5,]           -0.3561751          -0.5381510             -0.6730924
## [6,]            0.3844799          -0.5798298              0.2904589
##       Strength_vdif_.L.ADC SRE_align.L.ADC LRE_align.L.ADC GLNU_align.L.ADC
## [1,]            1.08878436      -0.5432046      -0.6178635       -0.6261970
## [2,]           -0.05349273      -0.5458232      -0.6137933       -0.5441134
## [3,]            0.06221020      -0.5607702      -0.5566774       -0.4608465
## [4,]           -0.48069605      -0.5791469      -0.4858621       -0.1783430
## [5,]           -0.20159009      -0.5426021      -0.6154515       -0.5346359
## [6,]           -0.09788725      -0.5308298      -0.6668765       -0.5690912
##       RLNU_align.L.ADC RP_align.L.ADC LGRE_align.L.ADC HGRE_align.L.ADC
## [1,]        -0.6678444     -0.5353171     6.109942e-02       -0.54292539
## [2,]        -0.5747492     -0.5400544    -3.801424e-02        0.06789313
## [3,]        -0.4549755     -0.5598945     2.092792e-01       -1.12656204
## [4,]        -0.1430350     -0.5840029     2.904285e-02       -0.62025951
## [5,]        -0.5426892     -0.5370995    -6.973871e-05       -0.53892281
## [6,]        -0.5195656     -0.5193700    -4.259375e-02        0.35906171
##       LGSRE_align.L.ADC HGSRE_align.L.ADC LGHRE_align.L.ADC HGLRE_align.L.ADC
## [1,]        0.067623844       -0.52408648        0.02829577        -0.6071760
## [2,]       -0.030420066        0.06957377       -0.07624384         0.0513619
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## [3,]       0.206135542      -1.12804770      0.21305610      -1.1064162
## [4,]       0.029459100      -0.63542049      0.03082241      -0.5596155
## [5,]       0.007086664      -0.53418758     -0.03644930      -0.5476899
## [6,]      -0.035355162       0.38423936     -0.07877047       0.2569200
##       GLNU_norm_align.L.ADC RLNU_norm_align.L.ADC GLVAR_align.L.ADC
## [1,]            -0.1203279            -0.5125345         0.6524756
## [2,]            -0.1128336            -0.5226589        -0.6881227
## [3,]            -0.2225712            -0.5600825         0.6739622
## [4,]            -0.1730555            -0.6053373        -0.7581559
## [5,]            -0.2306008            -0.5127052        -0.5532662
## [6,]            -0.5276951            -0.4824053         0.9801508
##       RLVAR_align.L.ADC Entropy_align.L.ADC SZSE.L.ADC LZSE.L.ADC LGLZE.L.ADC
## [1,]        -0.44582763          -0.5883206 -0.5014454 -0.7450547  0.07253492
## [2,]        -0.43730678          -0.6382575 -0.5322334 -0.6801099 -0.02713914
## [3,]        -0.24658490          -0.5106176 -0.6485655 -0.2386096  0.20773636
## [4,]        -0.01198974          -0.5812684 -0.5869649 -0.4695587  0.01990175
## [5,]        -0.41790827          -0.5837223 -0.5609116 -0.5131342  0.01661218
## [6,]        -0.61298122          -0.3955007 -0.5031381 -0.7854992 -0.03306038
##       HGLZE.L.ADC    SZLGE.L.ADC SZHGE.L.ADC  LZLGE.L.ADC   LZHGE.L.ADC
## [1,] -0.52116543  0.087641058  -0.4531762 -0.069331476 -0.722525947
## [2,]  0.03776169 -0.008292571   0.0300991 -0.173528216 -0.081345974
## [3,] -1.11061311  0.182242275  -1.1424450  0.296453924 -0.948870970
## [4,] -0.63424587  0.014691528  -0.6650952  0.001412627 -0.518685568
## [5,] -0.56442366  0.033678392  -0.5884310 -0.124720269 -0.445679435
## [6,]  0.31736403 -0.014621525   0.3350138 -0.178463851  0.008986928
##       GLNU_area.L.ADC ZSNU.L.ADC   ZSP.L.ADC GLNU_norm.L.ADC ZSNU_norm.L.ADC
## [1,]      -0.6384152 -0.6668395 -0.4462596      -0.1479371      -0.4206376
## [2,]      -0.5460429 -0.5690748 -0.4875722      -0.0875094      -0.4944409
## [3,]      -0.4826914 -0.4871185 -0.6694902      -0.2477384      -0.7518699
## [4,]      -0.1566395 -0.1301000 -0.5806975      -0.1514916      -0.6179428
## [5,]      -0.5424265 -0.5463444 -0.5542942      -0.2193018      -0.5559436
## [6,]      -0.5719915 -0.5041938 -0.4347400      -0.5039407      -0.4273670
##       GLVAR_area.L.ADC ZSVAR.L.ADC Entropy_area.L.ADC Max_cooc.H.ADC
## [1,]        0.6575768 -0.6125949         -0.6257851     0.08340477
## [2,]       -0.6983670 -0.5654684         -0.6568559     0.06727003
## [3,]        0.6482625 -0.0599094         -0.4381783     0.14134316
## [4,]       -0.7672453 -0.3265400         -0.5720668     0.08230468
## [5,]       -0.5238385 -0.3514997         -0.5622679     0.05736917
## [6,]        0.9330886 -0.6811584         -0.4352778     0.09513913
##       Average_cooc.H.ADC Variance_cooc.H.ADC Entropy_cooc.H.ADC DAVE_cooc.H.ADC
## [1,]         -0.6642144          -0.6262628         -0.5135162      -0.4035709
## [2,]         -0.3985375          -0.6128917         -0.5879123      -0.4490907
## [3,]         -0.6189469          -0.4471629         -0.5521140      -0.6742298
## [4,]         -0.6063365          -0.6286703         -0.5364986      -0.8378865
## [5,]         -0.5691155          -0.6641421         -0.5449454      -0.4736239
## [6,]         -0.6231404          -0.4813925         -0.5896604      -0.8362281
##       DVAR_cooc.H.ADC DENT_cooc.H.ADC SAVE_cooc.H.ADC SVAR_cooc.H.ADC
## [1,]       -0.3457743      -0.5427089      -0.6645724      -0.7020362
## [2,]       -0.5347957      -0.5544867      -0.3987956      -0.6241406
## [3,]       -0.5346473      -0.6002605      -0.6192882      -0.2874587
## [4,]       -0.9205151      -0.6518222      -0.6066727      -0.3859861
## [5,]       -0.4721307      -0.5533171      -0.5694384      -0.6923536
## [6,]       -0.7161951      -0.6504806      -0.6234836      -0.2260366
##       SENT_cooc.H.ADC ASM_cooc.H.ADC Contrast_cooc.H.ADC
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## [1,]      -0.4477105       0.1131243          -0.2927716
## [2,]      -0.8491975       0.1057101          -0.4138414
## [3,]      -0.4815200       0.1071929          -0.6417886
## [4,]      -0.5326087       0.1049686          -0.9390283
## [5,]      -0.6034431       0.1053393          -0.4160171
## [6,]      -0.6221580       0.1086758          -0.8597653
##      Dissimilarity_cooc.H.ADC Inv_diff_cooc.H.ADC Inv_diff_norm_cooc.H.ADC
## [1,]               -0.4035709          -0.5126398               -0.5783293
## [2,]               -0.4490907          -0.5808371               -0.5733662
## [3,]               -0.6742298          -0.2457501               -0.5284852
## [4,]               -0.8378865          -0.2186128               -0.5034298
## [5,]               -0.4736239          -0.4714618               -0.5669623
## [6,]               -0.8362281          -0.1572588               -0.4994273
##      IDM_cooc.H.ADC IDM_norm_cooc.H.ADC Inv_var_cooc.H.ADC
## [1,]    -0.40456384         -0.5739996         -0.3372000
## [2,]    -0.54895368         -0.5659544         -0.5233714
## [3,]    -0.08509688         -0.5433796         -0.1120096
## [4,]    -0.08864455         -0.5199402         -0.1261824
## [5,]    -0.37192535         -0.5650898         -0.3945912
## [6,]    -0.01644963         -0.5240950         -0.0437701
##      Correlation_cooc.H.ADC Autocorrelation_cooc.H.ADC Tendency_cooc.H.ADC
## [1,]            -0.63608177                 -0.7706165          -0.7020362
## [2,]            -0.47456466                 -0.2722283          -0.6241406
## [3,]            -0.05904703                 -0.5731530          -0.2874587
## [4,]             0.15083503                 -0.5416515          -0.3859861
## [5,]            -0.52544743                 -0.5940408          -0.6923536
## [6,]             0.16376241                 -0.5453615          -0.2260366
##      Shade_cooc.H.ADC Prominence_cooc.H.ADC IC1_d.H.ADC IC2_d.H.ADC
## [1,]       0.46889817           -0.74536242 -0.86166650   0.1157107
## [2,]      -1.70131741           -0.65856794  0.39133994  -0.4319173
## [3,]       1.06718493           -0.06008993  0.32513388  -0.3774947
## [4,]      -0.05494861           -0.37044251  0.47315352  -0.5048832
## [5,]      -0.73786494           -0.72042827  0.41273734  -0.4502685
## [6,]      -0.59074557           -0.18983207 -0.06392116  -0.1380789
##      Coarseness_vdif.H.ADC Contrast_vdif.H.ADC Busyness_vdif.H.ADC
## [1,]          0.432890709          -0.3950162          -0.6536208
## [2,]          0.039522006          -0.4548965          -0.5597792
## [3,]         -0.040985354          -0.8123096          -0.4779572
## [4,]         -0.118627683          -0.9057013          -0.2214241
## [5,]         -0.003453453          -0.4205023          -0.5253460
## [6,]          0.024050841          -0.8595558          -0.5485642
##      Complexity_vdif.H.ADC Strength_vdif.H.ADC SRE_align.H.ADC LRE_align.H.ADC
## [1,]            -0.3862680           0.6749416      -0.5481444      -0.6114778
## [2,]            -0.4645300          -0.1073982      -0.5503490      -0.6055486
## [3,]            -0.8080180          -0.2687408      -0.5658265      -0.5257023
## [4,]            -0.9119357          -0.4237682      -0.5698948      -0.5249950
## [5,]            -0.4395621          -0.1935487      -0.5570991      -0.5768597
## [6,]            -0.8775011          -0.1408891      -0.5622128      -0.5591346
##      GLNU_align.H.ADC RLNU_align.H.ADC RP_align.H.ADC LGRE_align.H.ADC
## [1,]       -0.6633318       -0.6673924     -0.5430933       -0.05398431
## [2,]       -0.5756171       -0.5768691     -0.5458591       -0.06489495
## [3,]       -0.4595511       -0.4614202     -0.5695632       -0.04650273
## [4,]       -0.1470269       -0.1457125     -0.5725348       -0.08952181
## [5,]       -0.5471152       -0.5488348     -0.5553682       -0.08016984
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## [6,]       -0.5305406      -0.5323010      -0.5613571      -0.08110504
##       HGRE_align.H.ADC LGSRE_align.H.ADC HGSRE_align.H.ADC LGHRE_align.H.ADC
## [1,]       -0.5745603      -0.03280154      -0.5618821      -0.18267144
## [2,]       -0.5854319      -0.04755818      -0.5775831      -0.17825372
## [3,]       -0.6087517      -0.02903388      -0.6283839      -0.15292546
## [4,]       -0.5810819      -0.09402591      -0.5874477      -0.05779723
## [5,]       -0.5828703      -0.06985013      -0.5794468      -0.15204192
## [6,]       -0.5771240      -0.08178103      -0.5736937      -0.08695418
##       HGLRE_align.H.ADC GLNU_norm_align.H.ADC RLNU_norm_align.H.ADC
## [1,]       -0.6171972          -0.03604207          -0.5265624
## [2,]       -0.6180332          -0.03900875          -0.5334162
## [3,]       -0.4831156          -0.03966801          -0.5729308
## [4,]       -0.5612980          -0.04131616          -0.5840042
## [5,]       -0.5953627          -0.03900875          -0.5507607
## [6,]       -0.5951628          -0.04065690          -0.5636524
##       GLVAR_align.H.ADC RLVAR_align.H.ADC Entropy_align.H.ADC SZSE.H.ADC
## [1,]       -0.5708740      -0.36484507          -0.6043268 -0.5346854
## [2,]       -0.5719358      -0.34004504          -0.5926918 -0.5422640
## [3,]       -0.5977942       0.12336936          -0.5713589 -0.6095598
## [4,]       -0.5819026       0.05502511          -0.5597051 -0.5735377
## [5,]       -0.5722561      -0.19845421          -0.5843242 -0.5572108
## [6,]       -0.5843167      -0.12722623          -0.5780064 -0.5901219
##       LZSE.H.ADC    LGLZE.H.ADC HGLZE.H.ADC  SZLGE.H.ADC SZHGE.H.ADC LZLGE.H.ADC
## [1,] -0.6981364  0.0666177435  -0.5767674  0.155938519  -0.5473062  -0.5353574
## [2,] -0.6958561  0.0001856309  -0.5725235  0.041762582  -0.5478138  -0.4547178
## [3,]  0.1545871 -0.0501129685  -0.6777485 -0.064694419  -0.7376807  -0.1269569
## [4,] -0.5155250 -0.0861761153  -0.5757788 -0.097821522  -0.5824360  -0.2065126
## [5,] -0.5454259 -0.0453678176  -0.6186968  0.006384122  -0.6369542  -0.2160507
## [6,] -0.4498940 -0.1643129334  -0.5594243 -0.157321658  -0.5874992   0.2944499
##       LZHGE.H.ADC GLNU_area.H.ADC ZSNU.H.ADC   ZSP.H.ADC GLNU_norm.H.ADC
## [1,] -0.6768543      -0.6642705 -0.6725977 -0.5168683      -0.03152093
## [2,] -0.7175082      -0.5751688 -0.5778406 -0.5216097      -0.04041668
## [3,]  0.9150997      -0.4667660 -0.4846950 -0.6662111      -0.03316829
## [4,] -0.5488053      -0.1441447 -0.1388711 -0.5778396      -0.04239351
## [5,] -0.4799949      -0.5478389 -0.5519269 -0.5613757      -0.03876932
## [6,] -0.5599065      -0.5333562 -0.5436026 -0.5982111      -0.03975773
##       ZSNU_norm.H.ADC GLVAR_area.H.ADC ZSVAR.H.ADC Entropy_area.H.ADC
## [1,]       -0.4954016      -0.5622214 -0.64742792          -0.6439049
## [2,]       -0.5166242      -0.5370231 -0.67651322          -0.6007301
## [3,]       -0.6745847      -0.6936563  2.35951019          -0.5334676
## [4,]       -0.5900432      -0.5806360 -0.24612217          -0.5508851
## [5,]       -0.5486951      -0.5619809 -0.24897717          -0.5892300
## [6,]       -0.6317154      -0.6210024 -0.09837599          -0.5535874
##       Max_cooc.W.ADC Average_cooc.W.ADC Variance_cooc.W.ADC DAVE_cooc.W.ADC
## [1,]       0.19349133      -0.84300136          -0.0154161      -0.13255040
## [2,]       0.08644844       0.11675254          -0.3782130      -0.33716774
## [3,]       0.08425643      -0.93506685           1.3339103       0.14095967
## [4,]       0.05722171       0.09734604           0.2202409      -0.17910738
## [5,]       0.07658442      -0.19741735          -0.1038016      -0.04782845
## [6,]       0.07220041       0.33324944           2.4174995       0.83171075
##       DVAR_cooc.W.ADC DENT_cooc.W.ADC SAVE_cooc.W.ADC SVAR_cooc.W.ADC
## [1,]       0.61946231      -0.4834815      -0.8470091      -0.1239002
## [2,]      -0.33068080      -0.5288387       0.1400958      -0.3998223
## [3,]       1.55899175      -0.4091896      -0.9416984       1.3894965
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##  [4,]     -0.03977472     -0.4771018      0.1201363       0.2845655
##  [5,]     -0.05742292     -0.4533533     -0.1830273      -0.1595859
##  [6,]      1.81350274     -0.2720697      0.3627625       2.5166759
##       SENT_cooc.W.ADC ASM_cooc.W.ADC Contrast_cooc.W.ADC
##  [1,]     -0.2297138     0.12046668          0.33932322
##  [2,]     -1.1487708     0.10453142         -0.27039311
##  [3,]      0.1752058     0.10267849          1.02076598
##  [4,]     -0.0319484     0.09897261         -0.01102572
##  [5,]     -0.1411365     0.10193731          0.08810514
##  [6,]     -0.7842625     0.09934320          1.85507756
##       Dissimilarity_cooc.W.ADC Inv_diff_cooc.W.ADC Inv_diff_norm_cooc.W.ADC
##  [1,]              -0.13255040          -0.1553491               -0.6079427
##  [2,]              -0.33716774          -0.4606680               -0.5438010
##  [3,]               0.14095967          -0.3883356               -0.5742573
##  [4,]              -0.17910738          -0.4560997               -0.5109719
##  [5,]              -0.04782845          -0.5316046               -0.5551029
##  [6,]               0.83171075          -0.7241103               -0.6098508
##       IDM_cooc.W.ADC IDM_norm_cooc.W.ADC Inv_var_cooc.W.ADC
##  [1,]    -0.03349743         -0.5973520        -0.04727434
##  [2,]    -0.49096209         -0.5502015        -0.51116122
##  [3,]    -0.37454564         -0.5799243        -0.34876260
##  [4,]    -0.44995630         -0.5392978        -0.47829938
##  [5,]    -0.51956613         -0.5542619        -0.57573855
##  [6,]    -0.69179048         -0.5872923        -0.70852330
##       Correlation_cooc.W.ADC Autocorrelation_cooc.W.ADC Tendency_cooc.W.ADC
##  [1,]            -0.70519175                -0.82825568          -0.1239002
##  [2,]            -0.51902018                 0.40596504          -0.3998223
##  [3,]             0.09406992                -0.81538896           1.3894965
##  [4,]             0.05818005                 0.41742441           0.2845655
##  [5,]            -0.52509677                -0.06977856          -0.1595859
##  [6,]             0.19000410                 0.94845945           2.5166759
##       Shade_cooc.W.ADC Prominence_cooc.W.ADC  IC1_d.W.ADC IC2_d.W.ADC
##  [1,]      0.748492311          -0.11542708 -0.903263171  -0.1907350
##  [2,]     -0.849230344          -0.35816223  0.001800882  -0.3183774
##  [3,]      5.445020127           3.59414354 -0.093125575  -0.2756556
##  [4,]     -0.006023108           0.08908301  0.541318048  -0.4760088
##  [5,]     -0.210118336          -0.22271379 -0.075272999  -0.2837085
##  [6,]     -1.349842393           2.39969624 -1.208111301  -0.1245345
##       Coarseness_vdif.W.ADC Contrast_vdif.W.ADC Busyness_vdif.W.ADC
##  [1,]            0.27382766          2.05493666          -0.3772693
##  [2,]            0.07761691         -0.14928773          -0.5719455
##  [3,]           -0.04800583          0.18526528          -0.1397398
##  [4,]           -0.10722798         -0.40258421          -0.3596382
##  [5,]            0.02976063          0.00417449          -0.5038700
##  [6,]            0.01689925          0.99857484          -0.5979023
##       Complexity_vdif.W.ADC Strength_vdif.W.ADC SRE_align.W.ADC LRE_align.W.ADC
##  [1,]            -0.6073412           1.4669901      -0.5607394      -0.5636282
##  [2,]            -0.4755028           0.3446350      -0.5544960      -0.5851724
##  [3,]             0.4134439           1.4197272      -0.5563057      -0.5759453
##  [4,]             0.1805608          -0.3174056      -0.5581606      -0.5711293
##  [5,]            -0.2096065           0.3114865      -0.5550163      -0.5809744
##  [6,]             0.7943650           1.3787764      -0.5492932      -0.6052889
##       GLNU_align.W.ADC RLNU_align.W.ADC RP_align.W.ADC LGRE_align.W.ADC
##  [1,]       -0.6918875       -0.6585680     -0.5598492       0.102514356
```

```
## [2,]      -0.6123816      -0.5705684      -0.5523782       0.011942997
## [3,]      -0.5149668      -0.4530326      -0.5552168       0.016044342
## [4,]      -0.3228389      -0.1392104      -0.5572378       0.066969370
## [5,]      -0.6154673      -0.5417353      -0.5534228       0.005790981
## [6,]      -0.6590509      -0.5222697      -0.5454068      -0.003095266
##        HGRE_align.W.ADC LGSRE_align.W.ADC HGSRE_align.W.ADC LGHRE_align.W.ADC
## [1,]      -0.72391839        0.10748791      -0.72254855        0.077168309
## [2,]       0.31043574        0.01660389       0.31244050       -0.012162463
## [3,]      -0.74102269        0.02037644      -0.73855319       -0.006809308
## [4,]       0.48049736        0.06598993       0.48251611        0.075830020
## [5,]      -0.02339079        0.01043064      -0.02076085       -0.018184762
## [6,]       1.12446188        0.00117076       1.13430855       -0.026883639
##        HGLRE_align.W.ADC GLNU_norm_align.W.ADC RLNU_norm_align.W.ADC
## [1,]      -0.72942321            0.11990386           -0.5601024
## [2,]       0.30239721           -0.03442756           -0.5440640
## [3,]      -0.74942271           -0.08728526           -0.5487189
## [4,]       0.47104532           -0.16167757           -0.5538576
## [5,]      -0.03187296           -0.11012500           -0.5451701
## [6,]       1.08473714           -0.22269232           -0.5301456
##        GLVAR_align.W.ADC RLVAR_align.W.ADC Entropy_align.W.ADC SZSE.W.ADC
## [1,]      0.0390388995      -0.07189017        -0.4489178 -0.5288302
## [2,]     -0.3518347261      -0.16482743        -0.5433374 -0.5737026
## [3,]      1.0925597603      -0.10788699        -0.5008749 -0.5217499
## [4,]      0.2872015907      -0.09381551        -0.3577119 -0.5381157
## [5,]     -0.0005432957      -0.13472099        -0.4469533 -0.5472388
## [6,]      2.1850902501      -0.26889098        -0.2581106 -0.5320105
##        LZSE.W.ADC LGLZE.W.ADC HGLZE.W.ADC SZLGE.W.ADC SZHGE.W.ADC LZLGE.W.ADC
## [1,] -0.6847176 0.113374483 -0.71989596  0.12431381 -0.70418503  0.01531010
## [2,] -0.6013426 0.022597678  0.30739854  0.03294163  0.30621407 -0.06733775
## [3,] -0.4855176 0.026380045 -0.74098507  0.03571049 -0.74294693 -0.05805147
## [4,] -0.6310472 0.053200465  0.47987855  0.04436315  0.49296111  0.07659951
## [5,] -0.5737353 0.016064499 -0.03008663  0.02636560 -0.02934976 -0.07290951
## [6,] -0.6652514 0.006780508  1.11776106  0.01667461  1.13227954 -0.08157670
##        LZHGE.W.ADC GLNU_area.W.ADC ZSNU.W.ADC  ZSP.W.ADC GLNU_norm.W.ADC
## [1,] -0.78023810      -0.6914700 -0.6513787 -0.5068231      0.07698041
## [2,]  0.29762888      -0.6100327 -0.5660417 -0.5606797     -0.06244984
## [3,] -0.72852195      -0.5190294 -0.4563908 -0.5221702      0.26861743
## [4,]  0.42004184      -0.3130419 -0.1207423 -0.5237049     -0.18723674
## [5,] -0.01111977      -0.6144844 -0.5366044 -0.5410354      0.27657578
## [6,]  1.02554608      -0.6568667 -0.5137505 -0.5128675     -0.24612851
##        ZSNU_norm.W.ADC GLVAR_area.W.ADC ZSVAR.W.ADC Entropy_area.W.ADC
## [1,]      -0.4888097      0.040207659 -0.70463402        -0.7414506
## [2,]      -0.5444800     -0.353463617 -0.42606449        -0.5771180
## [3,]      -0.5868989      1.070427270  0.09854219        -0.4508095
## [4,]      -0.5112910      0.284745010 -0.48028511        -0.4046157
## [5,]      -0.5328275      0.002215947 -0.23584790        -0.4859857
## [6,]      -0.4964165      2.154394753 -0.62125871        -0.3202609
```

function to compute total within-cluster sum of square

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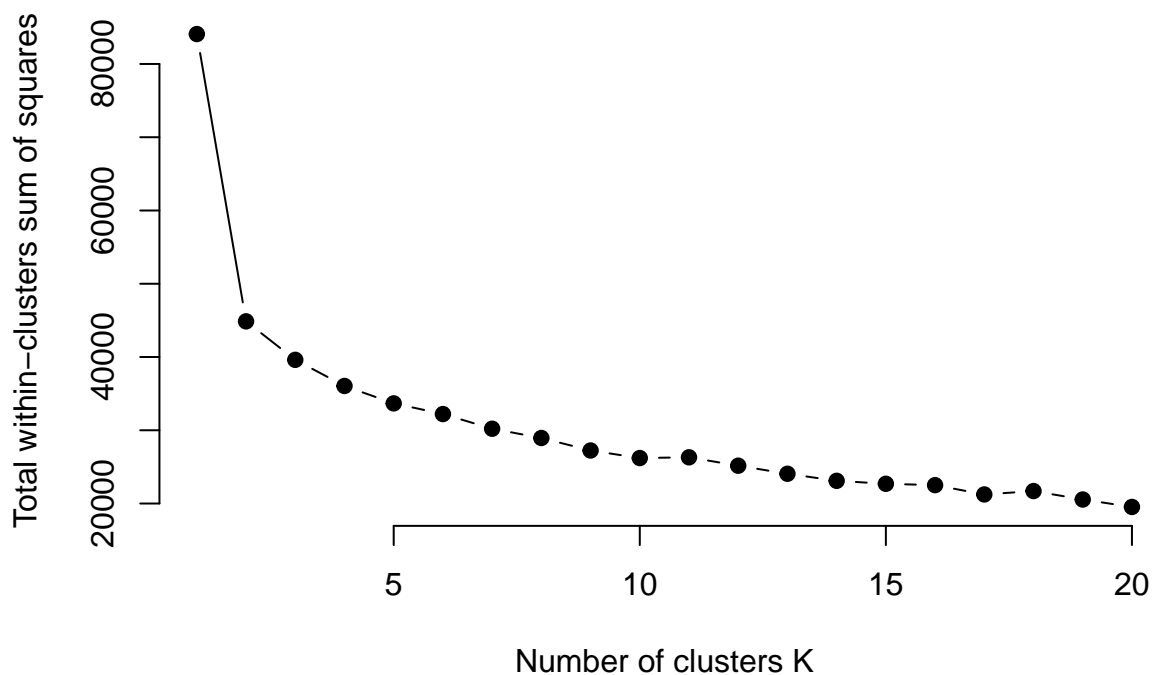
```
}
```

Compute and plot wss for k = 1 to k = 20
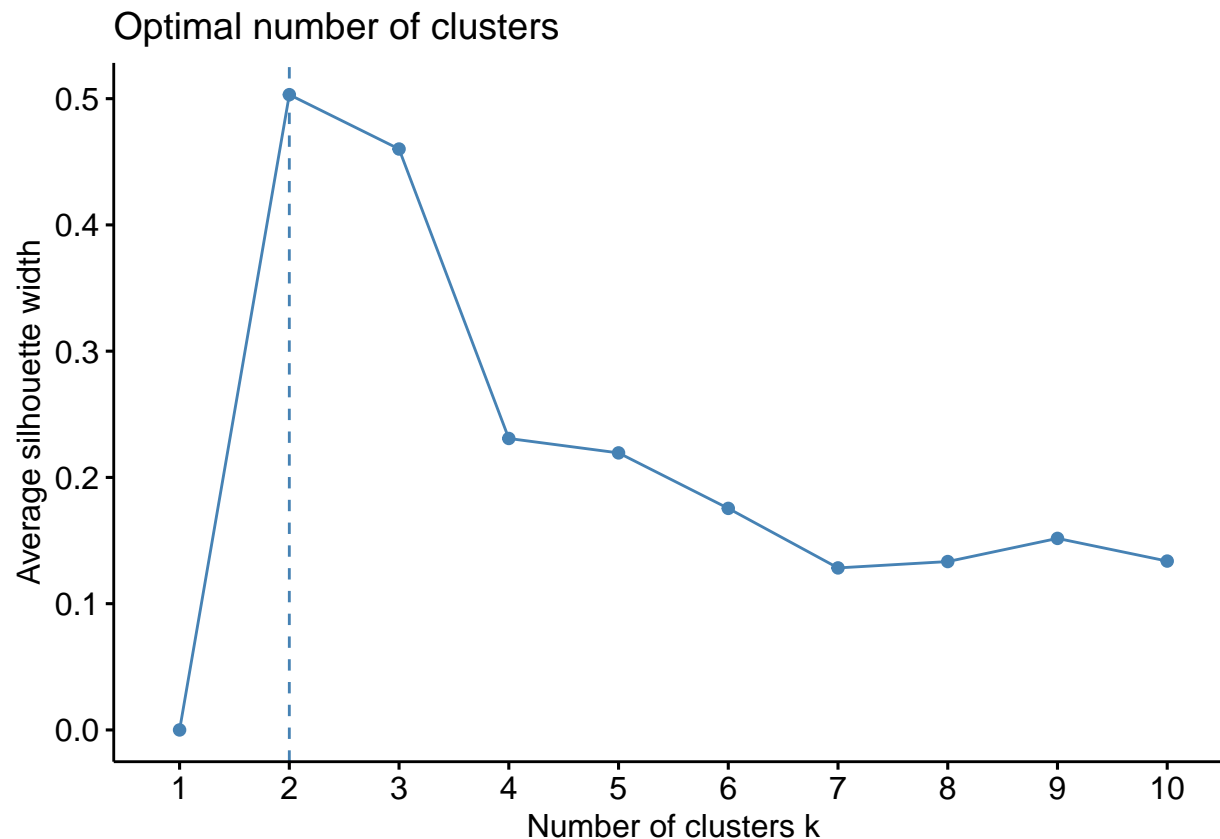
```
k.values <- 1:20
```

extract wss for 2-15 clusters

```
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")
```


#or use thE silhouette
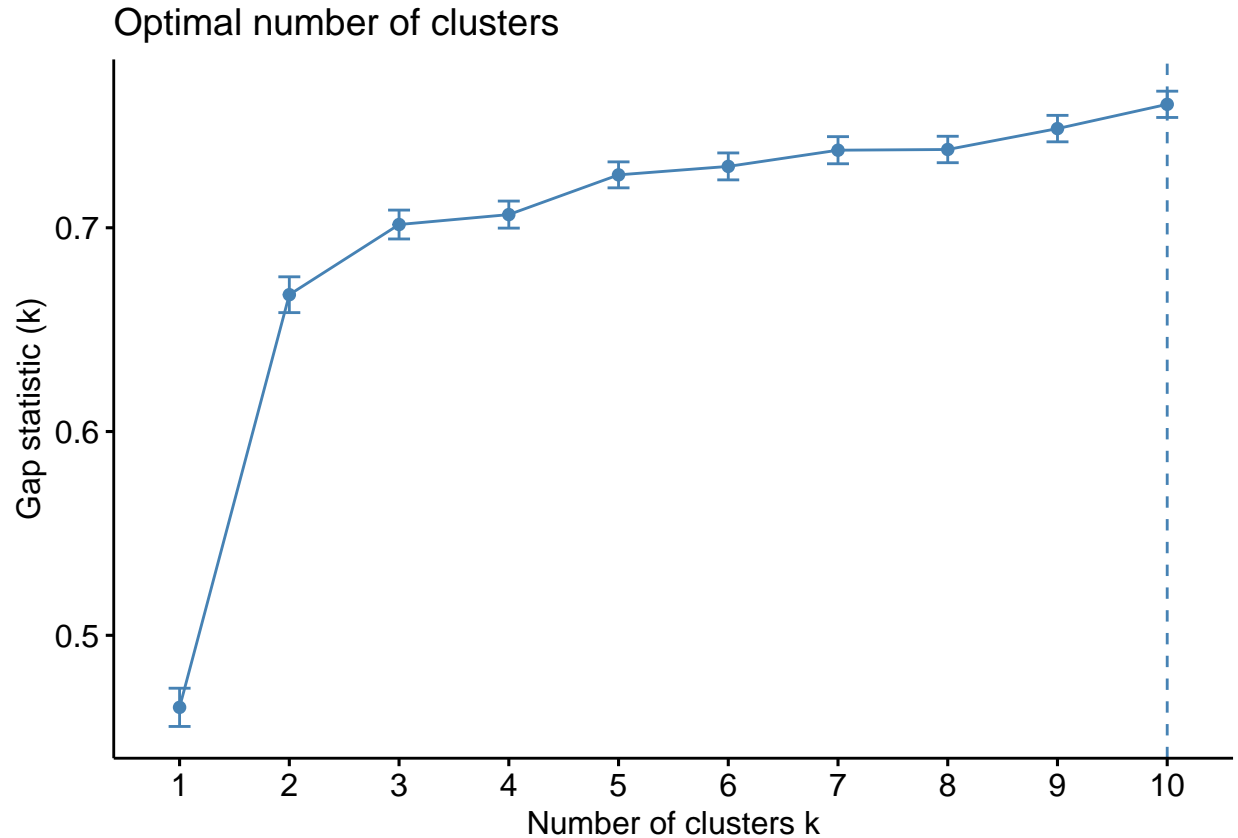
```
fviz_nbclust(Rad, kmeans, method = "silhouette")
```

Optimal number of clusters


```
# compute gap statistic
```

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

Print the result

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

```
## Clustering Gap statistic ["clusGap"] from call:
## clusGap(x = Rad, 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,] 7.171204 7.635853 0.4646496 0.009379996
##  [2,] 6.879524 7.546674 0.6671493 0.008786338
##  [3,] 6.798848 7.500436 0.7015873 0.007082545
##  [4,] 6.760004 7.466467 0.7064633 0.006632270
##  [5,] 6.715614 7.441579 0.7259645 0.006374244
##  [6,] 6.689522 7.419633 0.7301115 0.006603869
##  [7,] 6.661683 7.399745 0.7380616 0.006654018
##  [8,] 6.643211 7.381624 0.7384134 0.006480643
##  [9,] 6.616471 7.365139 0.7486677 0.006484664
## [10,] 6.588968 7.349544 0.7605765 0.006453097
```

```
fviz_gap_stat(gap_stat)
```

Optimal number of clusters


```
# Compute k-means clustering with k = 2
```

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

```
## K-means clustering with 2 clusters of sizes 50, 147
##
## Cluster means:
##        Failure Entropy_cooc.W.ADC GLNU_align.H.PET Min_hist.PET Max_hist.PET
## 1 -0.0014733768         0.04845450      -0.07901100    0.9204612    0.9468341
## 2  0.0005011486        -0.01648112       0.02687449   -0.3130820   -0.3220524
##   Mean_hist.PET Variance_hist.PET Standard_Deviation_hist.PET Skewness_hist.PET
## 1     0.9216792         0.4594337                   0.9319222         0.9115602
## 2    -0.3134963        -0.1562700                  -0.3169804        -0.3100545
##   Kurtosis_hist.PET Energy_hist.PET Entropy_hist.PET AUC_hist.PET  H_suv.PET
## 1        0.25274217       0.6864958        1.5003007    1.6957546  0.9652219
## 2       -0.08596673      -0.2335020       -0.5103064   -0.5767873 -0.3283068
##   Volume.PET X3D_surface.PET ratio_3ds_vol.PET ratio_3ds_vol_norm.PET
## 1  0.5900077       0.3802612         0.9436984              0.9622506
## 2 -0.2006829      -0.1293406        -0.3209858             -0.3272961
##   irregularity.PET tumor_length.PET Compactness_v1.PET Compactness_v2.PET
## 1        1.6522842        1.0256292          0.8807232          0.4324058
## 2       -0.5620014       -0.3488535         -0.2995657         -0.1470768
##   Spherical_disproportion.PET Sphericity.PET Asphericity.PET Center_of_mass.PET
```

```
## 1                0.9622506      0.4460709      0.9240341          0.6358358
## 2               -0.3272961     -0.1517248     -0.3142973         -0.2162707
##   Max_3D_diam.PET Major_axis_length.PET Minor_axis_length.PET
## 1      0.8259982             0.8904297               1.1433164
## 2     -0.2809518            -0.3028672              -0.3888831
##   Least_axis_length.PET Elongation.PET Flatness.PET Max_cooc.L.PET
## 1             0.9772289      1.4563692    1.3553445      0.7290795
## 2            -0.3323908     -0.4953637   -0.4610015     -0.2479862
##   Average_cooc.L.PET Variance_cooc.L.PET Entropy_cooc.L.PET DAVE_cooc.L.PET
## 1           1.389215           1.1041050          1.6813985       1.2936781
## 2          -0.472522          -0.3755459         -0.5719043      -0.4400266
##   DVAR_cooc.L.PET DENT_cooc.L.PET SAVE_cooc.L.PET SVAR_cooc.L.PET
## 1       1.1366603       1.6603800       1.3889879       1.1209781
## 2      -0.3866192      -0.5647551      -0.4724449      -0.3812851
##   SENT_cooc.L.PET ASM_cooc.L.PET Contrast_cooc.L.PET Dissimilarity_cooc.L.PET
## 1       1.6614758      0.6775498           0.9285775                1.2936781
## 2      -0.5651278     -0.2304591          -0.3158427               -0.4400266
##   Inv_diff_cooc.L.PET Inv_diff_norm_cooc.L.PET IDM_cooc.L.PET
## 1            1.443028                1.6979660      1.2814891
## 2           -0.490826               -0.5775395     -0.4358807
##   IDM_norm_cooc.L.PET Inv_var_cooc.L.PET Correlation_cooc.L.PET
## 1           1.7046571          1.2896785               1.123648
## 2          -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 SZHGE.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
```

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## 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
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## 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
```

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## 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 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
##  [38] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
##  [75] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
## [112] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1
## [149] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [186] 1 1 1 1 1 1 1 1 1 1 1 1 1
##
## Within cluster sum of squares by cluster:
## [1] 21058.70 23808.27
##  (between_SS / total_SS =  46.6 %)
##
## Available components:
##
## [1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
```

```
## [6] "betweenss"      "size"           "iter"           "ifault"
```

#final data

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