ML bpalazzo_5

Brandon Palazzo

11/30/2020

Data Cleaning and Manipulation

```
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------------------- tidyverse 1.3.0 --

## v ggplot2 3.3.2     v purrr   0.3.4
## v tibble  3.0.3     v dplyr   1.0.2
## v tidyr   1.1.2     v stringr 1.4.0
## v readr   1.4.0     v forcats 0.5.0

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

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

```
## Warning: package 'factoextra' was built under R version 4.0.3

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

```
library(dendextend)
```

```
## Warning: package 'dendextend' was built under R version 4.0.3

##
## ---------------------
## Welcome to dendextend version 1.14.0
## Type citation('dendextend') for how to cite the package.
##
## Type browseVignettes(package = 'dendextend') for the package vignette.
## The github page is: https://github.com/talgalili/dendextend/
##
## Suggestions and bug-reports can be submitted at: https://github.com/talgalili/dendextend/issues
## Or contact: <tal.galili@gmail.com>
##
##  To suppress this message use:  suppressPackageStartupMessages(library(dendextend))
## ---------------------
```

```
##
## Attaching package: 'dendextend'
```

```
## The following object is masked from 'package:stats':
##
##     cutree
```

```
library(caTools)
```

```
## Warning: package 'caTools' was built under R version 4.0.3
```

```
library(clValid)
```

```
## Warning: package 'clValid' was built under R version 4.0.3
```

```
cereals <- read.csv("Cereals.csv")

row.names(cereals) <- cereals[,1]

cereals <- cereals[,-1]

str(cereals)
```

```
## 'data.frame':    77 obs. of  15 variables:
##  $ mfr     : chr  "N" "Q" "K" "K" ...
##  $ type    : chr  "C" "C" "C" "C" ...
##  $ calories: int  70 120 70 50 110 110 110 130 90 90 ...
##  $ protein : int  4 3 4 4 2 2 2 3 2 3 ...
##  $ fat     : int  1 5 1 0 2 2 0 2 1 0 ...
##  $ sodium  : int  130 15 260 140 200 180 125 210 200 210 ...
##  $ fiber   : num  10 2 9 14 1 1.5 1 2 4 5 ...
##  $ carbo   : num  5 8 7 8 14 10.5 11 18 15 13 ...
##  $ sugars  : int  6 8 5 0 8 10 14 8 6 5 ...
##  $ potass  : int  280 135 320 330 NA 70 30 100 125 190 ...
##  $ vitamins: int  25 0 25 25 25 25 25 25 25 25 ...
##  $ shelf   : int  3 3 3 3 3 1 2 3 1 3 ...
##  $ weight  : num  1 1 1 1 1 1 1 1.33 1 1 ...
##  $ cups    : num  0.33 1 0.33 0.5 0.75 0.75 1 0.75 0.67 0.67 ...
##  $ rating  : num  68.4 34 59.4 93.7 34.4 ...
```

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

cereals_num <- cereals[, c(-1, -2, -12)]

cereals_num_scale <- scale(cereals_num)
```

Compute Euclidean distance

```r
d <- dist(cereals_num_scale, method = "euclidean")


hc_com <- agnes(d, method = "complete")
hc_avg <- agnes(d, method = "average")
hc_sin <- agnes(d, method = "single")
hc_ward <- agnes(d, method = "ward")


hc_com$ac   # 0.8469328
```

```
## [1] 0.8469328
```

```r
hc_avg$ac   # 0.7881955
```

```
## [1] 0.7881955
```

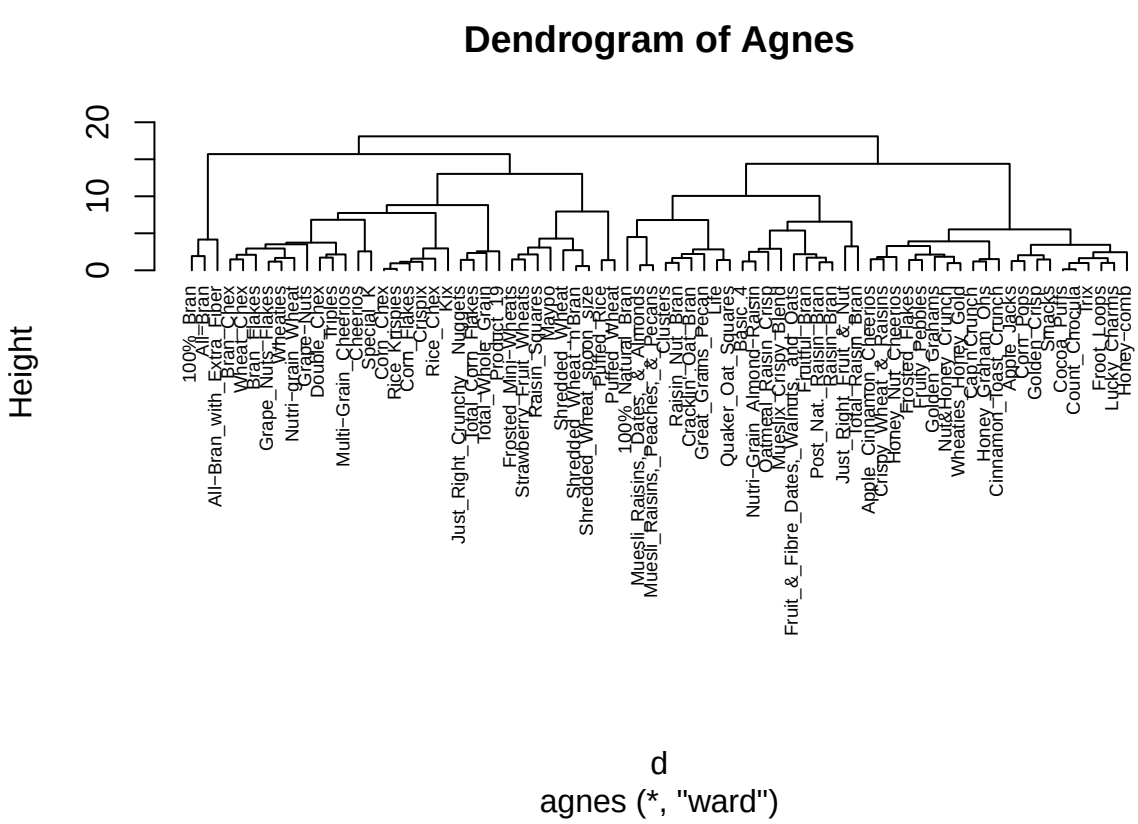
```r
hc_sin$ac   # 0.6072384
```

```
## [1] 0.6072384
```

```r
hc_ward$ac  # 0.9087265
```

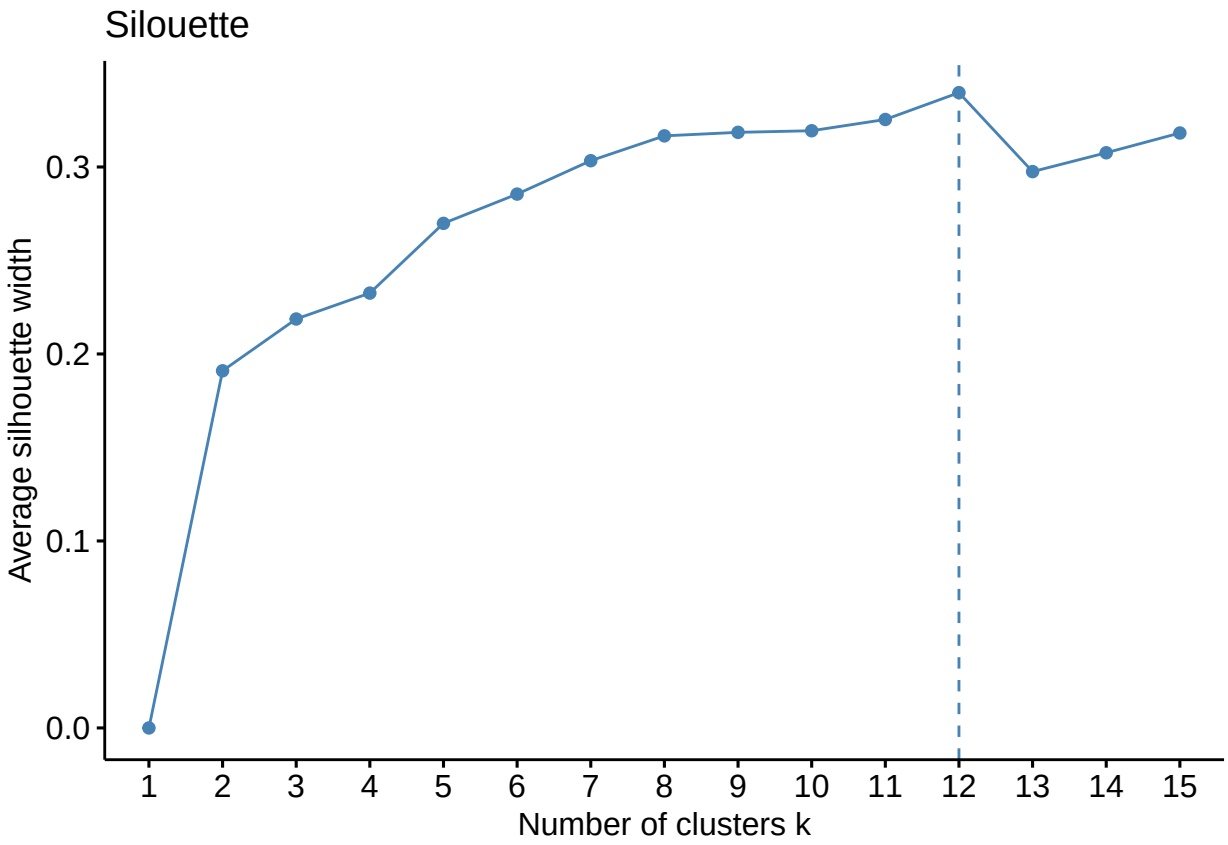
```
## [1] 0.9087265
```

```r
#Based on the highest agglomerative coefficient, the best method to use for this problem is Ward's Meth

#The biggest difference between hierarchical and k-means clustering is that k-means requires a pre-spec

pltree(hc_ward, cex = 0.6, hang = -1, main = "Dendrogram of Agnes")
```



Determining how many clusters to use

```
fviz_nbclust(cereals_num_scale, FUN = hcut, method = "silhouette", k.max = 15) + ggtitle("Silouette")
```




```
#Based on the silhouette method and studying the dendrogram,the ideal amount of clusters is 12.
```

```
cluster_groups <- cutree(hc_ward, k = 12)
cluster_groups
```

```
##                       100%_Bran                 100%_Natural_Bran
##                               1                                 2
##                         All-Bran            All-Bran_with_Extra_Fiber
##                               1                                 1
##           Apple_Cinnamon_Cheerios                       Apple_Jacks
##                               3                                 3
##                         Basic_4                         Bran_Chex
##                               4                                 5
##                     Bran_Flakes                     Cap'n'Crunch
##                               5                                 3
##                         Cheerios               Cinnamon_Toast_Crunch
##                               6                                 3
##                        Clusters                       Cocoa_Puffs
##                               7                                 3
##                       Corn_Chex                       Corn_Flakes
##                               8                                 8
##                       Corn_Pops                     Count_Chocula
##                               3                                 3
##             Cracklin'_Oat_Bran                           Crispix
##                               7                                 8
```

```
##                 Crispy_Wheat_&_Raisins                           Double_Chex
##                                      3                                     5
##                            Froot_Loops                         Frosted_Flakes
##                                      3                                     3
##                   Frosted_Mini-Wheats Fruit_&_Fibre_Dates,_Walnuts,_and_Oats
##                                      9                                     4
##                          Fruitful_Bran                         Fruity_Pebbles
##                                      4                                     3
##                           Golden_Crisp                        Golden_Grahams
##                                      3                                     3
##                       Grape_Nuts_Flakes                            Grape-Nuts
##                                      5                                     5
##                     Great_Grains_Pecan                       Honey_Graham_Ohs
##                                      7                                     3
##                     Honey_Nut_Cheerios                           Honey-comb
##                                      3                                     3
##           Just_Right_Crunchy__Nuggets                  Just_Right_Fruit_&_Nut
##                                     10                                    11
##                                    Kix                                  Life
##                                      8                                     7
##                            Lucky_Charms                                Maypo
##                                      3                                     9
##       Muesli_Raisins,_Dates,_&_Almonds      Muesli_Raisins,_Peaches,_&_Pecans
##                                      2                                     2
##                   Mueslix_Crispy_Blend                  Multi-Grain_Cheerios
##                                      4                                     5
##                      Nut&Honey_Crunch              Nutri-Grain_Almond-Raisin
##                                      3                                     4
##                     Nutri-grain_Wheat                  Oatmeal_Raisin_Crisp
##                                      5                                     4
##                  Post_Nat._Raisin_Bran                            Product_19
##                                      4                                    10
##                           Puffed_Rice                          Puffed_Wheat
##                                     12                                    12
##                     Quaker_Oat_Squares                           Raisin_Bran
##                                      7                                     4
##                       Raisin_Nut_Bran                         Raisin_Squares
##                                      7                                     9
##                             Rice_Chex                          Rice_Krispies
##                                      8                                     8
##                       Shredded_Wheat                Shredded_Wheat_'n'Bran
##                                      9                                     9
##              Shredded_Wheat_spoon_size                                Smacks
##                                      9                                     3
##                            Special_K                Strawberry_Fruit_Wheats
##                                      6                                     9
##                     Total_Corn_Flakes                     Total_Raisin_Bran
##                                     10                                    11
##                     Total_Whole_Grain                               Triples
##                                     10                                    5
##                                   Trix                             Wheat_Chex
##                                      3                                     5
##                               Wheaties                    Wheaties_Honey_Gold
##                                      5                                     3
```

```r
tapply(cereals$calories, cluster_groups, mean)
```

```
##         1         2         3         4         5         6         7         8
##  63.33333 140.00000 110.95238 130.00000  99.00000 110.00000 106.66667 108.33333
##         9        10        11        12
##  91.42857 105.00000 140.00000  50.00000
```

Stability Testing

```r
smp_size <- floor(0.75 * nrow(cereals_num_scale))


set.seed(123)
train_ind <- sample(seq_len(nrow(cereals_num_scale)), size = smp_size)

train <- cereals_num_scale[train_ind, ]
test <- cereals_num_scale[-train_ind, ]

train
```

```
##                                       calories    protein        fat
## Grape_Nuts_Flakes                    -0.3541153  0.4522084  0.0000000
## Post_Nat._Raisin_Bran                 0.6537514  0.4522084  0.0000000
## Cocoa_Puffs                           0.1498180 -1.4068705  0.0000000
## Total_Corn_Flakes                     0.1498180 -0.4773310  0.0000000
## Maypo                                -0.3541153  1.3817478  0.0000000
## Oatmeal_Raisin_Crisp                  1.1576848  0.4522084  0.9932203
## Muesli_Raisins,_Dates,_&_Almonds      2.1655516  1.3817478  1.9864405
## Wheat_Chex                           -0.3541153  0.4522084  0.0000000
## Frosted_Mini-Wheats                  -0.3541153  0.4522084 -0.9932203
## Raisin_Nut_Bran                      -0.3541153  0.4522084  0.9932203
## Fruity_Pebbles                        0.1498180 -1.4068705  0.0000000
## Special_K                             0.1498180  3.2408266 -0.9932203
## Bran_Flakes                          -0.8580487  0.4522084 -0.9932203
## Golden_Crisp                         -0.3541153 -0.4773310 -0.9932203
## Honey_Nut_Cheerios                    0.1498180  0.4522084  0.0000000
## Bran_Chex                            -0.8580487 -0.4773310  0.0000000
## Fruit_&_Fibre_Dates,_Walnuts,_and_Oats  0.6537514  0.4522084  0.9932203
## Basic_4                               1.1576848  0.4522084  0.9932203
## Triples                               0.1498180 -0.4773310  0.0000000
## Shredded_Wheat_'n'Bran               -0.8580487  0.4522084 -0.9932203
## Cracklin'_Oat_Bran                    0.1498180  0.4522084  1.9864405
## Honey-comb                            0.1498180 -1.4068705 -0.9932203
## Trix                                  0.1498180 -1.4068705  0.0000000
## Corn_Pops                             0.1498180 -1.4068705 -0.9932203
## Total_Raisin_Bran                     1.6616182  0.4522084  0.0000000
## Kix                                   0.1498180 -0.4773310  0.0000000
## Cinnamon_Toast_Crunch                 0.6537514 -1.4068705  1.9864405
## Corn_Chex                             0.1498180 -0.4773310 -0.9932203
## Grape-Nuts                            0.1498180  0.4522084 -0.9932203
## Raisin_Bran                           0.6537514  0.4522084  0.0000000
## Shredded_Wheat_spoon_size            -0.8580487  0.4522084 -0.9932203
```

```
## Quaker_Oat_Squares                       -0.3541153  1.3817478  0.0000000
## Lucky_Charms                              0.1498180 -0.4773310  0.0000000
## Cap'n'Crunch                              0.6537514 -1.4068705  0.9932203
## Froot_Loops                               0.1498180 -0.4773310  0.0000000
## Fruitful_Bran                             0.6537514  0.4522084 -0.9932203
## Muesli_Raisins,_Peaches,_&_Pecans         2.1655516  1.3817478  1.9864405
## Nutri-grain_Wheat                        -0.8580487  0.4522084 -0.9932203
## Multi-Grain_Cheerios                     -0.3541153 -0.4773310  0.0000000
## Strawberry_Fruit_Wheats                  -0.8580487 -0.4773310 -0.9932203
## Honey_Graham_Ohs                          0.6537514 -1.4068705  0.9932203
## Shredded_Wheat                           -1.3619821 -0.4773310 -0.9932203
## Apple_Cinnamon_Cheerios                   0.1498180 -0.4773310  0.9932203
## Rice_Chex                                 0.1498180 -1.4068705 -0.9932203
## Nutri-Grain_Almond-Raisin                 1.6616182  0.4522084  0.9932203
## Clusters                                  0.1498180  0.4522084  0.9932203
## Count_Chocula                             0.1498180 -1.4068705  0.0000000
## 100%_Bran                                -1.8659155  1.3817478  0.0000000
## Rice_Krispies                             0.1498180 -0.4773310 -0.9932203
## Raisin_Squares                           -0.8580487 -0.4773310 -0.9932203
## Apple_Jacks                               0.1498180 -0.4773310 -0.9932203
## Crispy_Wheat_&_Raisins                   -0.3541153 -0.4773310  0.0000000
## Nut&Honey_Crunch                          0.6537514 -0.4773310  0.0000000
## Total_Whole_Grain                        -0.3541153  0.4522084  0.0000000
## Double_Chex                              -0.3541153 -0.4773310 -0.9932203
##                                              sodium       fiber       carbo
## Grape_Nuts_Flakes                        -0.27020566  0.34015322  0.06944832
## Post_Nat._Raisin_Bran                     0.45469653  1.57808790 -0.95838683
## Cocoa_Puffs                               0.21306247 -0.89778146 -0.70142805
## Total_Corn_Flakes                         0.45469653 -0.89778146  1.61120105
## Maypo                                    -1.96164410 -0.89778146  0.32640711
## Oatmeal_Raisin_Crisp                      0.09224544 -0.27881412 -0.31598986
## Muesli_Raisins,_Dates,_&_Almonds         -0.81388230  0.34015322  0.32640711
## Wheat_Chex                                0.81714763  0.34015322  0.58336590
## Frosted_Mini-Wheats                      -1.96164410  0.34015322 -0.18751047
## Raisin_Nut_Bran                          -0.27020566  0.13383078 -1.08686623
## Fruity_Pebbles                           -0.33061417 -0.89778146 -0.44446926
## Special_K                                 0.81714763 -0.48513656  0.32640711
## Bran_Flakes                               0.57551356  1.16544301 -0.44446926
## Golden_Crisp                             -1.41796746 -0.89778146 -0.95838683
## Honey_Nut_Cheerios                        1.05878169 -0.27881412 -0.82990744
## Bran_Chex                                 0.45469653  0.75279812  0.06944832
## Fruit_&_Fibre_Dates,_Walnuts,_and_Oats -0.02857160  1.16544301 -0.70142805
## Basic_4                                   0.57551356 -0.07249167  0.84032469
## Triples                                   1.05878169 -0.89778146  1.61120105
## Shredded_Wheat_'n'Bran                   -1.96164410  0.75279812  1.09728348
## Cracklin'_Oat_Bran                       -0.27020566  0.75279812 -1.21534562
## Honey-comb                                0.21306247 -0.89778146 -0.18751047
## Trix                                     -0.27020566 -0.89778146 -0.44446926
## Corn_Pops                                -0.87429082 -0.48513656 -0.44446926
## Total_Raisin_Bran                         0.33387950  0.75279812  0.06944832
## Kix                                       1.17959872 -0.89778146  1.61120105
## Cinnamon_Toast_Crunch                     0.57551356 -0.89778146 -0.44446926
## Corn_Chex                                 1.42123279 -0.89778146  1.86815984
## Grape-Nuts                                0.09224544  0.34015322  0.58336590
```

```
## Raisin_Bran                               0.57551356  1.16544301 -0.18751047
## Shredded_Wheat_spoon_size                -1.96164410  0.34015322  1.35424227
## Quaker_Oat_Squares                       -0.33061417 -0.07249167 -0.18751047
## Lucky_Charms                              0.21306247 -0.89778146 -0.70142805
## Cap'n'Crunch                              0.69633060 -0.89778146 -0.70142805
## Froot_Loops                              -0.45143121 -0.48513656 -0.95838683
## Fruitful_Bran                             0.93796466  1.16544301 -0.18751047
## Muesli_Raisins,_Peaches,_&_Pecans        -0.14938863  0.34015322  0.32640711
## Nutri-grain_Wheat                         0.09224544  0.34015322  0.84032469
## Multi-Grain_Cheerios                      0.69633060 -0.07249167  0.06944832
## Strawberry_Fruit_Wheats                  -1.78041856  0.34015322  0.06944832
## Honey_Graham_Ohs                          0.69633060 -0.48513656 -0.70142805
## Shredded_Wheat                           -1.96164410  0.34015322  0.32640711
## Apple_Cinnamon_Cheerios                   0.21306247 -0.27881412 -1.08686623
## Rice_Chex                                 0.93796466 -0.89778146  2.12511863
## Nutri-Grain_Almond-Raisin                 0.69633060  0.34015322  1.61120105
## Clusters                                 -0.27020566 -0.07249167 -0.44446926
## Count_Chocula                             0.21306247 -0.89778146 -0.70142805
## 100%_Bran                                -0.39102269  3.22866747 -2.50013957
## Rice_Krispies                             1.54204982 -0.89778146  1.86815984
## Raisin_Squares                           -1.96164410 -0.07249167  0.06944832
## Apple_Jacks                              -0.45143121 -0.48513656 -0.95838683
## Crispy_Wheat_&_Raisins                   -0.27020566 -0.07249167 -0.95838683
## Nut&Honey_Crunch                          0.33387950 -0.89778146  0.06944832
## Total_Whole_Grain                         0.45469653  0.34015322  0.32640711
## Double_Chex                               0.33387950 -0.48513656  0.84032469
##                                              sugars      potass   vitamins
## Grape_Nuts_Flakes                        -0.48360961 -0.19065695 -0.1818422
## Post_Nat._Raisin_Bran                     1.58103142  2.27835060 -0.1818422
## Cocoa_Puffs                               1.35162686 -0.61391539 -0.1818422
## Total_Corn_Flakes                        -0.94241873 -0.89608768  3.1822385
## Maypo                                    -0.94241873 -0.04957081 -0.1818422
## Oatmeal_Raisin_Crisp                      0.66341318  0.30314456 -0.1818422
## Muesli_Raisins,_Dates,_&_Almonds          0.89281774  1.00857529 -0.1818422
## Wheat_Chex                               -0.94241873  0.23260148 -0.1818422
## Frosted_Mini-Wheats                      -0.02480049  0.02097226 -0.1818422
## Raisin_Nut_Bran                           0.20460407  0.58531685 -0.1818422
## Fruity_Pebbles                            1.12222230 -1.03717383 -0.1818422
## Special_K                                -0.94241873 -0.61391539 -0.1818422
## Bran_Flakes                              -0.48360961  1.29074758 -0.1818422
## Golden_Crisp                              1.81043598 -0.82554461 -0.1818422
## Honey_Nut_Cheerios                        0.66341318 -0.12011388 -0.1818422
## Bran_Chex                                -0.25420505  0.37368763 -0.1818422
## Fruit_&_Fibre_Dates,_Walnuts,_and_Oats    0.66341318  1.43183372 -0.1818422
## Basic_4                                   0.20460407  0.02097226 -0.1818422
## Triples                                  -0.94241873 -0.54337232 -0.1818422
## Shredded_Wheat_'n'Bran                   -1.63063240  0.58531685 -1.3032024
## Cracklin'_Oat_Bran                       -0.02480049  0.86748914 -0.1818422
## Honey-comb                                0.89281774 -0.89608768 -0.1818422
## Trix                                      1.12222230 -1.03717383 -0.1818422
## Corn_Pops                                 1.12222230 -1.10771690 -0.1818422
## Total_Raisin_Bran                         1.58103142  1.85509216  3.1822385
## Kix                                      -0.94241873 -0.82554461 -0.1818422
## Cinnamon_Toast_Crunch                     0.43400862 -0.75500154 -0.1818422
```

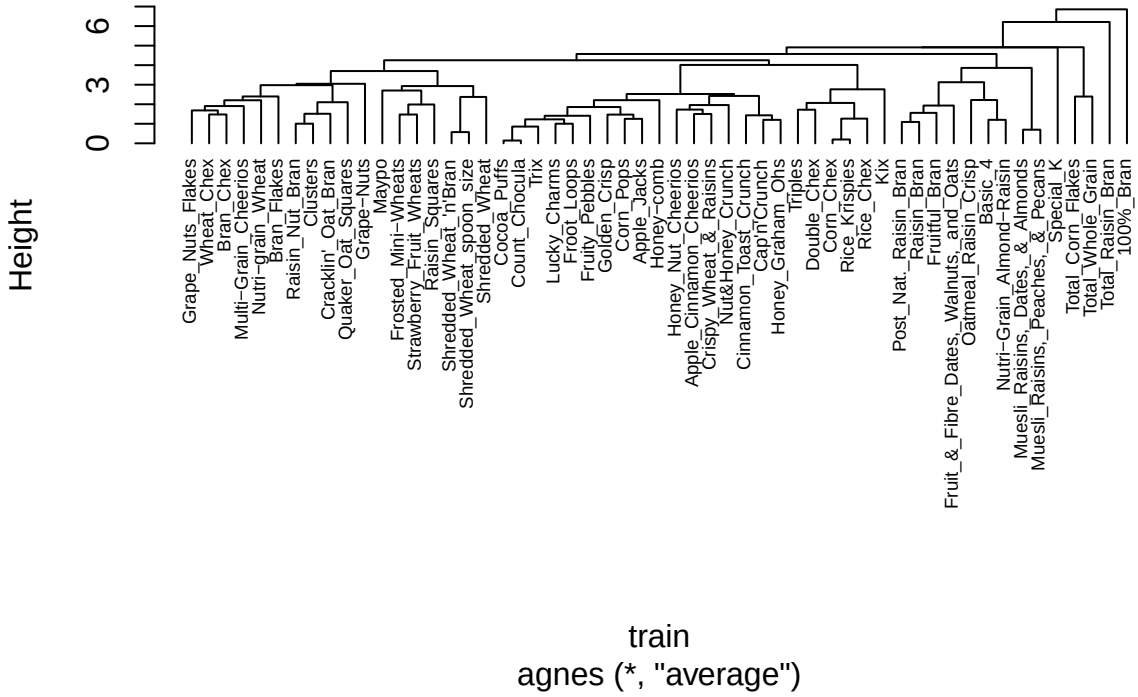
```
## Corn_Chex                                -0.94241873 -1.03717383 -0.1818422
## Grape-Nuts                               -0.94241873 -0.12011388 -0.1818422
## Raisin_Bran                               1.12222230  1.99617831 -0.1818422
## Shredded_Wheat_spoon_size                -1.63063240  0.30314456 -1.3032024
## Quaker_Oat_Squares                       -0.25420505  0.16205841 -0.1818422
## Lucky_Charms                              1.12222230 -0.61391539 -0.1818422
## Cap'n'Crunch                              1.12222230 -0.89608768 -0.1818422
## Froot_Loops                               1.35162686 -0.96663076 -0.1818422
## Fruitful_Bran                             1.12222230  1.29074758 -0.1818422
## Muesli_Raisins,_Peaches,_&_Pecans         0.89281774  1.00857529 -0.1818422
## Nutri-grain_Wheat                        -1.17182329 -0.12011388 -0.1818422
## Multi-Grain_Cheerios                     -0.25420505 -0.12011388 -0.1818422
## Strawberry_Fruit_Wheats                  -0.48360961 -0.12011388 -0.1818422
## Honey_Graham_Ohs                          0.89281774 -0.75500154 -0.1818422
## Shredded_Wheat                           -1.63063240 -0.04957081 -1.3032024
## Apple_Cinnamon_Cheerios                   0.66341318 -0.40228617 -0.1818422
## Rice_Chex                                -1.17182329 -0.96663076 -0.1818422
## Nutri-Grain_Almond-Raisin                -0.02480049  0.44423070 -0.1818422
## Clusters                                 -0.02480049  0.09151534 -0.1818422
## Count_Chocula                             1.35162686 -0.47282925 -0.1818422
## 100%_Bran                                -0.25420505  2.56052289 -0.1818422
## Rice_Krispies                            -0.94241873 -0.89608768 -0.1818422
## Raisin_Squares                           -0.25420505  0.16205841 -0.1818422
## Apple_Jacks                               1.58103142 -0.96663076 -0.1818422
## Crispy_Wheat_&_Raisins                    0.66341318  0.30314456 -0.1818422
## Nut&Honey_Crunch                          0.43400862 -0.82554461 -0.1818422
## Total_Whole_Grain                        -0.94241873  0.16205841  3.1822385
## Double_Chex                              -0.48360961 -0.26120003 -0.1818422
##                                             weight        cups      rating
## Grape_Nuts_Flakes                        -0.2008324  0.24766475  0.69155685
## Post_Nat._Raisin_Bran                     1.9501886 -0.64324039 -0.32287913
## Cocoa_Puffs                              -0.2008324  0.75675340 -1.39915514
## Total_Corn_Flakes                        -0.2008324  0.75675340 -0.25168258
## Maypo                                    -0.2008324  0.75675340  0.88922515
## Oatmeal_Raisin_Crisp                      1.4287290 -1.36444931 -0.84945049
## Muesli_Raisins,_Dates,_&_Almonds         -0.2008324  0.75675340 -0.37302488
## Wheat_Chex                               -0.2008324 -0.64324039  0.52841741
## Frosted_Mini-Wheats                      -0.2008324 -0.09172768  1.13821301
## Raisin_Nut_Bran                          -0.2008324 -1.36444931 -0.19014120
## Fruity_Pebbles                           -0.2008324 -0.30384795 -1.02225423
## Special_K                                -0.2008324  0.75675340  0.76669214
## Bran_Flakes                              -0.2008324 -0.64324039  0.77969576
## Golden_Crisp                             -0.2008324  0.24766475 -0.50730289
## Honey_Nut_Cheerios                       -0.2008324 -0.30384795 -0.80517325
## Bran_Chex                                -0.2008324 -0.64324039  0.48087533
## Fruit_&_Fibre_Dates,_Walnuts,_and_Oats    1.4287290 -0.64324039 -0.10366038
## Basic_4                                   1.9501886 -0.30384795 -0.38002951
## Triples                                  -0.2008324 -0.30384795 -0.23269772
## Shredded_Wheat_'n'Bran                   -0.2008324 -0.64324039  2.28743193
## Cracklin'_Oat_Bran                       -0.2008324 -1.36444931 -0.13702824
## Honey-comb                               -0.2008324  2.15674718 -0.97118798
## Trix                                     -0.2008324  0.75675340 -1.04166919
## Corn_Pops                                -0.2008324  0.75675340 -0.46951197
## Total_Raisin_Bran                         3.0582904  0.75675340 -0.98185009
```

```
## Kix                                  -0.2008324  2.87795610 -0.22308231
## Cinnamon_Toast_Crunch                -0.2008324 -0.30384795 -1.60671768
## Corn_Chex                            -0.2008324  0.75675340 -0.06603869
## Grape-Nuts                           -0.2008324 -2.42505066  0.78377123
## Raisin_Bran                           1.9501886 -0.30384795 -0.22179377
## Shredded_Wheat_spoon_size            -0.2008324 -0.64324039  2.16834997
## Quaker_Oat_Squares                   -0.2008324 -1.36444931  0.50878106
## Lucky_Charms                         -0.2008324  0.75675340 -1.11426481
## Cap'n'Crunch                         -0.2008324 -0.30384795 -1.73360655
## Froot_Loops                          -0.2008324  0.75675340 -0.72427057
## Fruitful_Bran                         1.9501886 -0.64324039 -0.09664548
## Muesli_Raisins,_Peaches,_&_Pecans    -0.2008324  0.75675340 -0.58658904
## Nutri-grain_Wheat                    -0.2008324  0.75675340  1.23068291
## Multi-Grain_Cheerios                 -0.2008324  0.75675340 -0.16145563
## Strawberry_Fruit_Wheats              -0.2008324  0.75675340  1.21081332
## Honey_Graham_Ohs                     -0.2008324  0.75675340 -1.46080340
## Shredded_Wheat                       -1.3089342  0.75675340  1.84299757
## Apple_Cinnamon_Cheerios              -0.2008324 -0.30384795 -0.91652483
## Rice_Chex                            -0.2008324  1.30826610 -0.02656845
## Nutri-Grain_Almond-Raisin             1.9501886 -0.64324039 -0.11967375
## Clusters                             -0.2008324 -1.36444931 -0.14048876
## Count_Chocula                        -0.2008324  0.75675340 -1.42337774
## 100%_Bran                            -0.2008324 -2.08565823  1.85490376
## Rice_Krispies                        -0.2008324  0.75675340 -0.12909114
## Raisin_Squares                       -0.2008324 -1.36444931  0.92358705
## Apple_Jacks                          -0.2008324  0.75675340 -0.65539984
## Crispy_Wheat_&_Raisins               -0.2008324 -0.30384795 -0.44147911
## Nut&Honey_Crunch                     -0.2008324 -0.64324039 -0.88697142
## Total_Whole_Grain                    -0.2008324  0.75675340  0.30548275
## Double_Chex                          -0.2008324 -0.30384795  0.13959735
```

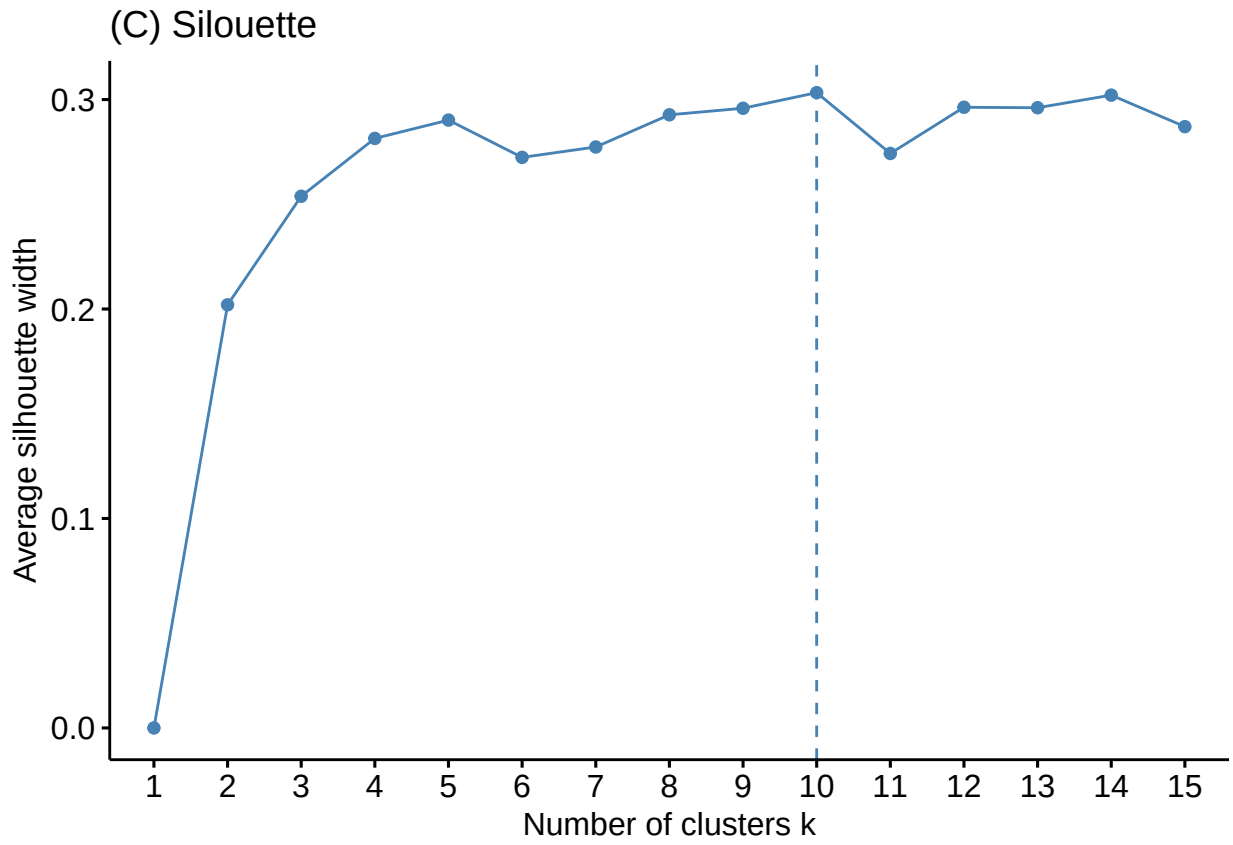
```
hc2_avg <- agnes(train, method = "average")

hc2_avg$ac # 0.7492276
```

```
## [1] 0.7492276
```

```
pltree(hc2_avg, cex = 0.6, hang = -1, main = "Dendrogram of Training Data")
```




```
fviz_nbclust(train, FUN = hcut, method = "silhouette", k.max = 15) + ggtitle("(C) Silouette")
```




```
cluster_groups2 <- cutree(hc2_avg, k = 10)

cluster_groups2
```

```
##                         Grape_Nuts_Flakes                   Post_Nat._Raisin_Bran
##                                         1                                       2
##                              Cocoa_Puffs                      Total_Corn_Flakes
##                                         3                                       4
##                                    Maypo                    Oatmeal_Raisin_Crisp
##                                         5                                       2
##       Muesli_Raisins,_Dates,_&_Almonds                             Wheat_Chex
##                                         6                                       1
##                     Frosted_Mini-Wheats                      Raisin_Nut_Bran
##                                         5                                       1
##                           Fruity_Pebbles                            Special_K
##                                         3                                       7
##                              Bran_Flakes                          Golden_Crisp
##                                         1                                       3
##                      Honey_Nut_Cheerios                             Bran_Chex
##                                         3                                       1
## Fruit_&_Fibre_Dates,_Walnuts,_and_Oats                               Basic_4
##                                         2                                       2
##                                  Triples                 Shredded_Wheat_'n'Bran
##                                         8                                       5
##                       Cracklin'_Oat_Bran                             Honey-comb
```

```
##                                   1                                   3
##                                Trix                           Corn_Pops
##                                   3                                   3
##                 Total_Raisin_Bran                                 Kix
##                                   9                                   8
##              Cinnamon_Toast_Crunch                           Corn_Chex
##                                   3                                   8
##                          Grape-Nuts                          Raisin_Bran
##                                   1                                   2
##          Shredded_Wheat_spoon_size                    Quaker_Oat_Squares
##                                   5                                   1
##                       Lucky_Charms                         Cap'n'Crunch
##                                   3                                   3
##                       Froot_Loops                         Fruitful_Bran
##                                   3                                   2
##  Muesli_Raisins,_Peaches,_&_Pecans                     Nutri-grain_Wheat
##                                   6                                   1
##              Multi-Grain_Cheerios                 Strawberry_Fruit_Wheats
##                                   1                                   5
##                  Honey_Graham_Ohs                      Shredded_Wheat
##                                   3                                   5
##           Apple_Cinnamon_Cheerios                           Rice_Chex
##                                   3                                   8
##          Nutri-Grain_Almond-Raisin                            Clusters
##                                   2                                   1
##                     Count_Chocula                           100%_Bran
##                                   3                                  10
##                     Rice_Krispies                       Raisin_Squares
##                                   8                                   5
##                       Apple_Jacks                 Crispy_Wheat_&_Raisins
##                                   3                                   3
##                  Nut&Honey_Crunch                      Total_Whole_Grain
##                                   3                                   4
##                       Double_Chex
##                                   8
```

```
#Comparing the assignment of clusters from the original set of data to the training set, which had 75%
```

Elementary Healthy Cereal Choices

```
#  The data should not be normalized at first because the school would have constraints on what a cerea
```

Comparing Hierarchical and K-means Clustering

```
#Hierarchical and k-means clustering both group data points into clusters with similar attributes. Hier
```