

# k-means with Imputation

ClustImpute package

PMS

18 May, 2023

## Introduction

The following analysis is an implementation of the ClustImpute algorithm on multi-dimensional, log-scaled proximity measures. Other variables used for clustering include:

- “CSD\_AREA”
- “PMS\_CSDPOP”
- “PMS\_DBPOP”
- “IOR\_Index\_of\_remoteness”

These variables were scaled from 0-1 prior to clustering.

## Assumptions of the Algorithm

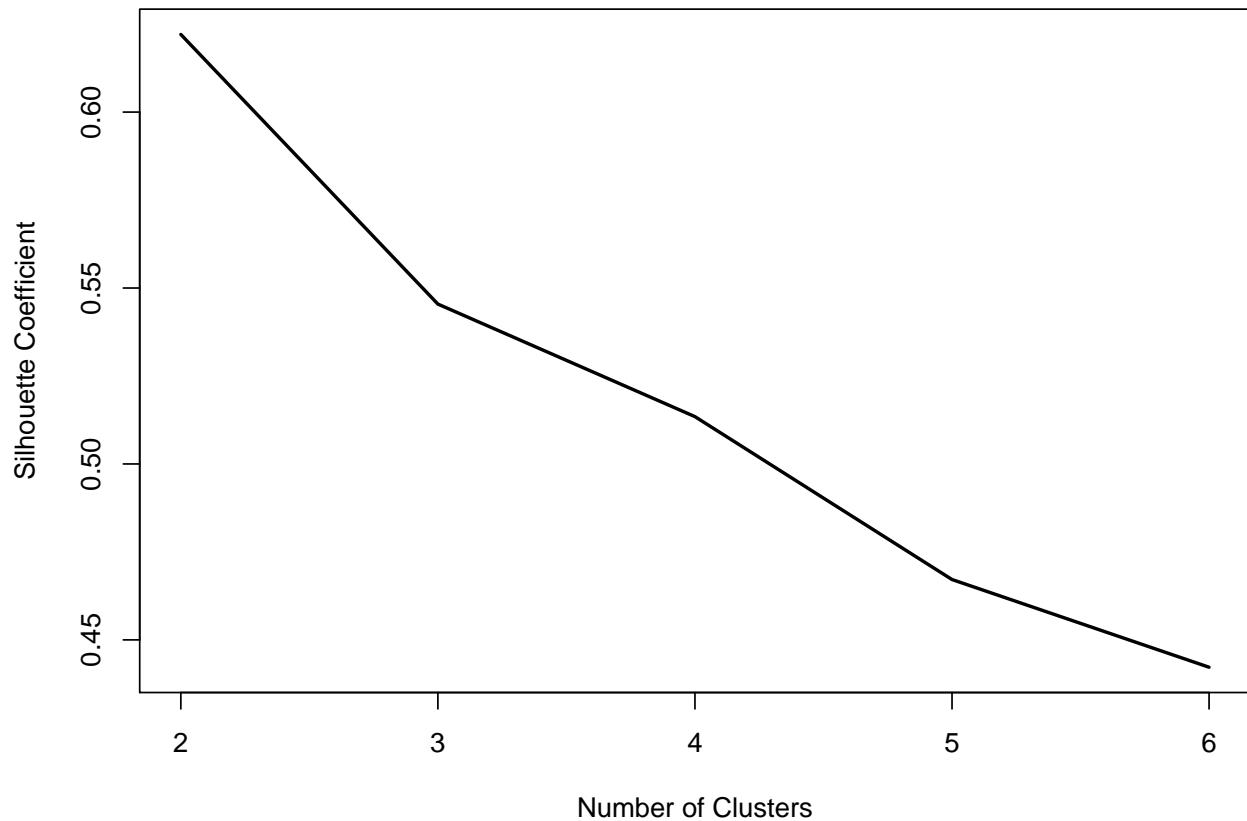
This algorithm “draws the missing values iteratively based on the current cluster assignment so that correlations are considered on this level”. Also, “penalizing weights are imposed on imputed values and successively decreased (to zero) as the missing data imputation gets better”. The idea is that the missing value is imputed by those other observations that are more similar to it (ie. in the same cluster).

Algorithm steps:

1. It replaces all NAs by random imputation, i.e., for each variable with missings, it draws from the marginal distribution of this variable not taking into account any correlations with other variables
  2. Weights  $< 1$  are used to adjust the scale of an observation that was generated in step 1. The weights are calculated by a (linear) weight function that starts near zero and converges to 1 at  $n\_end$ .
  3. A k-means clustering is performed with a number of  $c\_steps$  steps starting with a random initialization.
  4. The values from step 2 are replaced by new draws conditionally on the assigned cluster from step 3.
  5. Steps 2-4 are repeated  $nr\_iter$  times in total. The k-means clustering in step 3 uses the previous cluster centroids for initialization.
  6. After the last draws a final k-means clustering is performed.
-

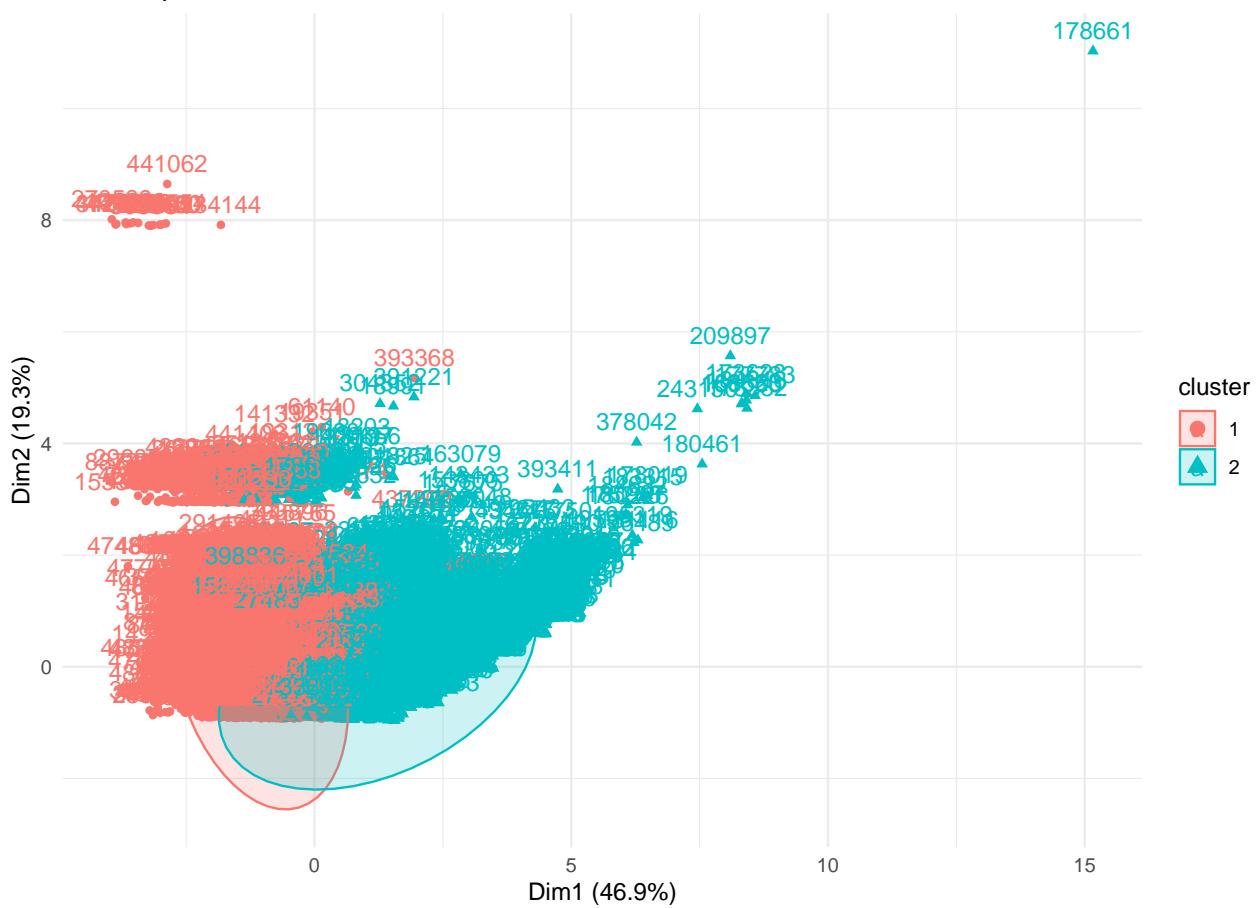
Amenities

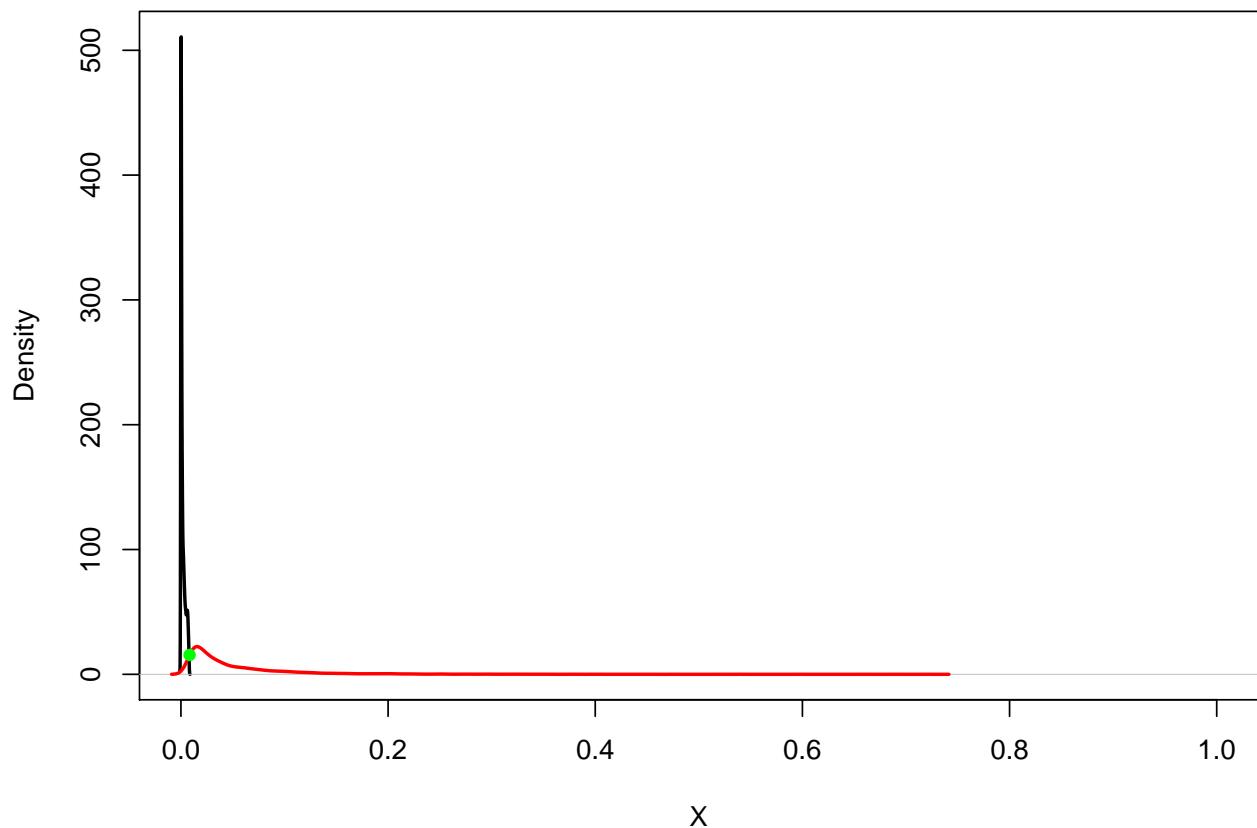
Employment



```
## [1] "Maximum silhouette coefficient: 0.622064640002785 For 2 clusters."
```

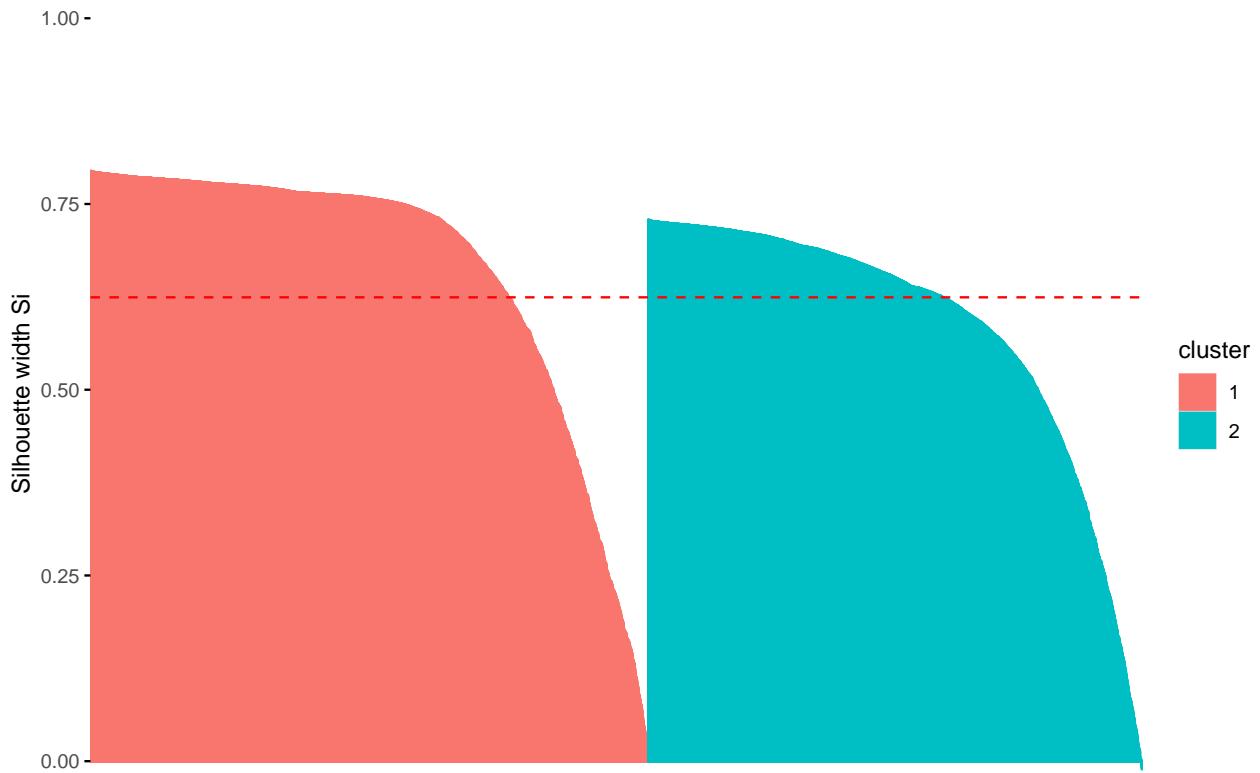
Cluster plot





```
## [1] "Segment cutoff values:"  
## [1] 0.008377788  
##   cluster size ave.sil.width  
## 1       1 6715      0.66  
## 2       2 5938      0.58
```

Clusters silhouette plot  
Average silhouette width: 0.62



```
## [1] "Cluster profiles:"  
## [1] "Num of DBs:"  
##   Cluster 1 Cluster 2  
##       7823      6867  
##  
##  
##  
##   DB Population:  
##   Cluster 1 Cluster 2  
##       71.5      73.6  
##  
##  
##  
##   CSD Population:  
##   Cluster 1 Cluster 2  
##       237581.5  230586.3  
##  
##  
##  
##   CMA Type:  
##   Cluster 1 Cluster 2  
##       3419      3019  
##   B       3235      2880  
##   D       895       723  
##   K       274       245
```

```

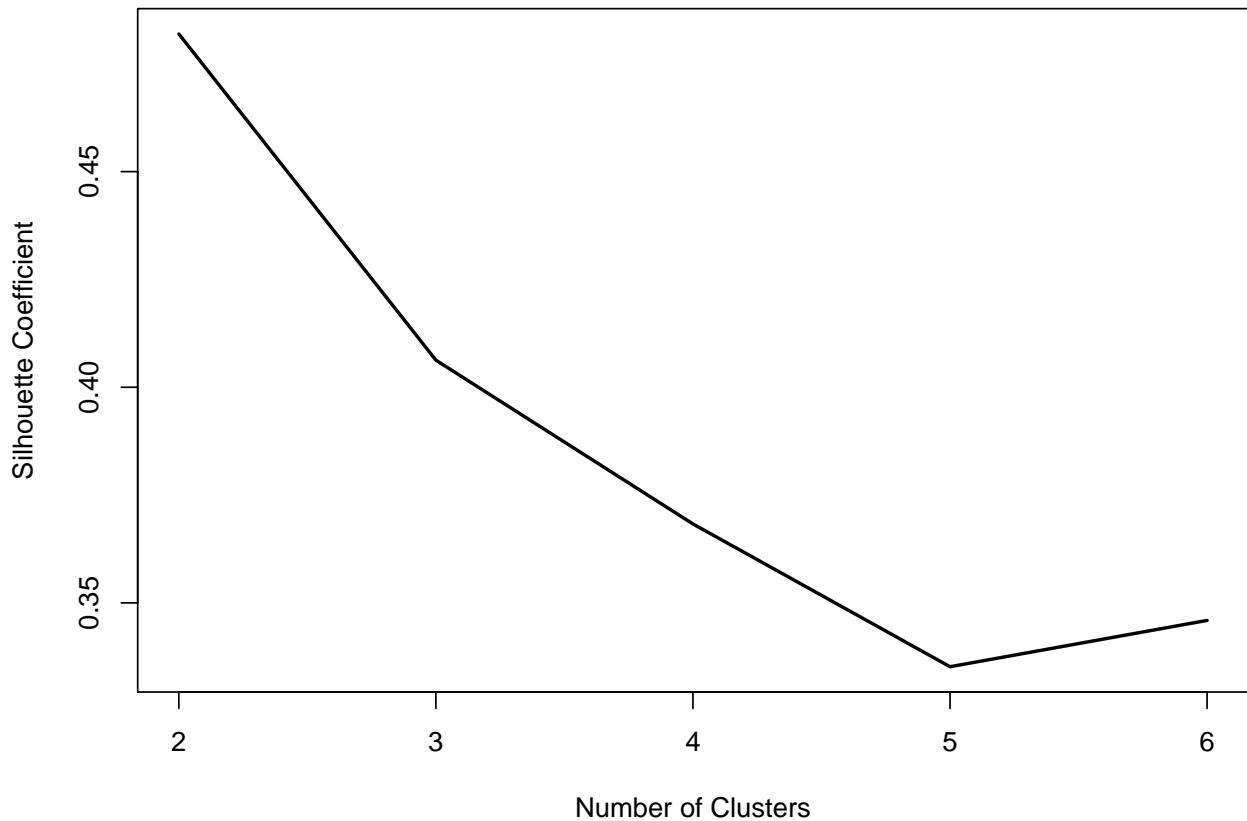
##
##
##
## Index of Remoteness:
## Cluster 1 Cluster 2
##      0.227      0.229
##
##
##
## Provinces:
##          Cluster 1 Cluster 2
## Alberta            240      218
## BritishColumbia   383      340
## NewBrunswick       65       57
## NorthwestTerritories 4       3
## NovaScotia         245      205
## Ontario            1200     1040
## Quebec              463      395
## Saskatchewan       44       27
## NA's                5179     4582
##
##
##
## Amenity dense:
## Cluster 1 Cluster 2
## 0      7080      6214
## 1      573       511
## 2       82       65
## F       88       77
##
##
##
## PMS_prox_idx_emp :
## Cluster 1 Cluster 2
##      0.02539    0.02528
##
##
##
## PMS_prox_idx_pharma :
## Cluster 1 Cluster 2
##      0.04538    0.04444
##
##
##
## PMS_prox_idx_childcare :
## Cluster 1 Cluster 2
##      0.07601    0.07707
##
##
##
## PMS_prox_idx_health :
## Cluster 1 Cluster 2
##      0.01377    0.01379
##

```

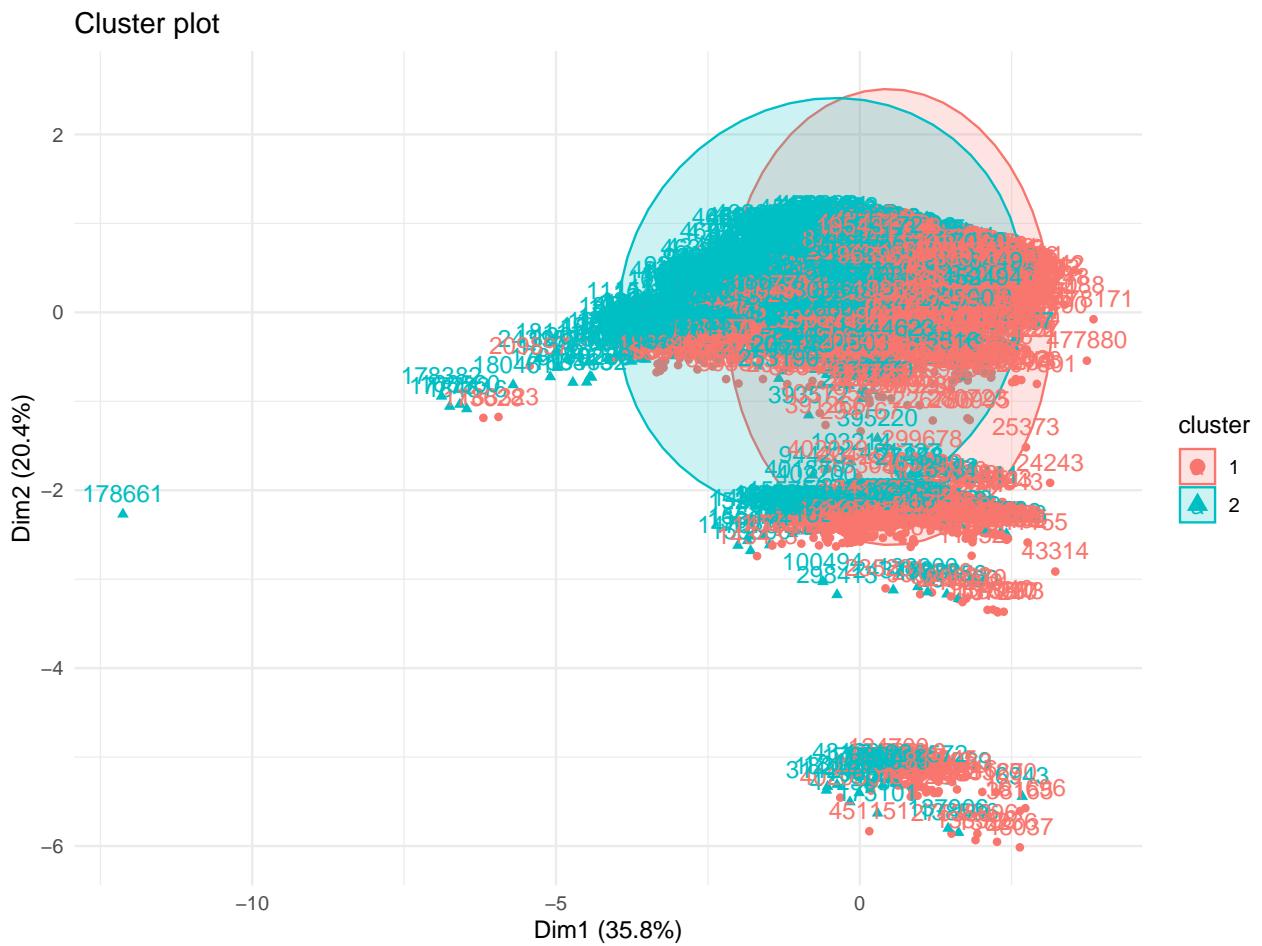
```
##  
##  
## PMS_prox_idx_grocery :  
## Cluster 1 Cluster 2  
##      0.07056   0.07126  
##  
##  
##  
## PMS_prox_idx_educpri :  
## Cluster 1 Cluster 2  
##      0.1179    0.11583  
##  
##  
##  
## PMS_prox_idx_educsec :  
## Cluster 1 Cluster 2  
##      0.10407   0.10278  
##  
##  
##  
## PMS_prox_idx_lib :  
## Cluster 1 Cluster 2  
##      0.11416   0.11255  
##  
##  
##  
## PMS_prox_idx_parks :  
## Cluster 1 Cluster 2  
##      0.06931   0.06742  
##  
##  
##  
## PMS_prox_idx_transit :  
## Cluster 1 Cluster 2  
##      0.01782   0.01822
```

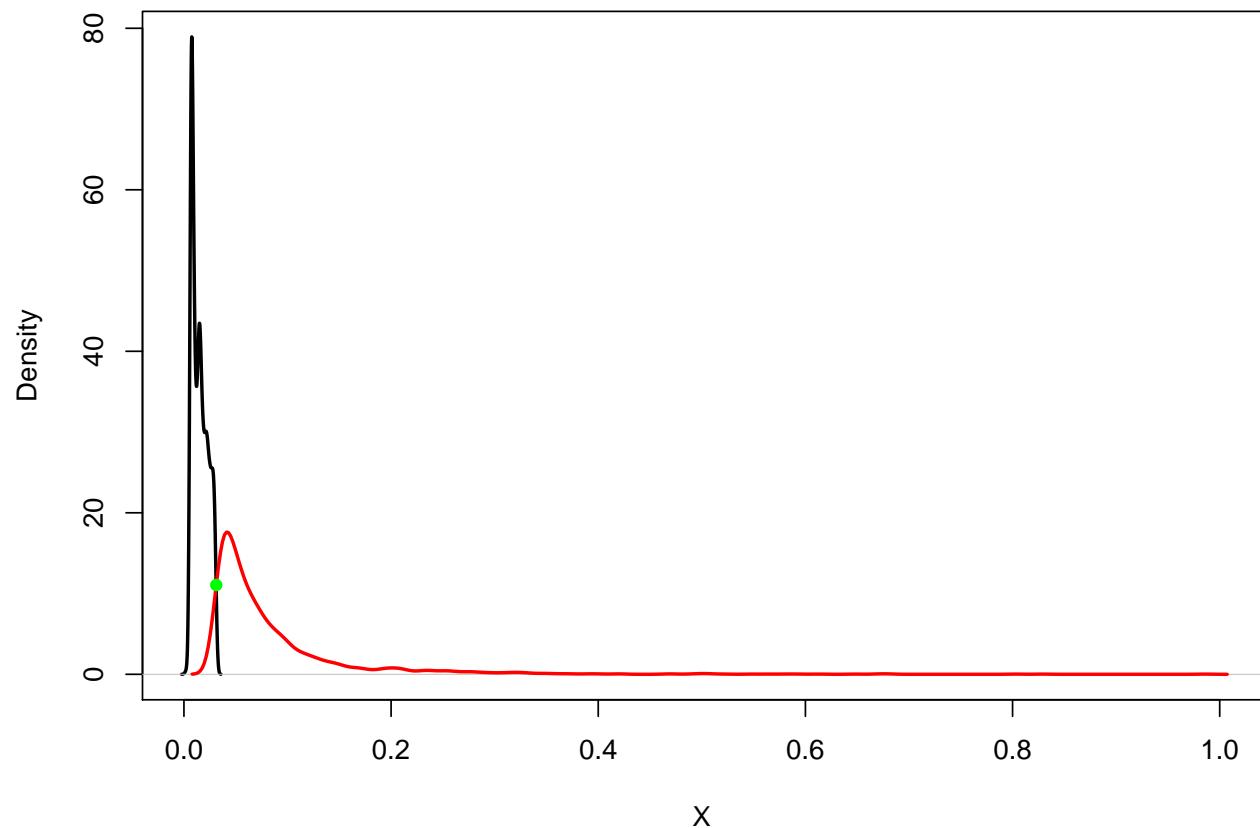
---

## Pharmacy



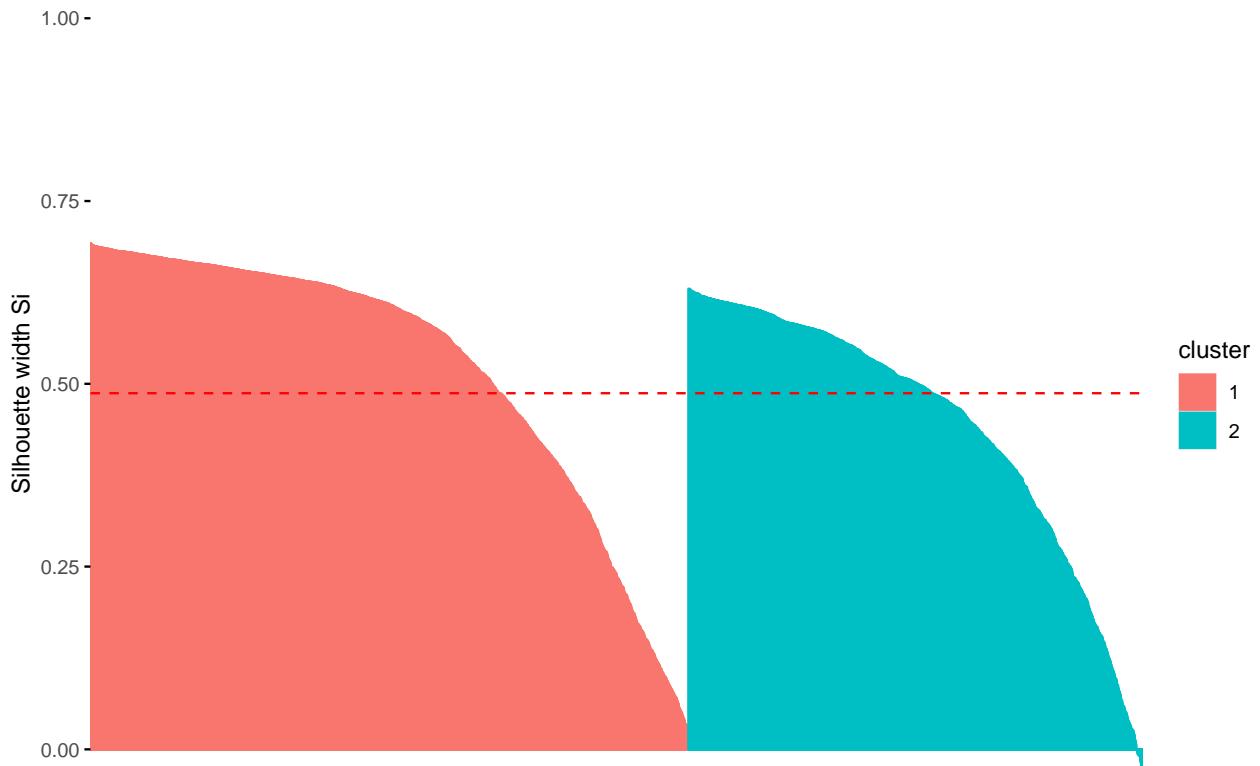
```
## [1] "Maximum silhouette coefficient: 0.481917338377466 For 2 clusters."
```





```
## [1] "Segment cutoff values:"  
## [1] 0.03120957  
##   cluster size ave.sil.width  
## 1       1 2976      0.52  
## 2       2 2255      0.44
```

Clusters silhouette plot  
Average silhouette width: 0.49



```
## [1] "Cluster profiles:"  
## [1] "Num of DBs:"  
##   Cluster 1 Cluster 2  
##       8368      6322  
##  
##  
##  
##   DB Population:  
##   Cluster 1 Cluster 2  
##       72.9       72  
##  
##  
##  
##   CSD Population:  
##   Cluster 1 Cluster 2  
##       231928.1  237464.8  
##  
##  
##  
##   CMA Type:  
##   Cluster 1 Cluster 2  
##       3649      2789  
##   B       3513      2602  
##   D       914       704  
##   K       292       227
```

```

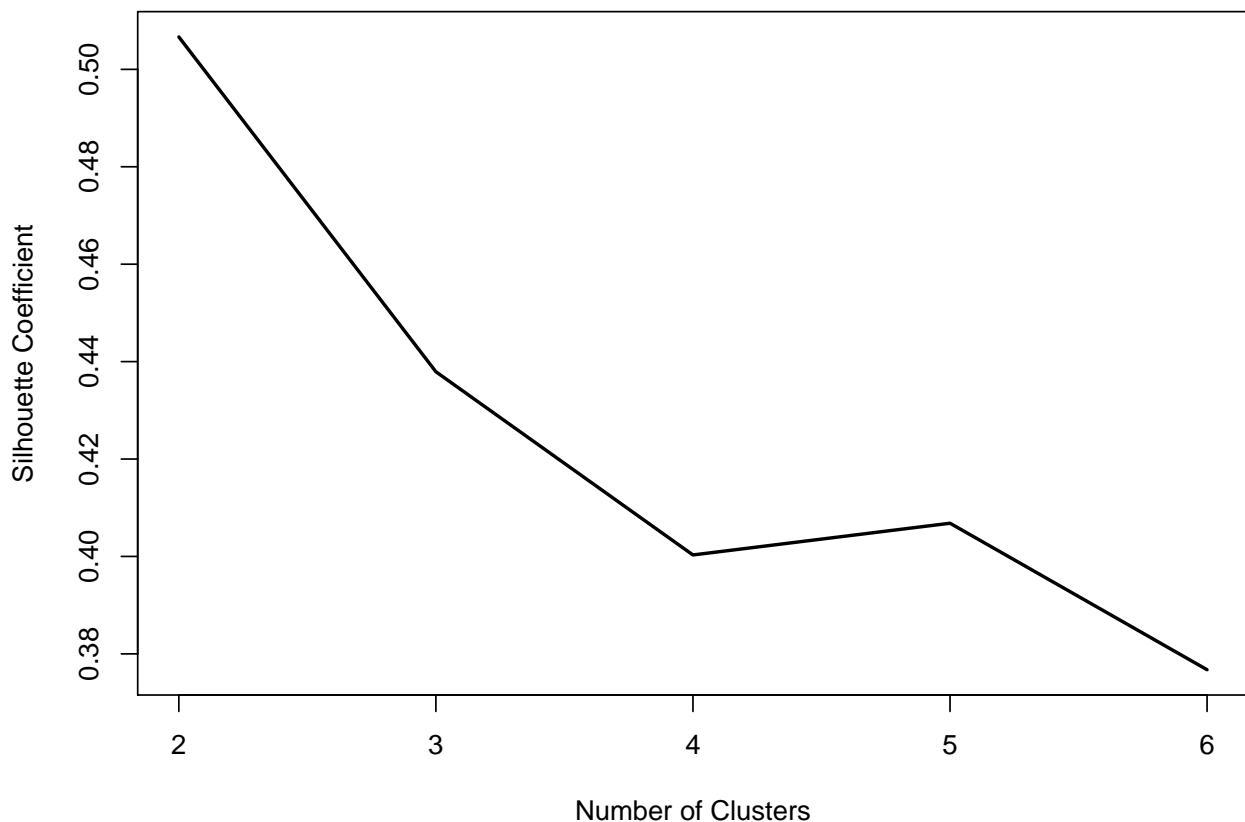
##
##
##
## Index of Remoteness:
## Cluster 1 Cluster 2
##      0.229      0.227
##
##
##
## Provinces:
##          Cluster 1 Cluster 2
## Alberta            260      198
## BritishColumbia    424      299
## NewBrunswick        67       55
## NorthwestTerritories   5       2
## NovaScotia          256      194
## Ontario             1234     1006
## Quebec              503      355
## Saskatchewan        37       34
## NA's                 5582     4179
##
##
##
## Amenity dense:
## Cluster 1 Cluster 2
## 0      7558      5736
## 1      641       443
## 2       81        66
## F       88        77
##
##
##
## PMS_prox_idx_emp :
## Cluster 1 Cluster 2
##      0.0256     0.02499
##
##
##
## PMS_prox_idx_pharma :
## Cluster 1 Cluster 2
##      0.04632    0.04312
##
##
##
## PMS_prox_idx_childcare :
## Cluster 1 Cluster 2
##      0.07705    0.0758
##
##
##
## PMS_prox_idx_health :
## Cluster 1 Cluster 2
##      0.01393    0.01358
##

```

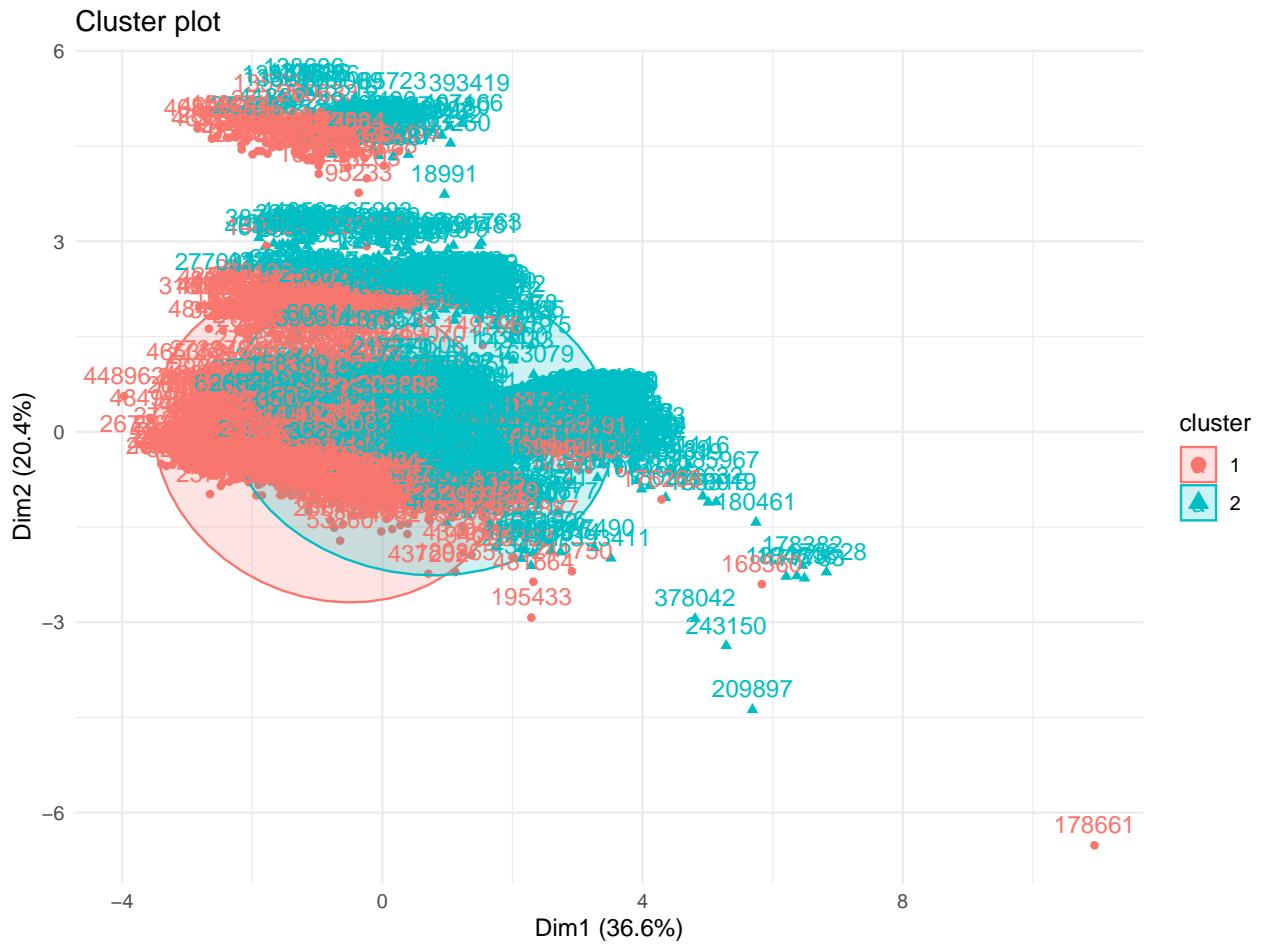
```
##  
##  
## PMS_prox_idx_grocery :  
## Cluster 1 Cluster 2  
## 0.07296 0.06816  
##  
##  
##  
## PMS_prox_idx_educpri :  
## Cluster 1 Cluster 2  
## 0.11935 0.11366  
##  
##  
##  
## PMS_prox_idx_educsec :  
## Cluster 1 Cluster 2  
## 0.1044 0.10218  
##  
##  
##  
## PMS_prox_idx_lib :  
## Cluster 1 Cluster 2  
## 0.111 0.1167  
##  
##  
##  
## PMS_prox_idx_parks :  
## Cluster 1 Cluster 2  
## 0.06724 0.06999  
##  
##  
##  
## PMS_prox_idx_transit :  
## Cluster 1 Cluster 2  
## 0.01833 0.01757
```

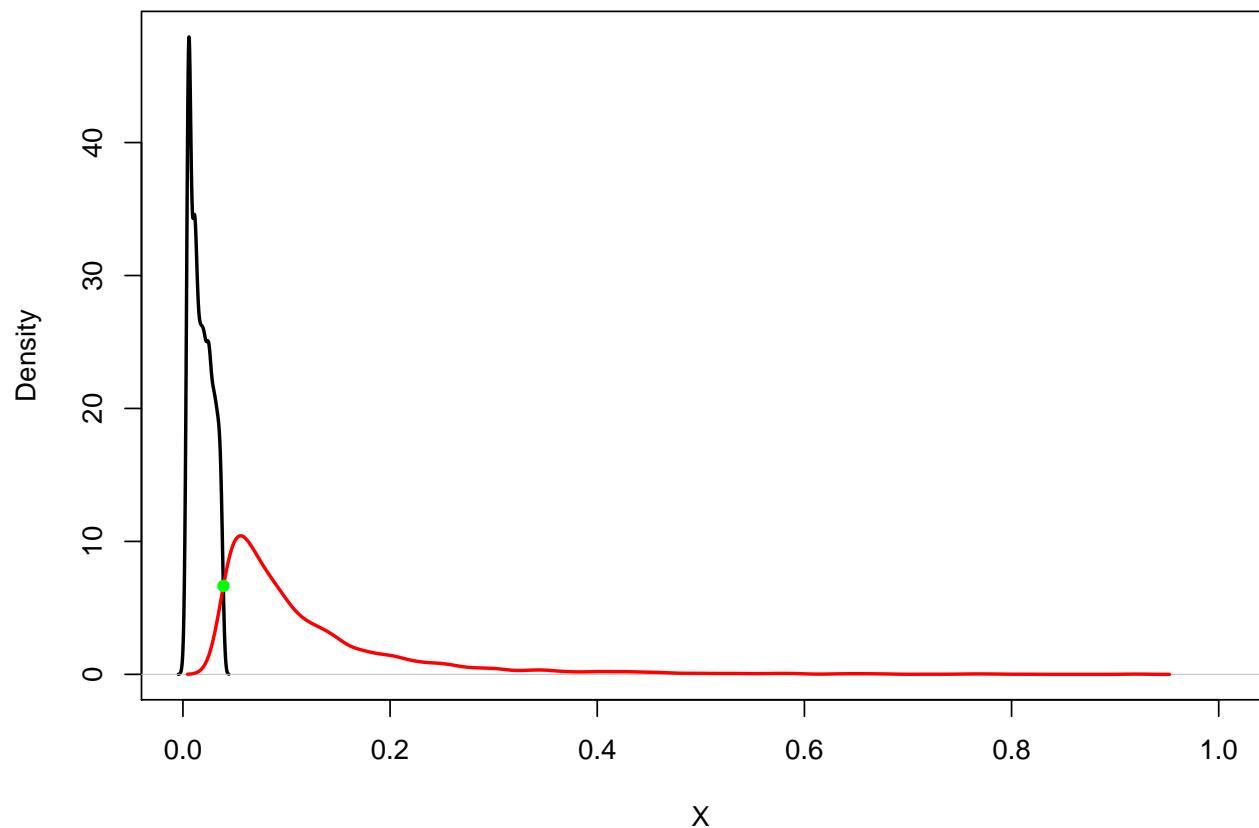
---

## Childcare



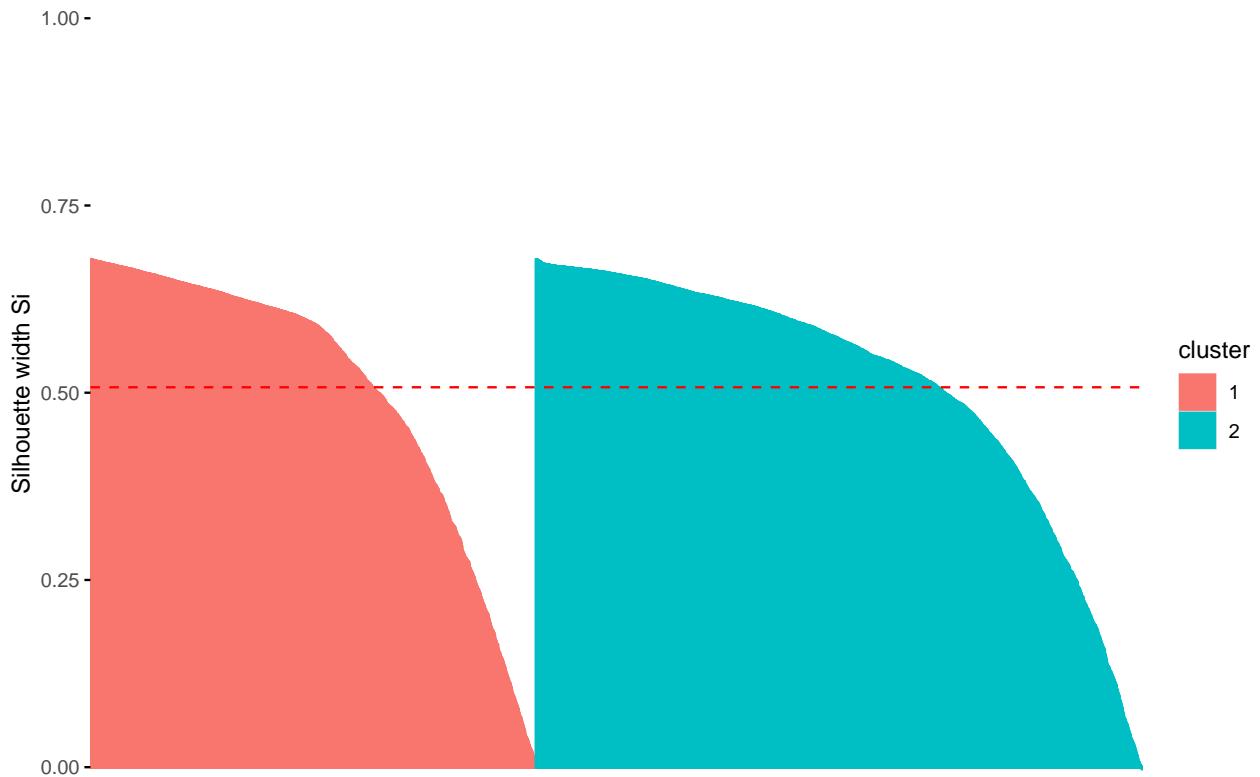
```
## [1] "Maximum silhouette coefficient: 0.506653425867399 For 2 clusters."
```





```
## [1] "Segment cutoff values:"  
## [1] 0.03912203  
##   cluster size ave.sil.width  
## 1       1 3063      0.50  
## 2       2 4168      0.51
```

Clusters silhouette plot  
Average silhouette width: 0.51



```
## [1] "Cluster profiles:"  
## [1] "Num of DBs:"  
##   Cluster 1 Cluster 2  
##       6220      8470  
##  
##  
##  
##  
##   DB Population:  
##   Cluster 1 Cluster 2  
##       75.5      70.3  
##  
##  
##  
##  
##   CSD Population:  
##   Cluster 1 Cluster 2  
## 238178.8 231469.7  
##  
##  
##  
##  
##   CMA Type:  
##   Cluster 1 Cluster 2  
##       2670      3768  
##   B       2656      3459  
##   D       685       933  
##   K       209       310
```

```

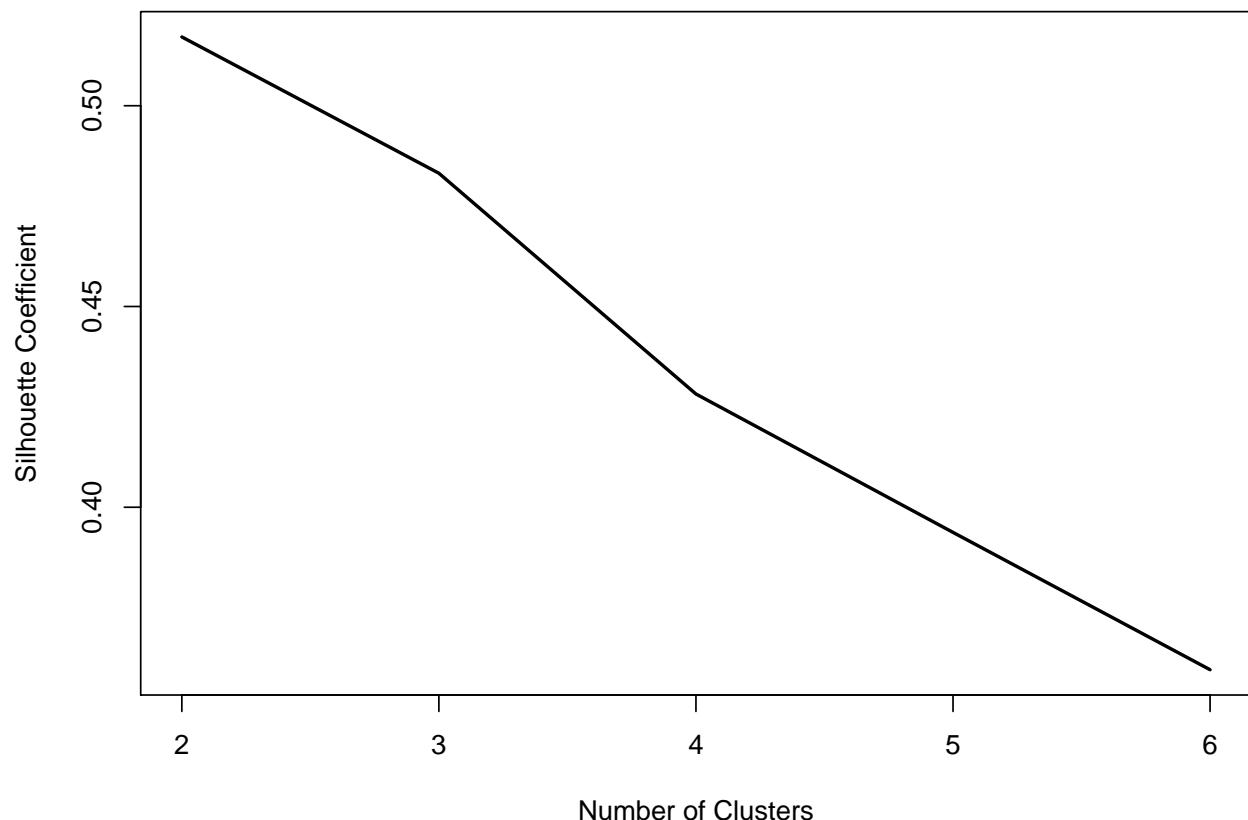
##
##
##
## Index of Remoteness:
## Cluster 1 Cluster 2
##      0.224      0.231
##
##
##
## Provinces:
##                  Cluster 1 Cluster 2
## Alberta            203      255
## BritishColumbia   321      402
## NewBrunswick       52       70
## NorthwestTerritories 3       4
## NovaScotia        201      249
## Ontario           994     1246
## Quebec            369      489
## Saskatchewan      29       42
## NA's              4048     5713
##
##
##
## Amenity dense:
## Cluster 1 Cluster 2
## 0      5612      7682
## 1      461       623
## 2       65       82
## F       82       83
##
##
##
## PMS_prox_idx_emp :
## Cluster 1 Cluster 2
##      0.02558    0.02516
##
##
##
## PMS_prox_idx_pharma :
## Cluster 1 Cluster 2
##      0.0462     0.04399
##
##
##
## PMS_prox_idx_childcare :
## Cluster 1 Cluster 2
##      0.07539    0.07736
##
##
##
## PMS_prox_idx_health :
## Cluster 1 Cluster 2
##      0.01422    0.01345
##

```

```
##  
##  
## PMS_prox_idx_grocery :  
## Cluster 1 Cluster 2  
## 0.07235 0.06981  
##  
##  
##  
## PMS_prox_idx_educpri :  
## Cluster 1 Cluster 2  
## 0.11607 0.11755  
##  
##  
##  
## PMS_prox_idx_educsec :  
## Cluster 1 Cluster 2  
## 0.10374 0.10328  
##  
##  
##  
## PMS_prox_idx_lib :  
## Cluster 1 Cluster 2  
## 0.11549 0.11186  
##  
##  
##  
## PMS_prox_idx_parks :  
## Cluster 1 Cluster 2  
## 0.06771 0.06894  
##  
##  
##  
## PMS_prox_idx_transit :  
## Cluster 1 Cluster 2  
## 0.01833 0.01776
```

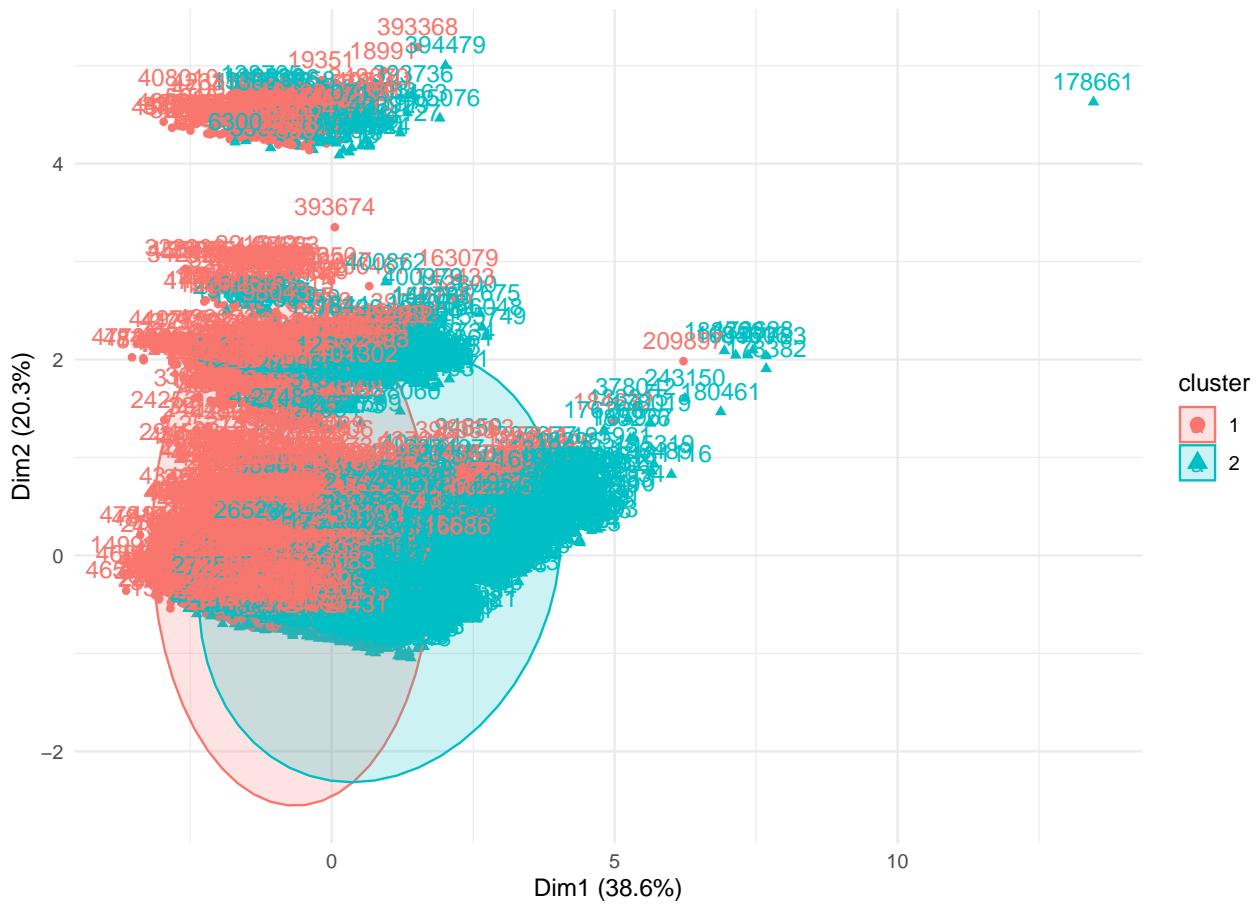
---

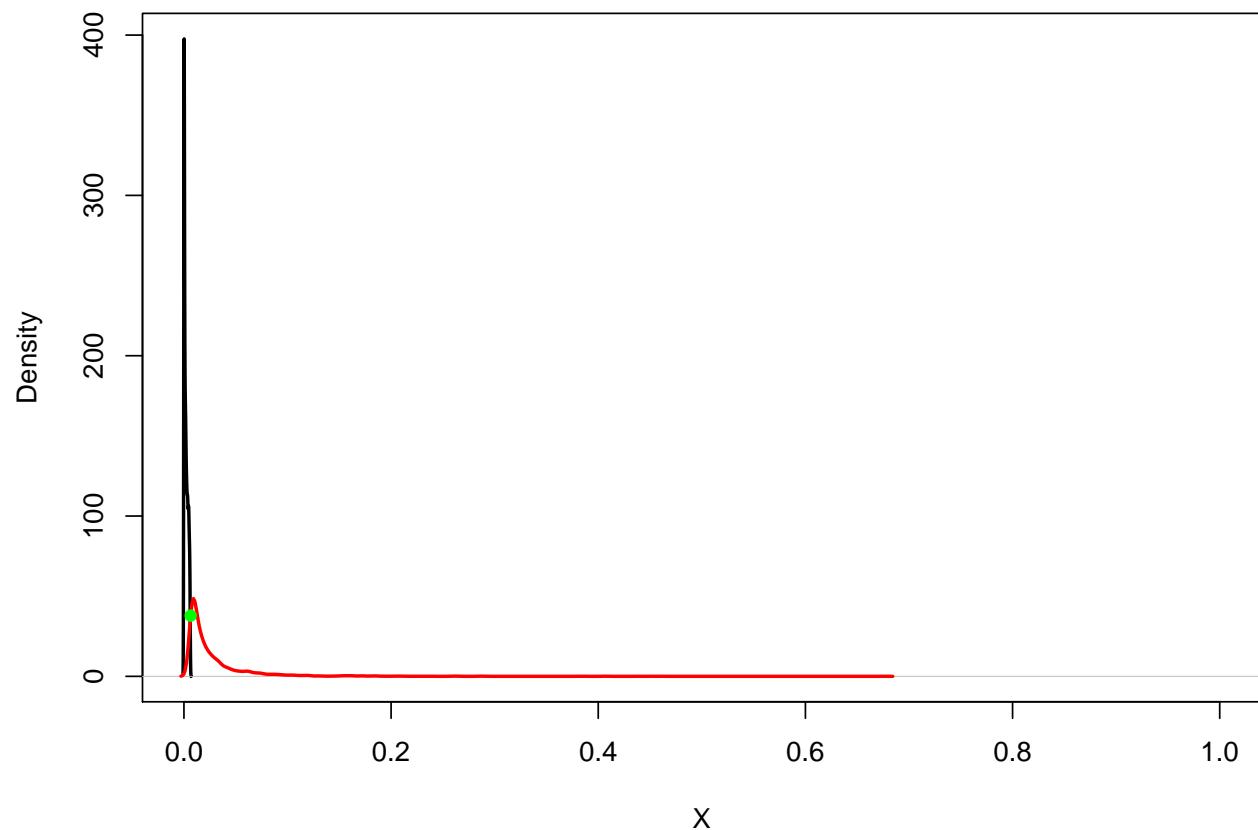
## Health



```
## [1] "Maximum silhouette coefficient: 0.517134015986981 For 2 clusters."
```

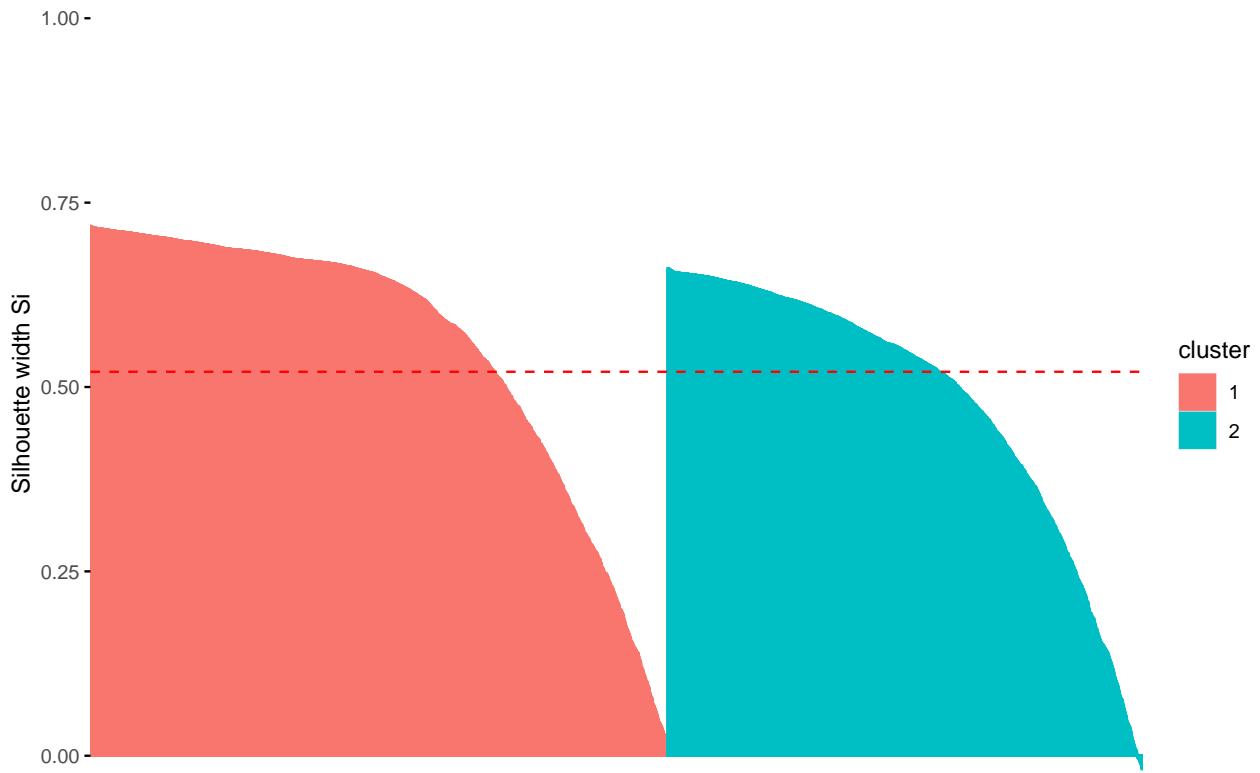
Cluster plot





```
## [1] "Segment cutoff values:"  
## [1] 0.006496828  
##   cluster size ave.sil.width  
## 1       1 4893      0.55  
## 2       2 4020      0.48
```

Clusters silhouette plot  
Average silhouette width: 0.52



```
## [1] "Cluster profiles:"  
## [1] "Num of DBs:"  
##   Cluster 1 Cluster 2  
##       8043      6647  
##  
##  
##  
##   DB Population:  
##   Cluster 1 Cluster 2  
##       71.6      73.7  
##  
##  
##  
##   CSD Population:  
##   Cluster 1 Cluster 2  
##       237088.2  230947.8  
##  
##  
##  
##   CMA Type:  
##   Cluster 1 Cluster 2  
##       3539      2899  
##   B       3360      2755  
##   D       865       753  
##   K       279       240
```

```

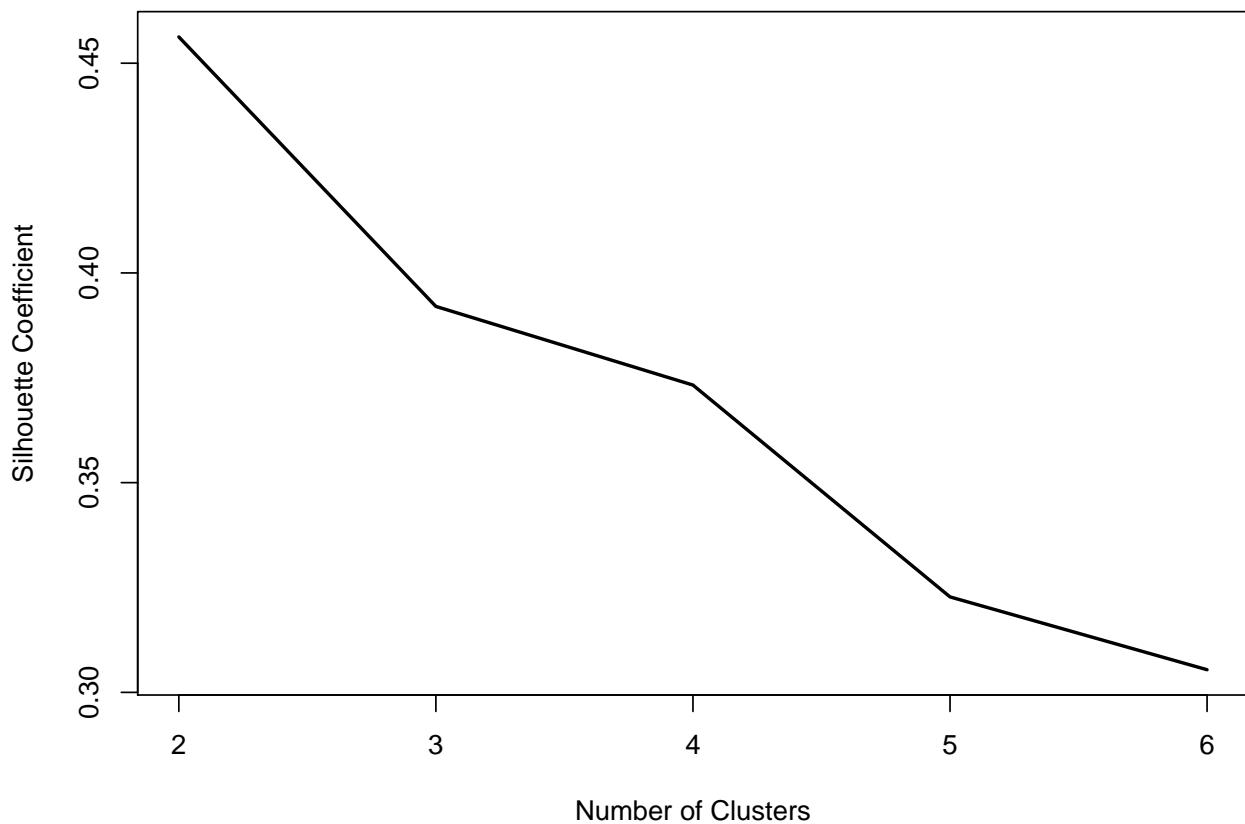
##
##
##
## Index of Remoteness:
## Cluster 1 Cluster 2
##      0.228      0.229
##
##
##
## Provinces:
##                  Cluster 1 Cluster 2
## Alberta            269      189
## BritishColumbia   393      330
## NewBrunswick       69       53
## NorthwestTerritories 5       2
## NovaScotia        258      192
## Ontario           1255     985
## Quebec            468      390
## Saskatchewan      32       39
## NA's              5294     4467
##
##
##
## Amenity dense:
## Cluster 1 Cluster 2
## 0      7288      6006
## 1      581       503
## 2       79       68
## F       95       70
##
##
##
## PMS_prox_idx_emp :
## Cluster 1 Cluster 2
##      0.02534    0.02534
##
##
##
## PMS_prox_idx_pharma :
## Cluster 1 Cluster 2
##      0.04406    0.04597
##
##
##
## PMS_prox_idx_childcare :
## Cluster 1 Cluster 2
##      0.07633    0.07674
##
##
##
## PMS_prox_idx_health :
## Cluster 1 Cluster 2
##      0.01329    0.01437
##

```

```
##  
##  
## PMS_prox_idx_grocery :  
## Cluster 1 Cluster 2  
## 0.07112  0.07061  
##  
##  
##  
## PMS_prox_idx_educpri :  
## Cluster 1 Cluster 2  
## 0.11707  0.11675  
##  
##  
##  
## PMS_prox_idx_educsec :  
## Cluster 1 Cluster 2  
## 0.10587  0.10064  
##  
##  
##  
## PMS_prox_idx_lib :  
## Cluster 1 Cluster 2  
## 0.11275  0.11417  
##  
##  
##  
## PMS_prox_idx_parks :  
## Cluster 1 Cluster 2  
## 0.06835  0.0685  
##  
##  
##  
## PMS_prox_idx_transit :  
## Cluster 1 Cluster 2  
## 0.0181   0.01789
```

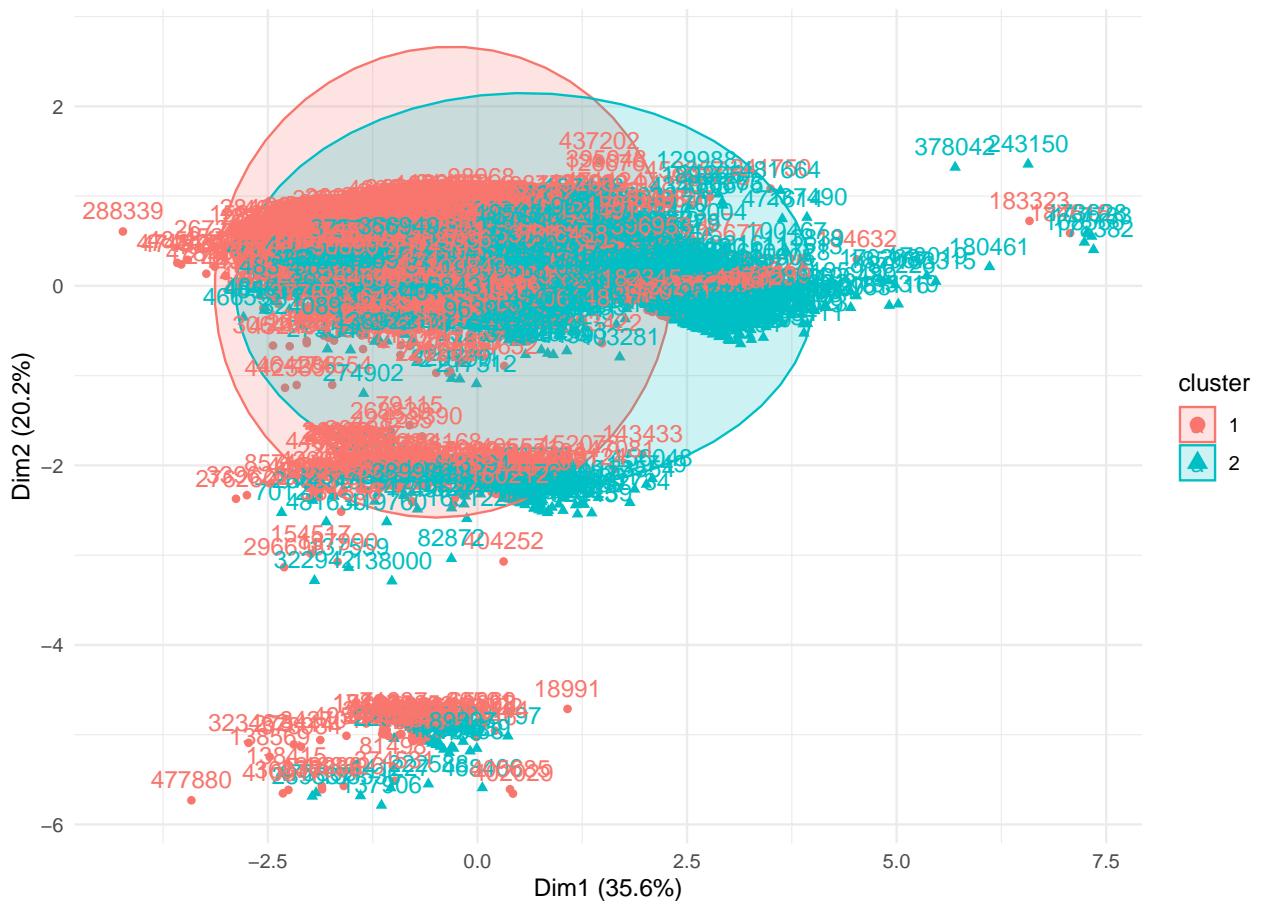
---

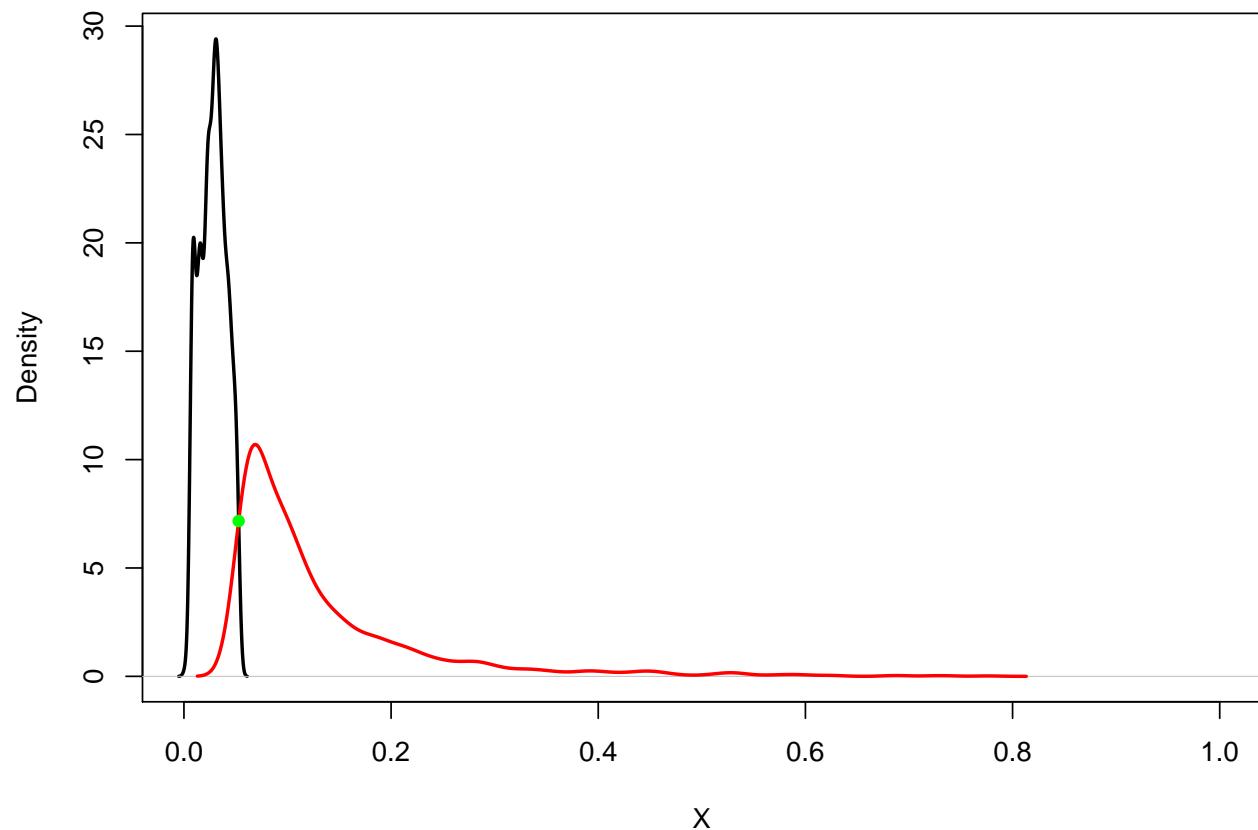
## Grocery



```
## [1] "Maximum silhouette coefficient: 0.456257228330827 For 2 clusters."
```

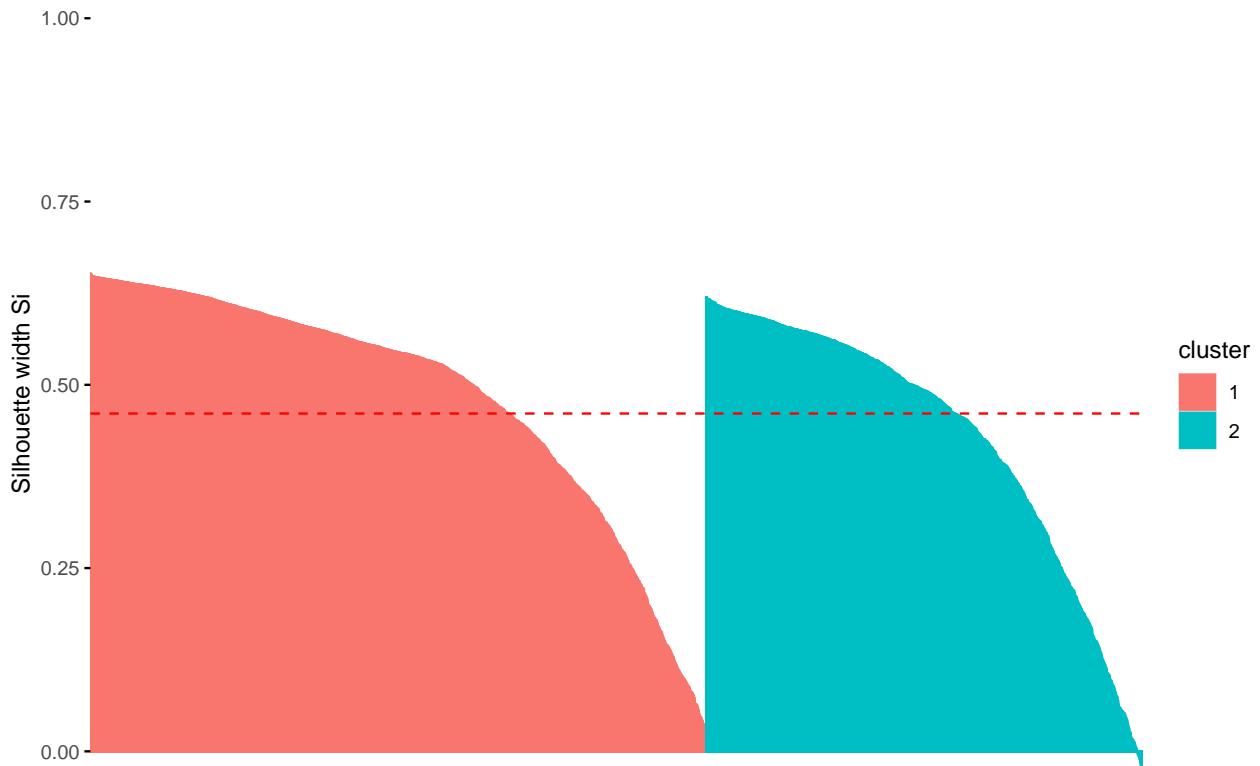
Cluster plot





```
## [1] "Segment cutoff values:"  
## [1] 0.05284028  
##   cluster size ave.sil.width  
## 1       1 2456      0.48  
## 2       2 1739      0.43
```

Clusters silhouette plot  
Average silhouette width: 0.46



```
## [1] "Cluster profiles:"  
## [1] "Num of DBs:"  
##   Cluster 1 Cluster 2  
##       8594      6096  
##  
##  
##  
##   DB Population:  
##   Cluster 1 Cluster 2  
##       72.7      72.3  
##  
##  
##  
##   CSD Population:  
##   Cluster 1 Cluster 2  
##       231720.2  237963.3  
##  
##  
##  
##   CMA Type:  
##   Cluster 1 Cluster 2  
##       3758      2680  
##   B       3578      2537  
##   D       967       651  
##   K       291       228
```

```

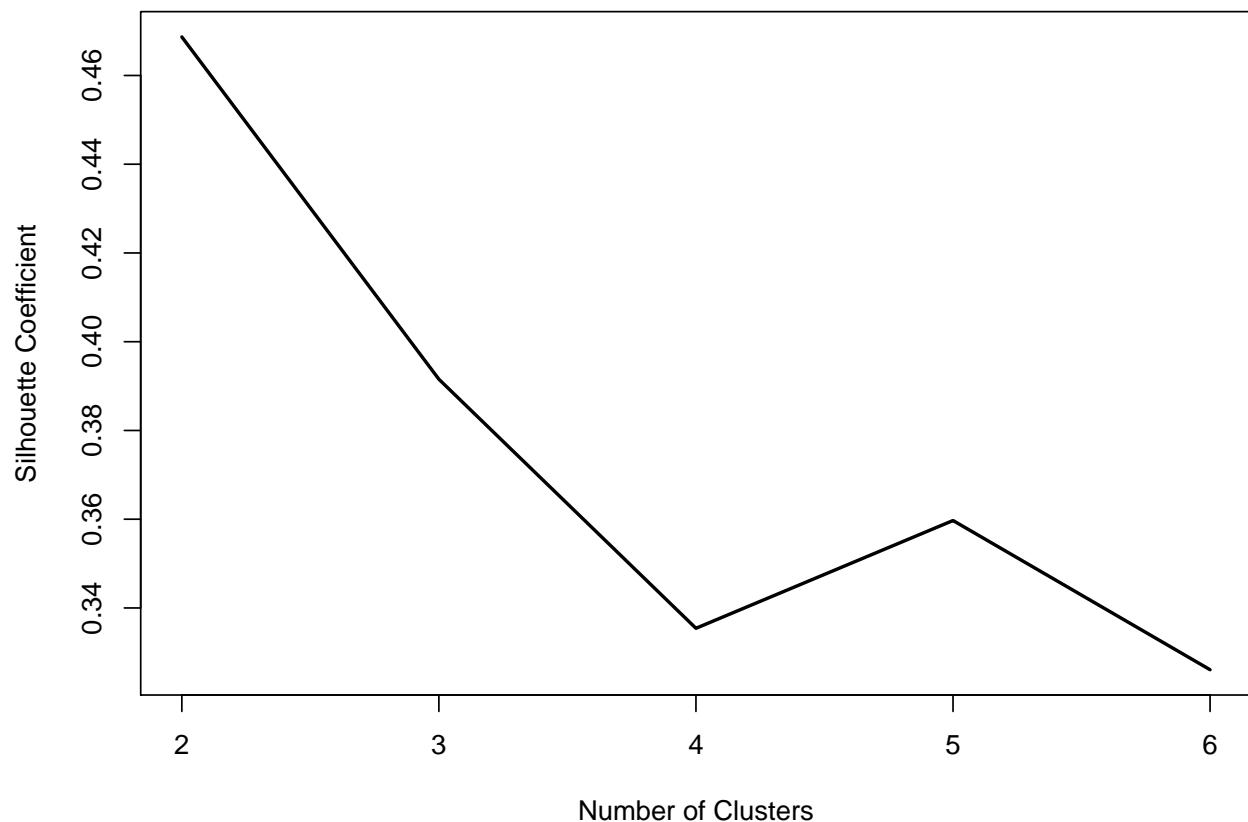
##
##
##
## Index of Remoteness:
## Cluster 1 Cluster 2
##      0.227      0.231
##
##
##
## Provinces:
##                  Cluster 1 Cluster 2
## Alberta            271      187
## BritishColumbia   415      308
## NewBrunswick       76       46
## NorthwestTerritories 4       3
## NovaScotia         264      186
## Ontario            1339     901
## Quebec             493      365
## Saskatchewan       42       29
## NA's               5690     4071
##
##
##
## Amenity dense:
## Cluster 1 Cluster 2
## 0      7765      5529
## 1      642       442
## 2       87        60
## F      100       65
##
##
##
## PMS_prox_idx_emp :
## Cluster 1 Cluster 2
##      0.0249    0.02596
##
##
##
## PMS_prox_idx_pharma :
## Cluster 1 Cluster 2
##      0.04469   0.04526
##
##
##
## PMS_prox_idx_childcare :
## Cluster 1 Cluster 2
##      0.07669   0.07627
##
##
##
## PMS_prox_idx_health :
## Cluster 1 Cluster 2
##      0.01355   0.0141
##

```

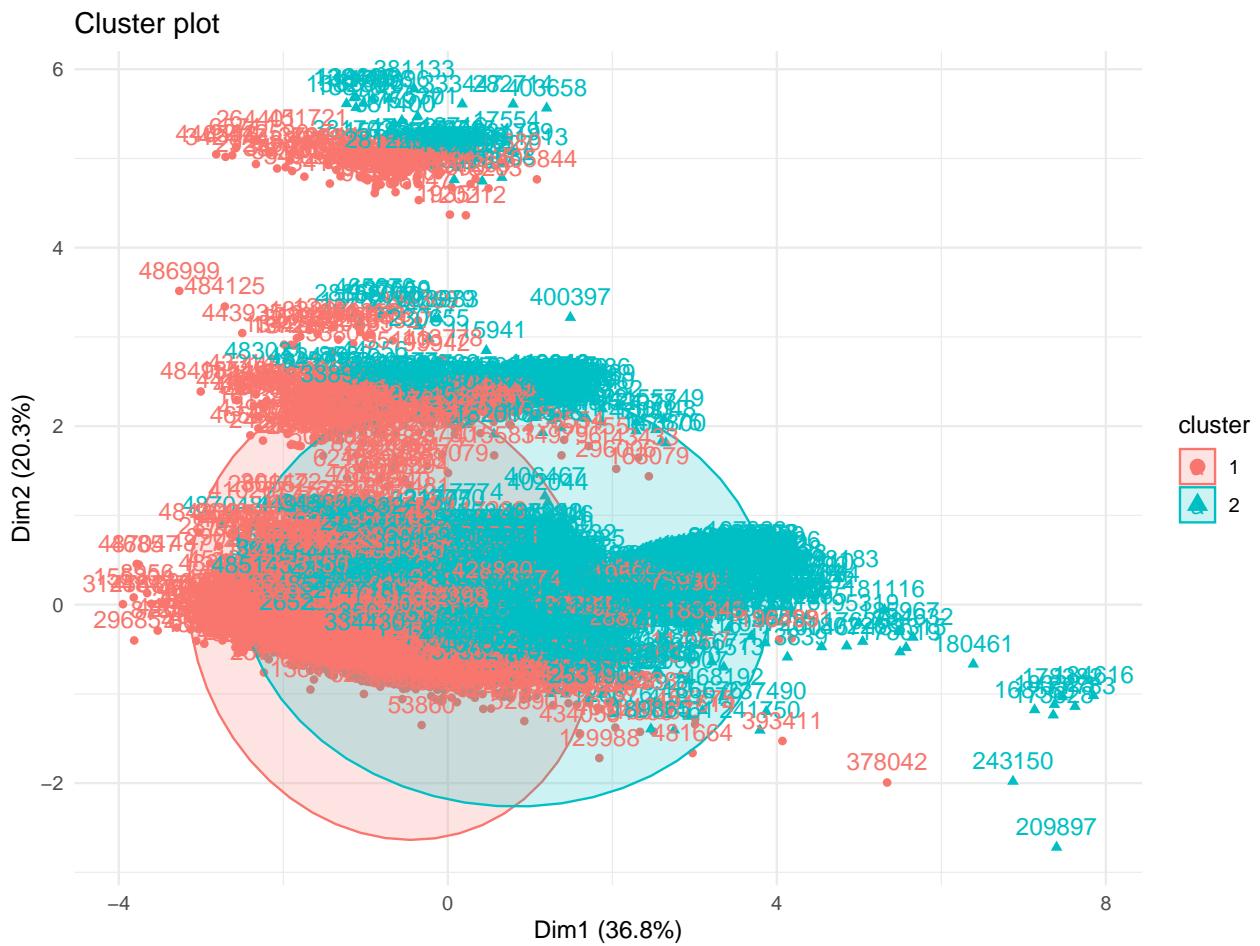
```
##  
##  
## PMS_prox_idx_grocery :  
## Cluster 1 Cluster 2  
##      0.07101    0.07071  
##  
##  
##  
## PMS_prox_idx_educpri :  
## Cluster 1 Cluster 2  
##      0.11733    0.11633  
##  
##  
##  
## PMS_prox_idx_educsec :  
## Cluster 1 Cluster 2  
##      0.1036     0.1033  
##  
##  
##  
## PMS_prox_idx_lib :  
## Cluster 1 Cluster 2  
##      0.11562    0.11033  
##  
##  
##  
## PMS_prox_idx_parks :  
## Cluster 1 Cluster 2  
##      0.06763    0.06953  
##  
##  
##  
## PMS_prox_idx_transit :  
## Cluster 1 Cluster 2  
##      0.0179     0.01815
```

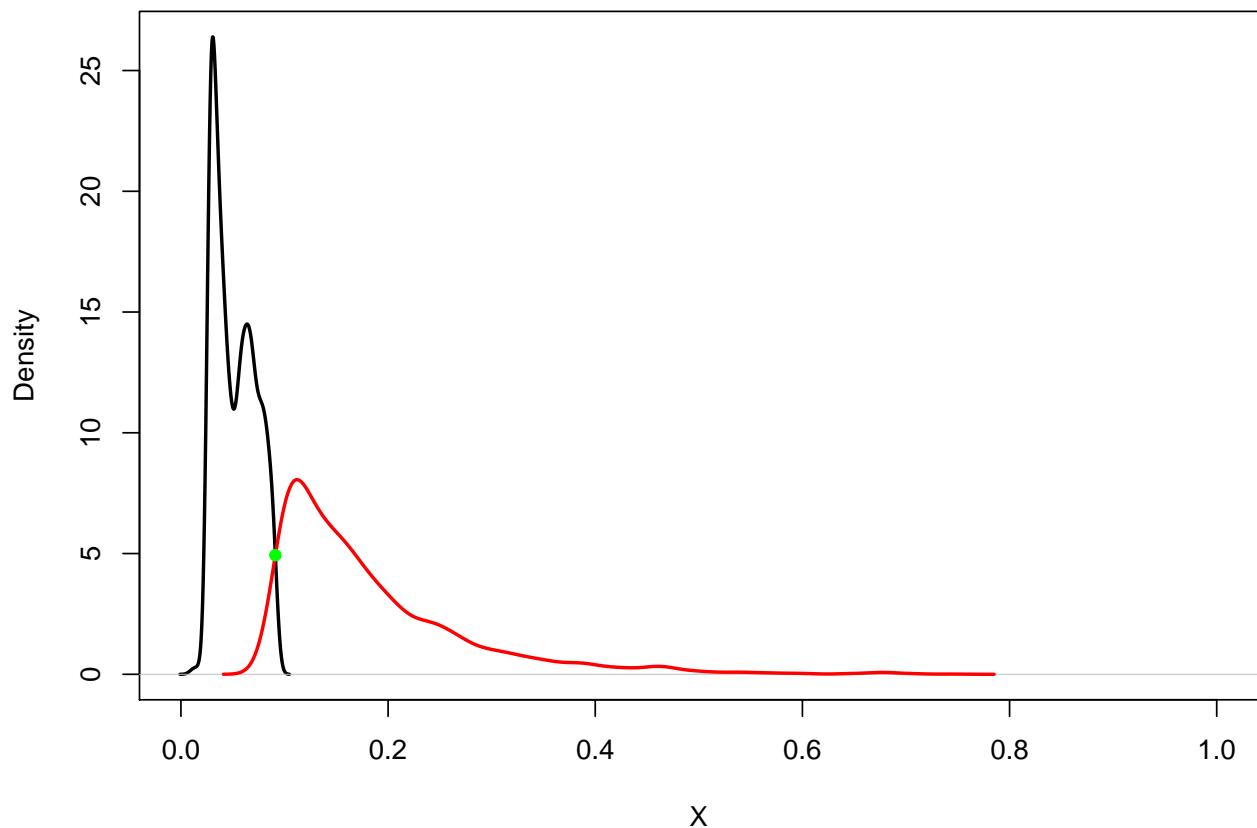
---

## Primary Education



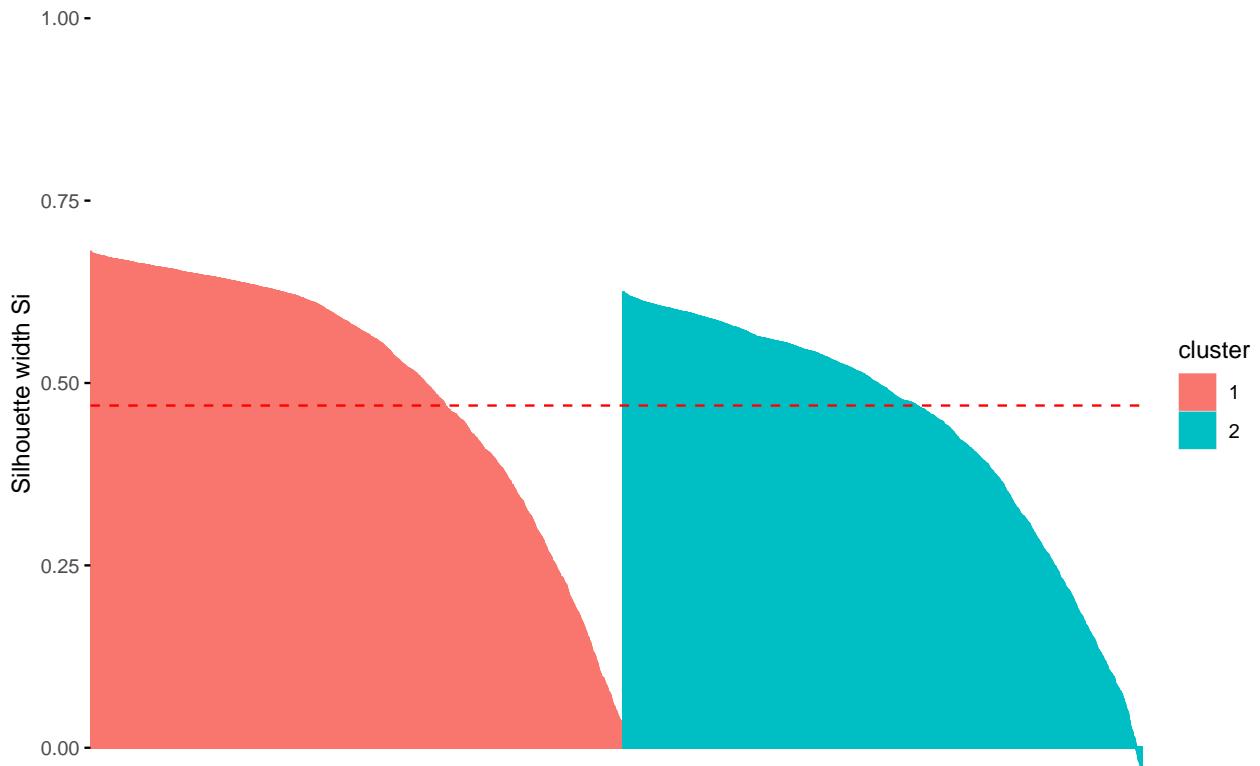
```
## [1] "Maximum silhouette coefficient: 0.468680602706478 For 2 clusters."
```





```
## [1] "Segment cutoff values:"  
## [1] 0.09115334  
##   cluster size ave.sil.width  
## 1       1 3390      0.50  
## 2       2 3301      0.44
```

Clusters silhouette plot  
Average silhouette width: 0.47



```
## [1] "Cluster profiles:"  
## [1] "Num of DBs:"  
##   Cluster 1 Cluster 2  
##       7460      7230  
##  
##  
##  
##  
##   DB Population:  
##   Cluster 1 Cluster 2  
##       71.7      73.4  
##  
##  
##  
##  
##   CSD Population:  
##   Cluster 1 Cluster 2  
##       231359.3  237354.3  
##  
##  
##  
##  
##   CMA Type:  
##   Cluster 1 Cluster 2  
##       3282      3156  
##   B       3089      3026  
##   D       821       797  
##   K       268       251
```

```

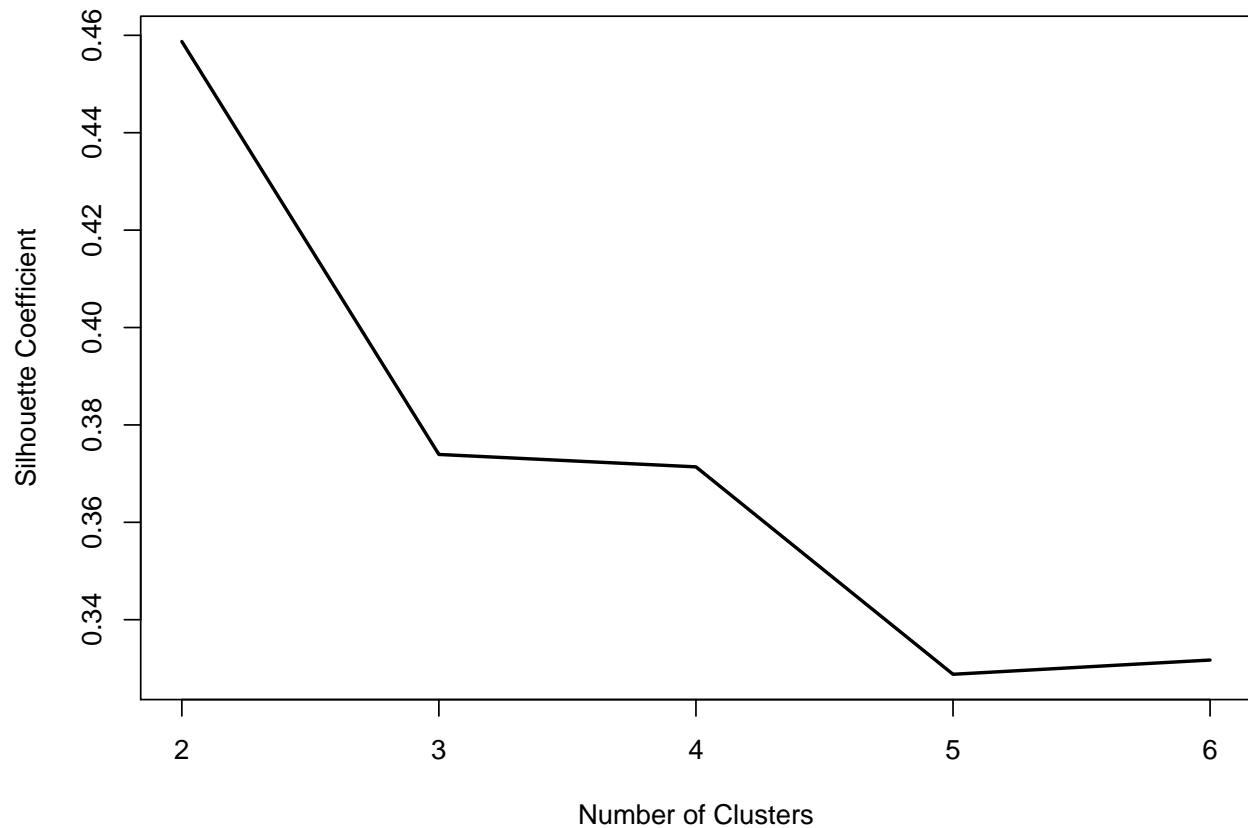
##
##
##
## Index of Remoteness:
## Cluster 1 Cluster 2
##      0.228      0.228
##
##
##
## Provinces:
##          Cluster 1 Cluster 2
## Alberta            234      224
## BritishColumbia    379      344
## NewBrunswick        63       59
## NorthwestTerritories   3       4
## NovaScotia          226      224
## Ontario             1107     1133
## Quebec              438      420
## Saskatchewan         40       31
## NA's                 4970     4791
##
##
##
## Amenity dense:
## Cluster 1 Cluster 2
## 0      6746      6548
## 1      559       525
## 2       79       68
## F       76       89
##
##
##
## PMS_prox_idx_emp :
## Cluster 1 Cluster 2
##      0.02537     0.0253
##
##
##
## PMS_prox_idx_pharma :
## Cluster 1 Cluster 2
##      0.0442      0.0457
##
##
##
## PMS_prox_idx_childcare :
## Cluster 1 Cluster 2
##      0.07614     0.0769
##
##
##
## PMS_prox_idx_health :
## Cluster 1 Cluster 2
##      0.01342     0.01415
##

```

```
##  
##  
## PMS_prox_idx_grocery :  
## Cluster 1 Cluster 2  
##      0.07096   0.07081  
##  
##  
##  
## PMS_prox_idx_educpri :  
## Cluster 1 Cluster 2  
##      0.1171    0.11673  
##  
##  
##  
## PMS_prox_idx_educsec :  
## Cluster 1 Cluster 2  
##      0.1056    0.10118  
##  
##  
##  
## PMS_prox_idx_lib :  
## Cluster 1 Cluster 2  
##      0.11309   0.11374  
##  
##  
##  
## PMS_prox_idx_parks :  
## Cluster 1 Cluster 2  
##      0.06763   0.06925  
##  
##  
##  
## PMS_prox_idx_transit :  
## Cluster 1 Cluster 2  
##      0.01781   0.01821
```

---

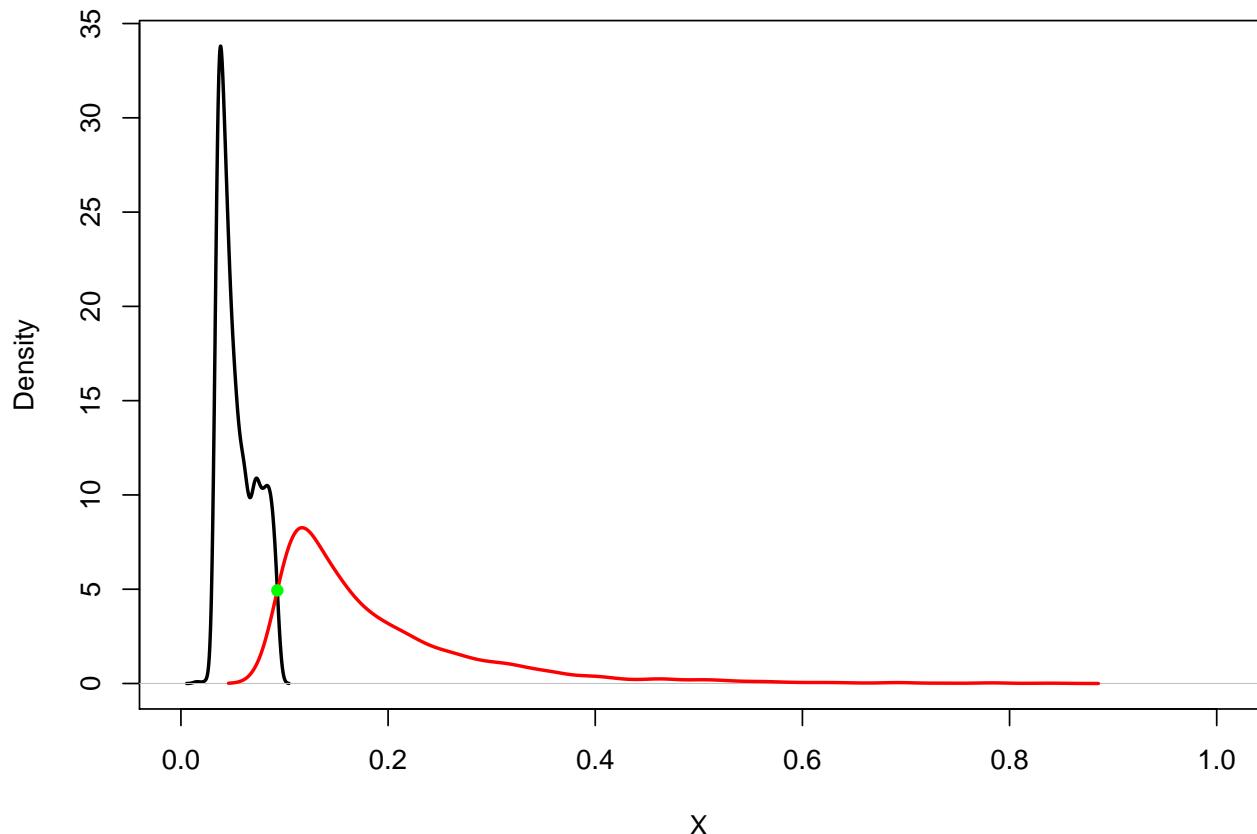
## Secondary Education



```
## [1] "Maximum silhouette coefficient: 0.458730649615218 For 2 clusters."
```

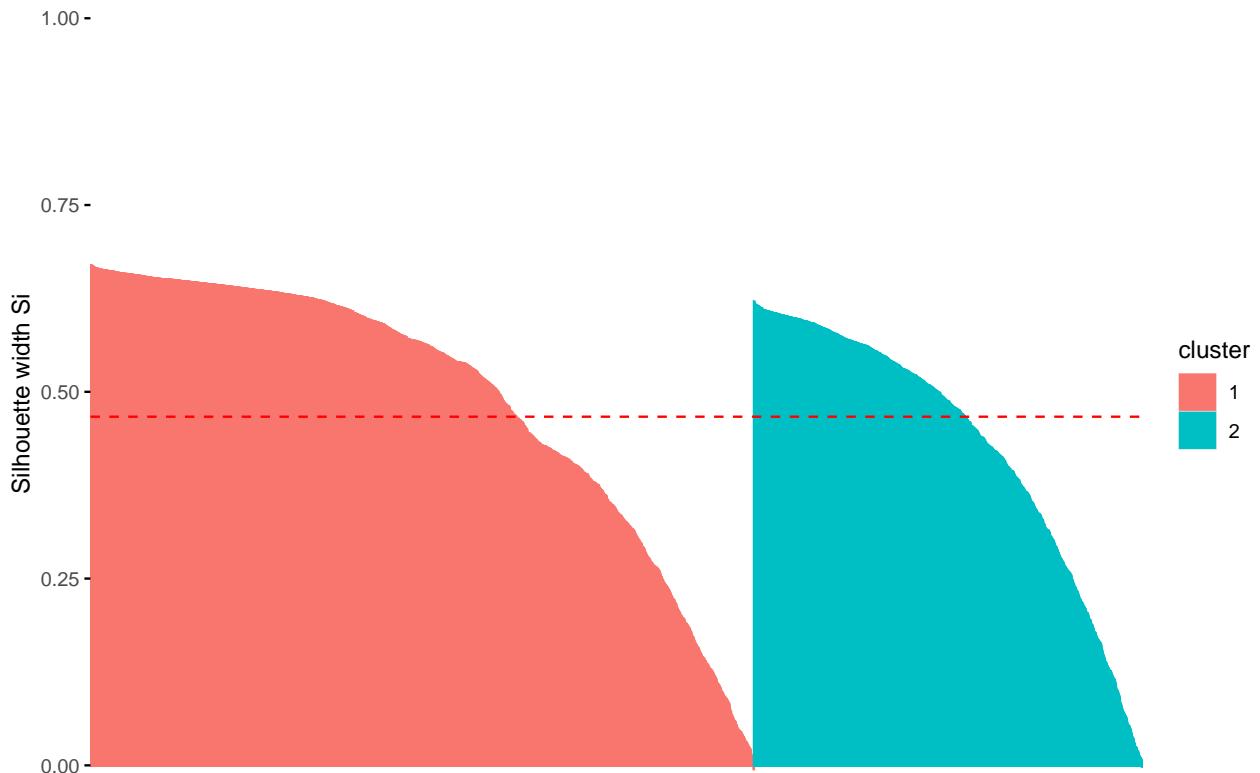
Cluster plot





```
## [1] "Segment cutoff values:"  
## [1] 0.09309558  
##   cluster size ave.sil.width  
## 1      1 2643      0.49  
## 2      2 1546      0.43
```

Clusters silhouette plot  
Average silhouette width: 0.47



```
## [1] "Cluster profiles:"  
## [1] "Num of DBs:"  
##   Cluster 1 Cluster 2  
##      9259      5431  
##  
##  
##  
## DB Population:  
##   Cluster 1 Cluster 2  
##      71.2       74.7  
##  
##  
##  
## CSD Population:  
##   Cluster 1 Cluster 2  
##      236130    231209.4  
##  
##  
##  
## CMA Type:  
##   Cluster 1 Cluster 2  
##      4008      2430  
## B      3864      2251  
## D      1034       584  
## K      353        166
```

```

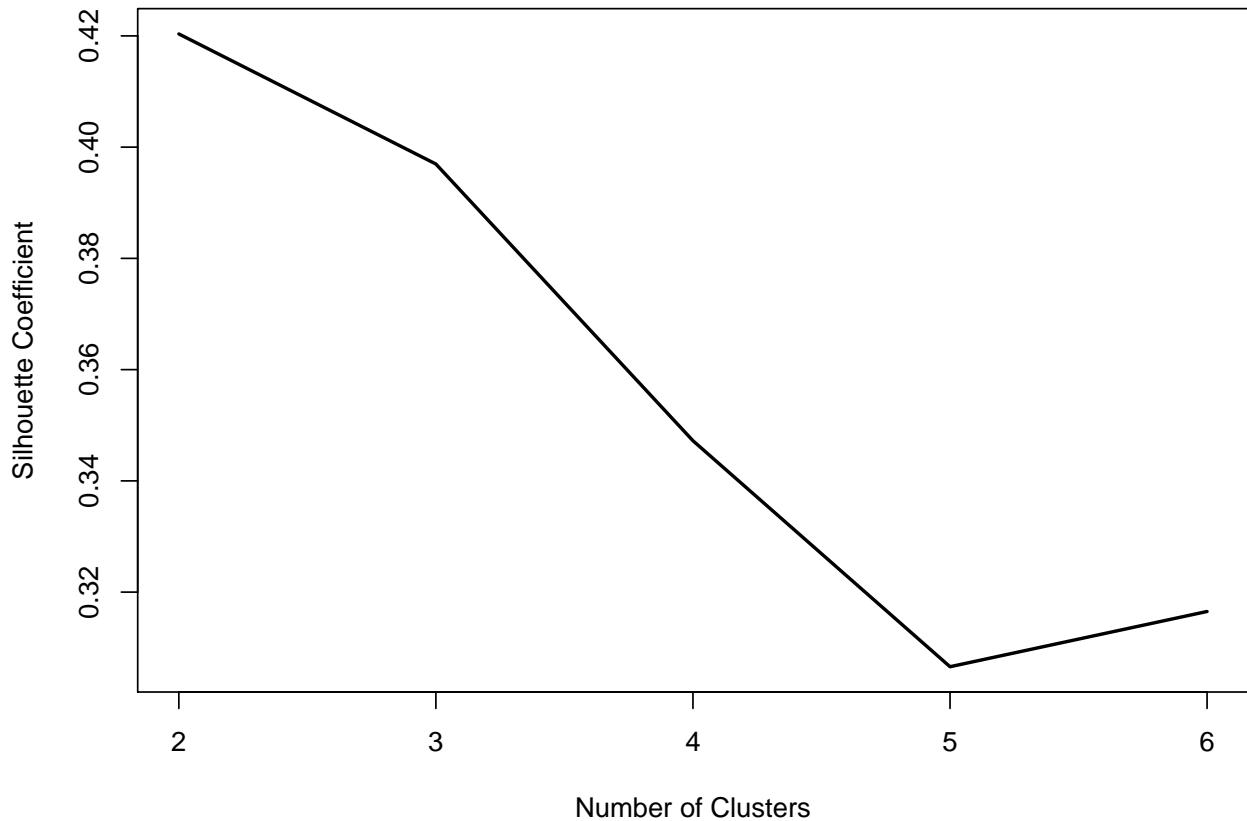
##
##
##
## Index of Remoteness:
## Cluster 1 Cluster 2
##      0.229      0.228
##
##
##
## Provinces:
##                  Cluster 1 Cluster 2
## Alberta            300      158
## BritishColumbia   468      255
## NewBrunswick       81       41
## NorthwestTerritories 4       3
## NovaScotia        269      181
## Ontario           1390     850
## Quebec            548      310
## Saskatchewan      48       23
## NA's              6151     3610
##
##
##
## Amenity dense:
## Cluster 1 Cluster 2
## 0      8350      4944
## 1      702       382
## 2       91       56
## F      116       49
##
##
##
## PMS_prox_idx_emp :
## Cluster 1 Cluster 2
##      0.02593    0.02432
##
##
##
## PMS_prox_idx_pharma :
## Cluster 1 Cluster 2
##      0.04589    0.04323
##
##
##
## PMS_prox_idx_childcare :
## Cluster 1 Cluster 2
##      0.07576    0.07782
##
##
##
## PMS_prox_idx_health :
## Cluster 1 Cluster 2
##      0.01424    0.01297
##

```

```
##  
##  
## PMS_prox_idx_grocery :  
## Cluster 1 Cluster 2  
## 0.07056 0.07147  
##  
##  
##  
## PMS_prox_idx_educpri :  
## Cluster 1 Cluster 2  
## 0.11631 0.11796  
##  
##  
##  
## PMS_prox_idx_educsec :  
## Cluster 1 Cluster 2  
## 0.10381 0.10287  
##  
##  
##  
## PMS_prox_idx_lib :  
## Cluster 1 Cluster 2  
## 0.11253 0.11491  
##  
##  
##  
## PMS_prox_idx_parks :  
## Cluster 1 Cluster 2  
## 0.06871 0.06791  
##  
##  
##  
## PMS_prox_idx_transit :  
## Cluster 1 Cluster 2  
## 0.01836 0.01737
```

---

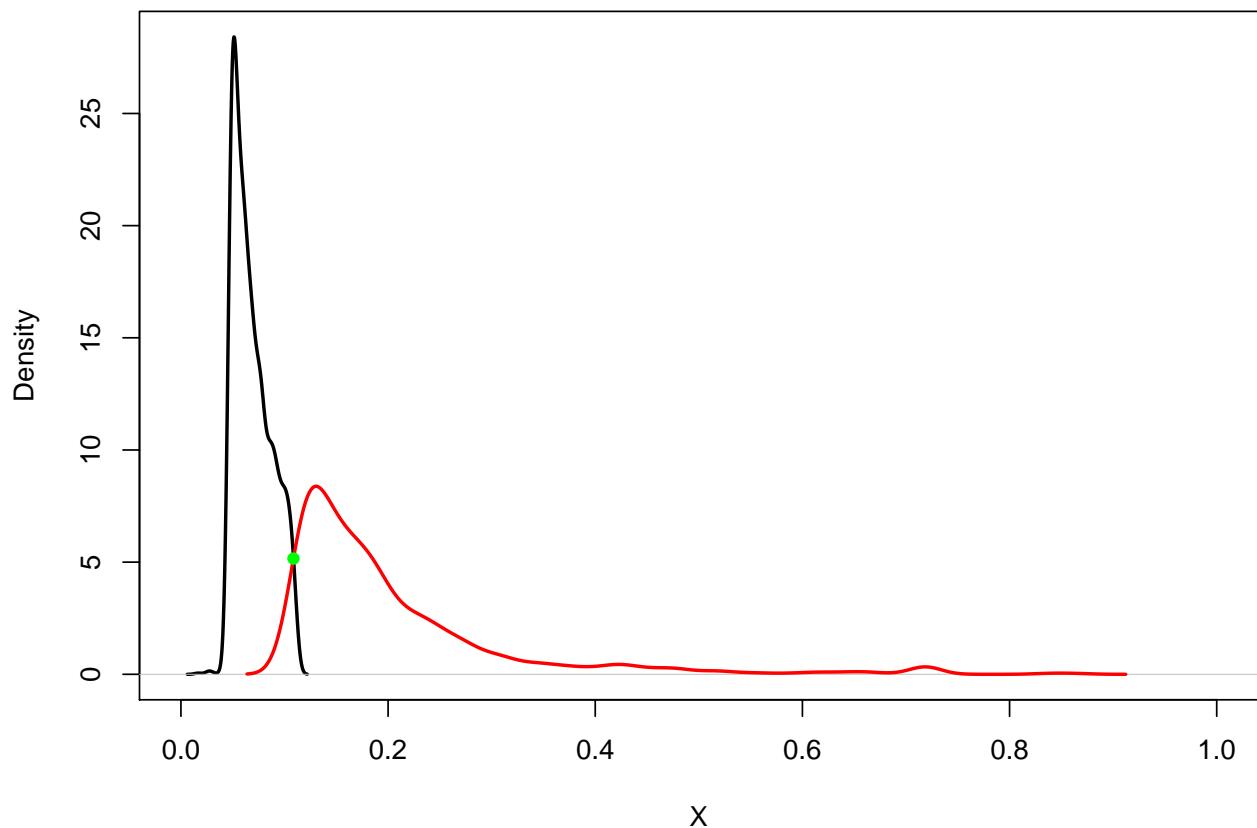
## Libraries



```
## [1] "Maximum silhouette coefficient: 0.420350257570142 For 2 clusters."
```

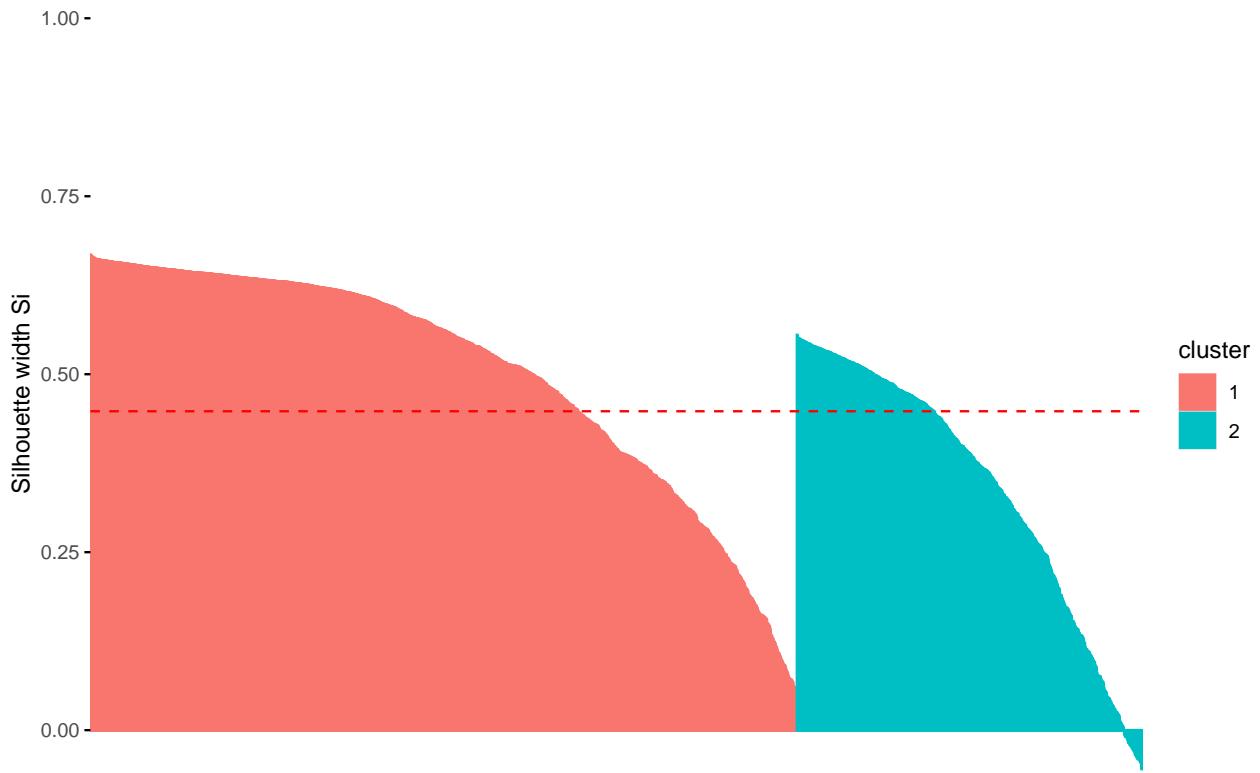
Cluster plot





```
## [1] "Segment cutoff values:"  
## [1] 0.1086404  
##   cluster size ave.sil.width  
## 1       1 2210      0.50  
## 2       2 1080      0.34
```

Clusters silhouette plot  
Average silhouette width: 0.45



```
## [1] "Cluster profiles:"  
## [1] "Num of DBs:"  
##   Cluster 1 Cluster 2  
##      9858      4832  
##  
##  
##  
##   DB Population:  
##   Cluster 1 Cluster 2  
##      74.3       69  
##  
##  
##  
##  
##   CSD Population:  
##   Cluster 1 Cluster 2  
##      232900.6  237188.4  
##  
##  
##  
##   CMA Type:  
##   Cluster 1 Cluster 2  
##      4274      2164  
##   B      4141      1974  
##   D      1094       524  
##   K      349        170
```

```

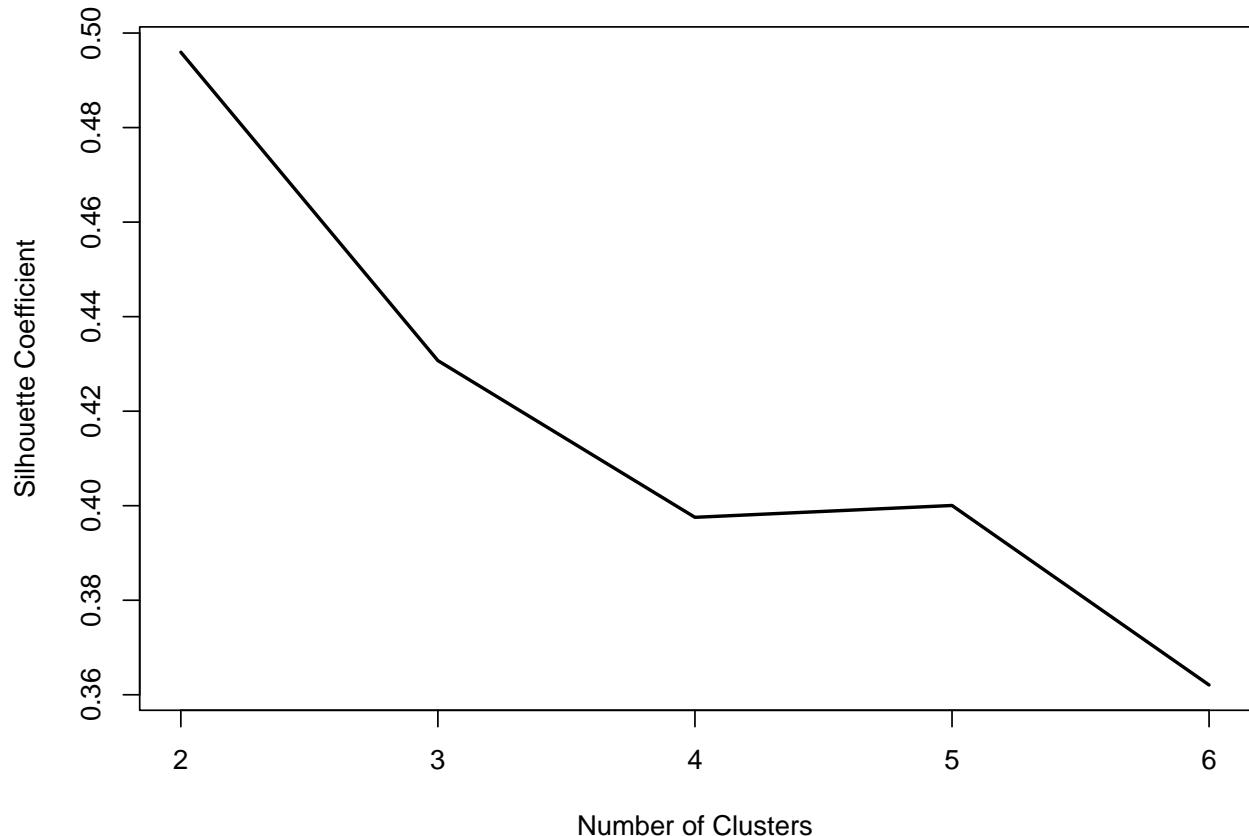
##
##
##
## Index of Remoteness:
## Cluster 1 Cluster 2
##      0.227      0.231
##
##
##
## Provinces:
##                  Cluster 1 Cluster 2
## Alberta            312      146
## BritishColumbia   488      235
## NewBrunswick       81       41
## NorthwestTerritories 5       2
## NovaScotia        299      151
## Ontario           1513     727
## Quebec            583      275
## Saskatchewan      50       21
## NA's              6527     3234
##
##
##
## Amenity dense:
## Cluster 1 Cluster 2
## 0      8939      4355
## 1      722       362
## 2       90       57
## F      107       58
##
##
##
## PMS_prox_idx_emp :
## Cluster 1 Cluster 2
##      0.02528    0.02546
##
##
##
## PMS_prox_idx_pharma :
## Cluster 1 Cluster 2
##      0.04487    0.04506
##
##
##
## PMS_prox_idx_childcare :
## Cluster 1 Cluster 2
##      0.07614    0.07727
##
##
##
## PMS_prox_idx_health :
## Cluster 1 Cluster 2
##      0.01393    0.01346
##

```

```
##  
##  
## PMS_prox_idx_grocery :  
## Cluster 1 Cluster 2  
##      0.07032    0.07208  
##  
##  
##  
## PMS_prox_idx_educpri :  
## Cluster 1 Cluster 2  
##      0.11704    0.11667  
##  
##  
##  
## PMS_prox_idx_educsec :  
## Cluster 1 Cluster 2  
##      0.1024     0.10566  
##  
##  
##  
## PMS_prox_idx_lib :  
## Cluster 1 Cluster 2  
##      0.11334    0.11354  
##  
##  
##  
## PMS_prox_idx_parks :  
## Cluster 1 Cluster 2  
##      0.06867    0.0679  
##  
##  
##  
## PMS_prox_idx_transit :  
## Cluster 1 Cluster 2  
##      0.01764    0.01877
```

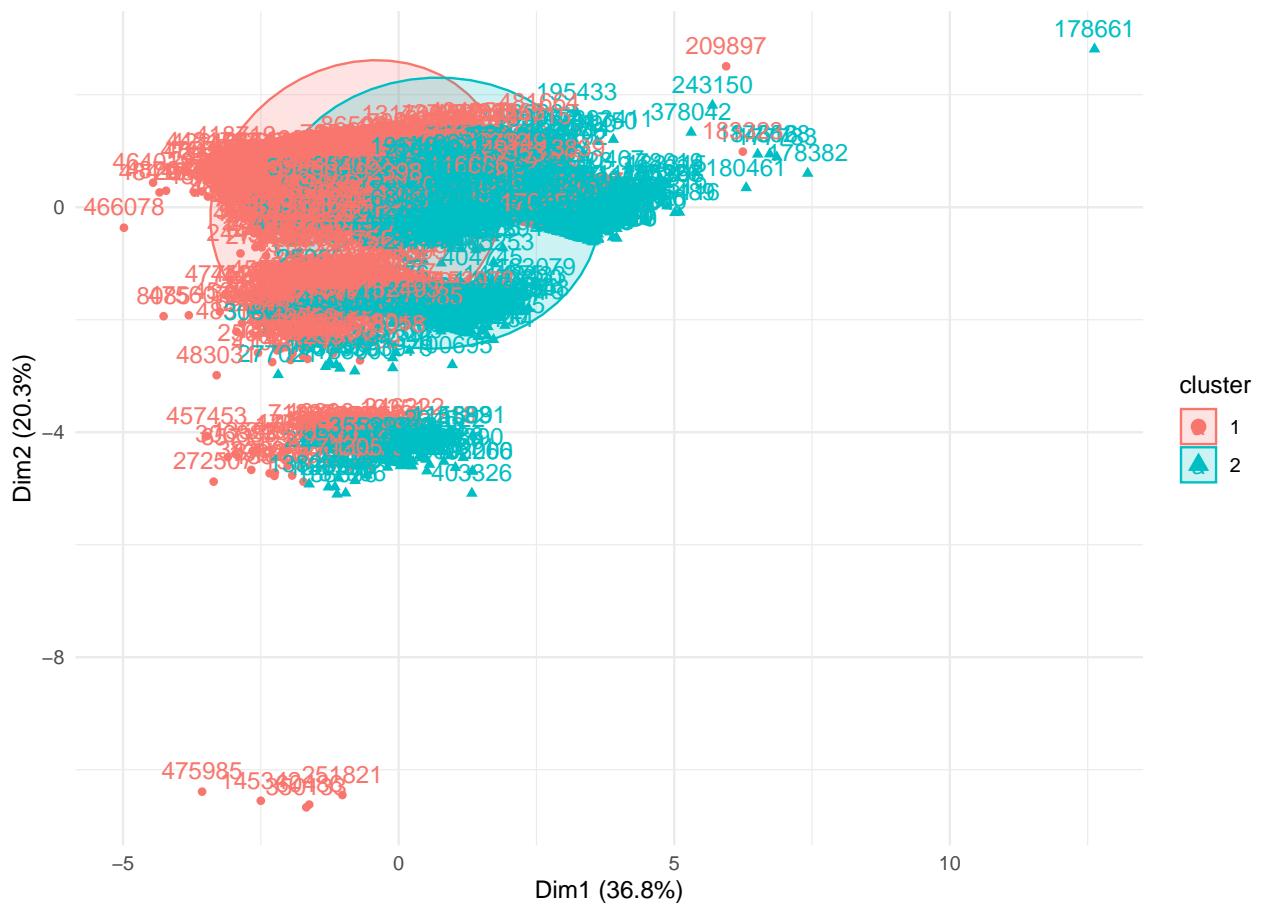
---

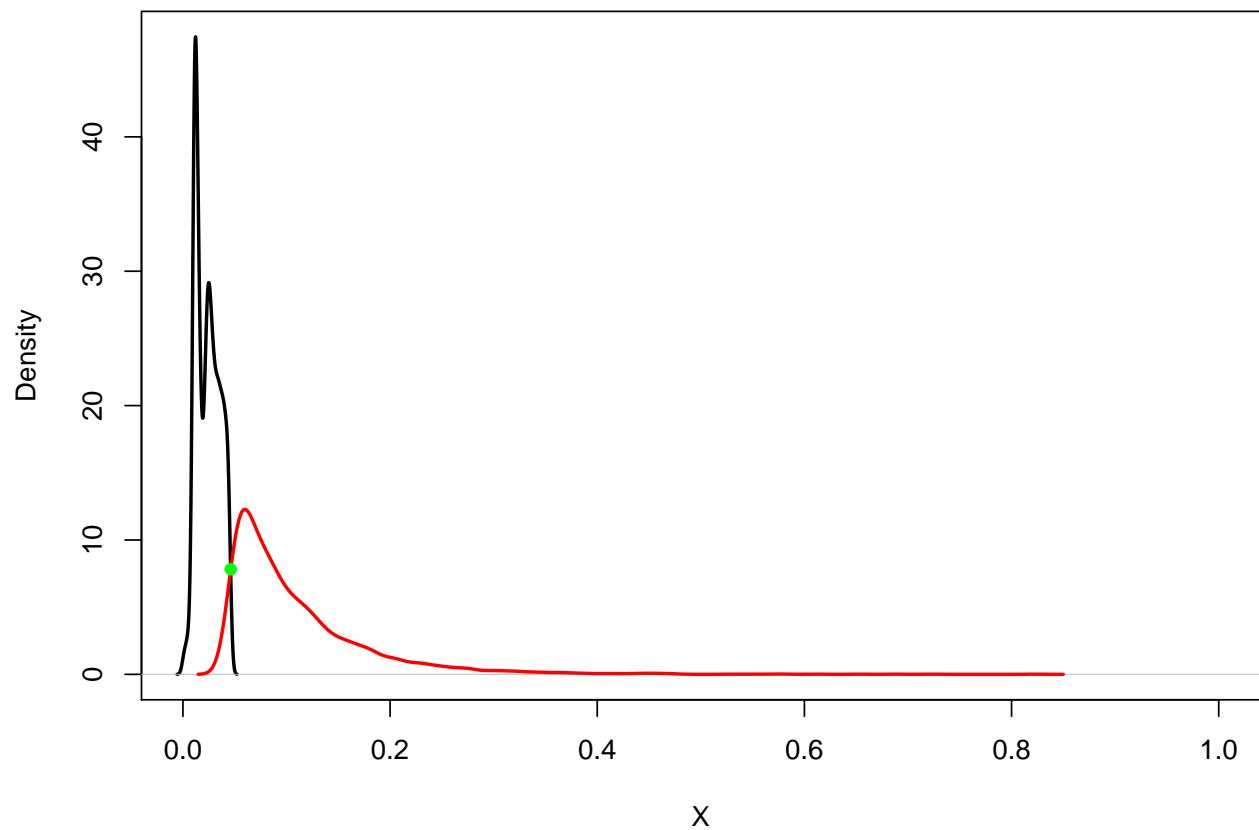
## Parks



```
## [1] "Maximum silhouete coefficient: 0.495947488039136 For 2 clusters."
```

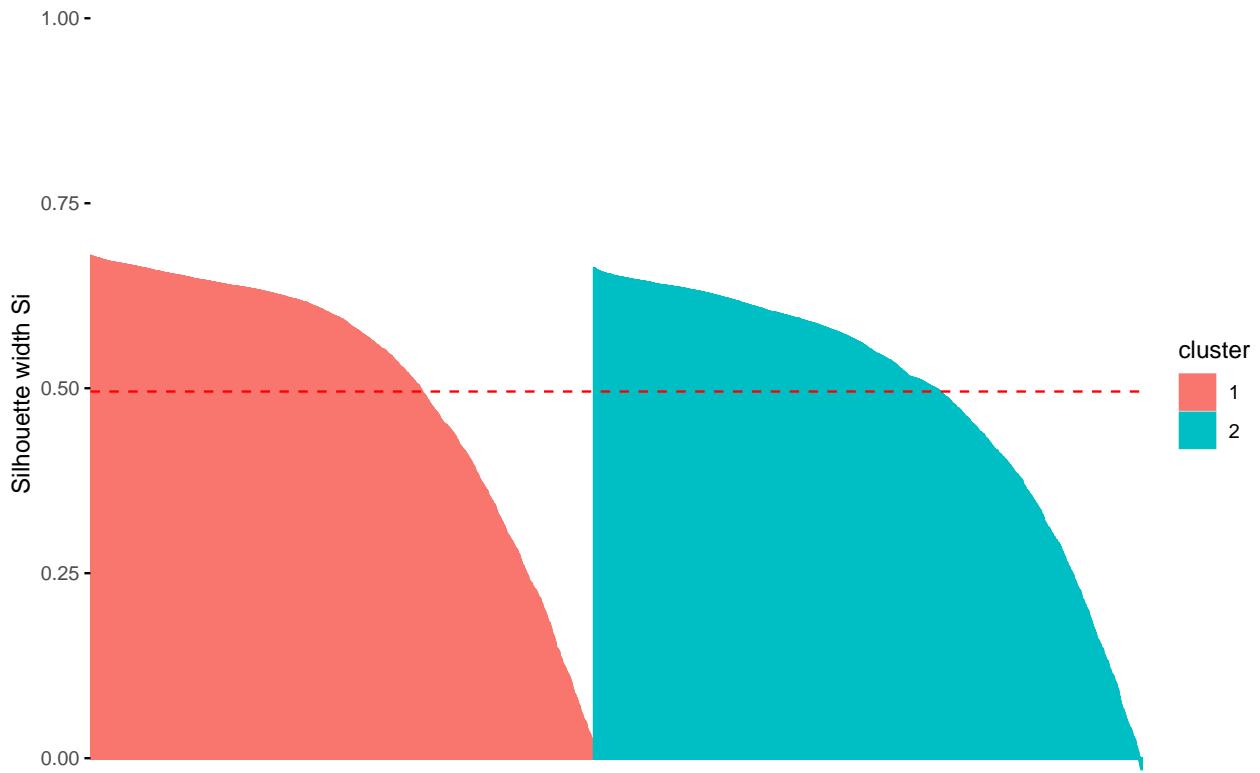
Cluster plot





```
## [1] "Segment cutoff values:"  
## [1] 0.04614224  
##   cluster size ave.sil.width  
## 1       1 3337      0.51  
## 2       2 3632      0.49
```

Clusters silhouette plot  
Average silhouette width: 0.5



```
## [1] "Cluster profiles:"  
## [1] "Num of DBs:"  
##   Cluster 1 Cluster 2  
##       7012      7678  
##  
##  
##  
##   DB Population:  
##   Cluster 1 Cluster 2  
##       73.2      71.9  
##  
##  
##  
##   CSD Population:  
##   Cluster 1 Cluster 2  
##       239213.5  229833.4  
##  
##  
##  
##   CMA Type:  
##   Cluster 1 Cluster 2  
##       3052      3386  
##   B          2932      3183  
##   D          771       847  
##   K          257       262
```

```

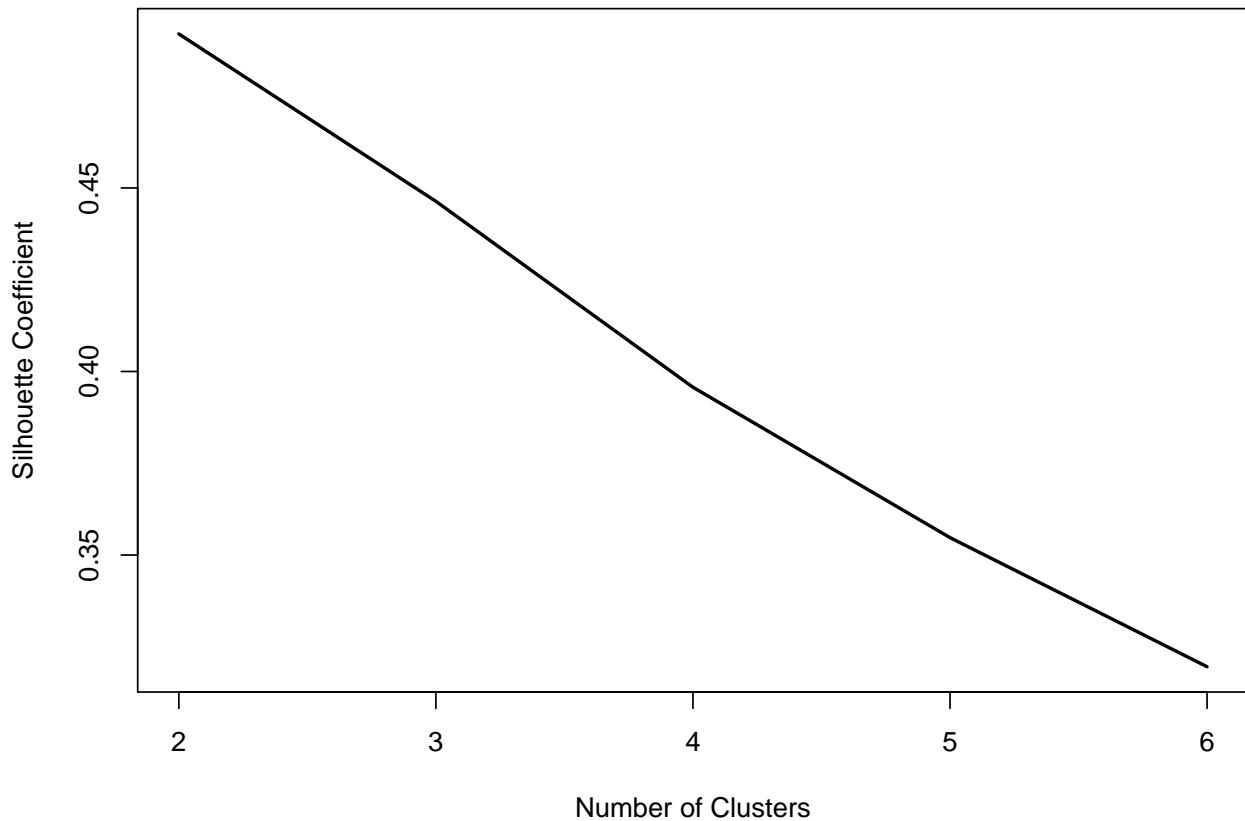
##
##
##
## Index of Remoteness:
## Cluster 1 Cluster 2
##      0.227      0.229
##
##
##
## Provinces:
##                  Cluster 1 Cluster 2
## Alberta            236      222
## BritishColumbia   335      388
## NewBrunswick       66       56
## NorthwestTerritories 5       2
## NovaScotia        213      237
## Ontario           1087     1153
## Quebec            403      455
## Saskatchewan      32       39
## NA's              4635     5126
##
##
##
## Amenity dense:
## Cluster 1 Cluster 2
## 0      6342      6952
## 1      518       566
## 2       72       75
## F       80       85
##
##
##
## PMS_prox_idx_emp :
## Cluster 1 Cluster 2
##      0.02591    0.02482
##
##
##
## PMS_prox_idx_pharma :
## Cluster 1 Cluster 2
##      0.04529    0.0446
##
##
##
## PMS_prox_idx_childcare :
## Cluster 1 Cluster 2
##      0.07737    0.07571
##
##
##
## PMS_prox_idx_health :
## Cluster 1 Cluster 2
##      0.01395    0.01361
##

```

```
##  
##  
## PMS_prox_idx_grocery :  
## Cluster 1 Cluster 2  
##      0.07079    0.07098  
##  
##  
##  
## PMS_prox_idx_educpri :  
## Cluster 1 Cluster 2  
##      0.11731    0.11656  
##  
##  
##  
## PMS_prox_idx_educsec :  
## Cluster 1 Cluster 2  
##      0.10389    0.1031  
##  
##  
##  
## PMS_prox_idx_lib :  
## Cluster 1 Cluster 2  
##      0.1141     0.11274  
##  
##  
##  
## PMS_prox_idx_parks :  
## Cluster 1 Cluster 2  
##      0.06951    0.06741  
##  
##  
##  
## PMS_prox_idx_transit :  
## Cluster 1 Cluster 2  
##      0.01859    0.01747
```

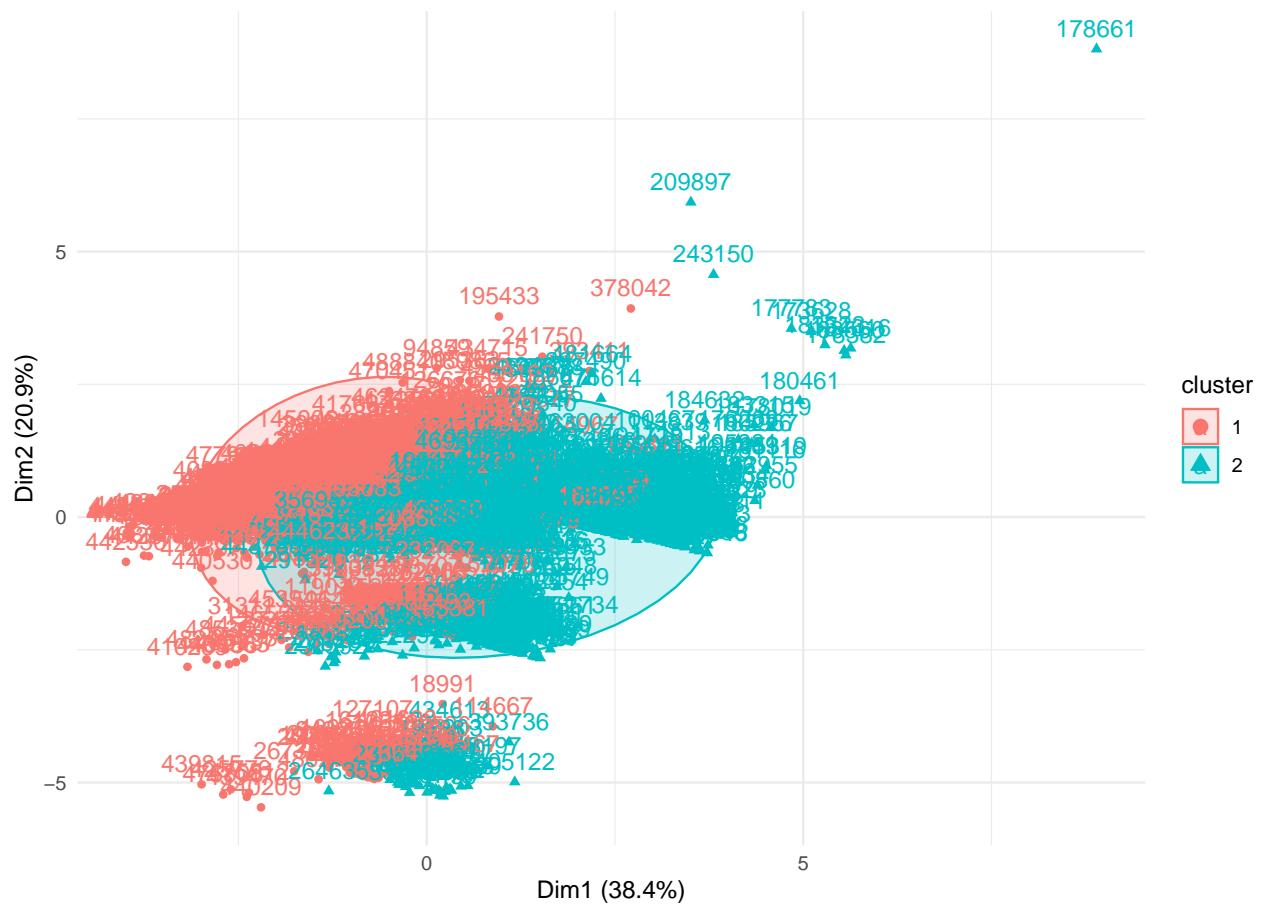
---

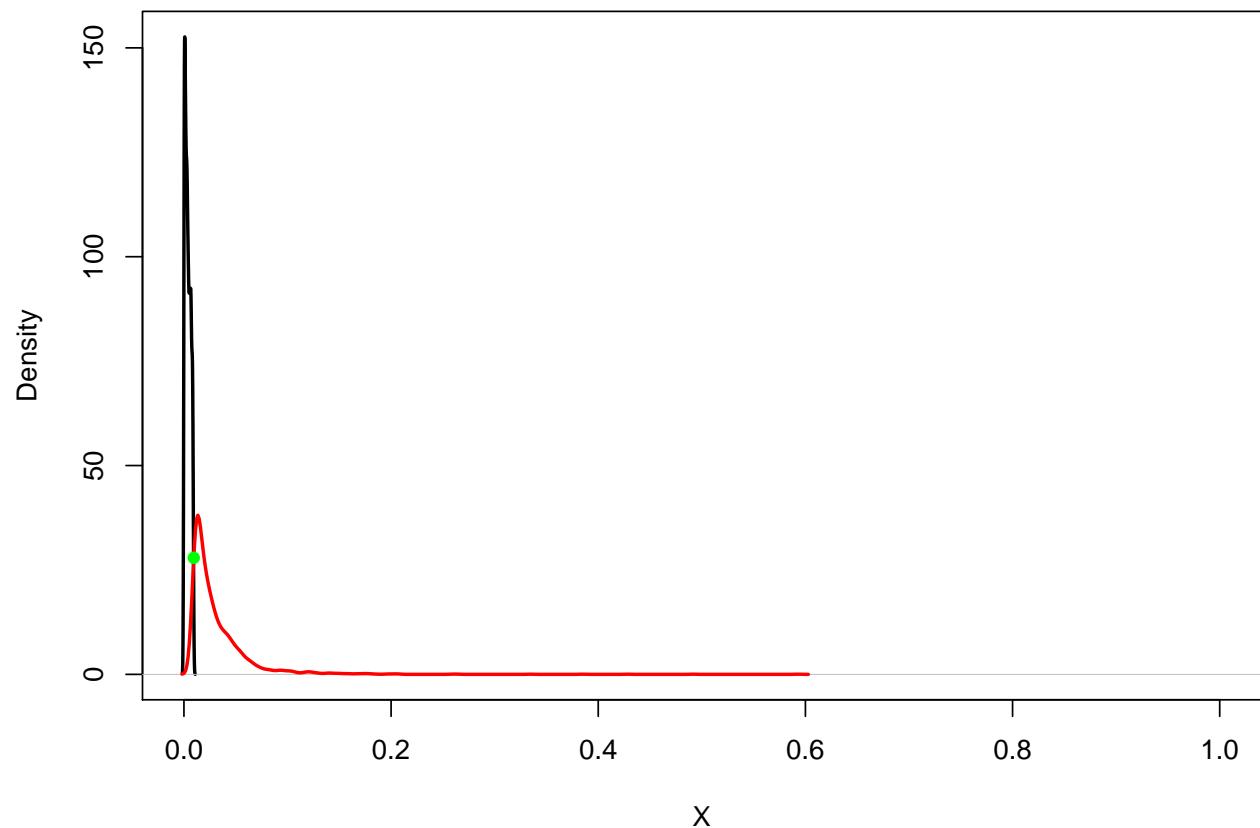
Transit



```
## [1] "Maximum silhouette coefficient: 0.491954395188029 For 2 clusters."
```

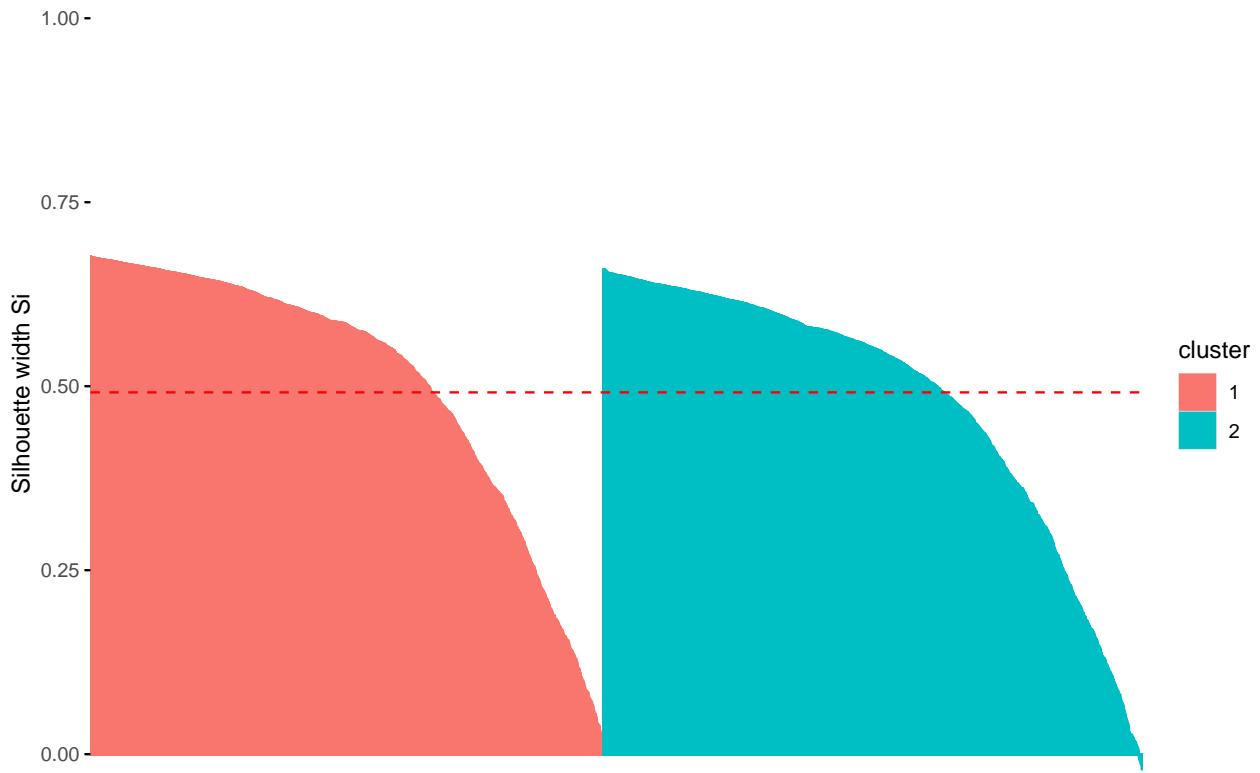
Cluster plot





```
## [1] "Segment cutoff values:"  
## [1] 0.009488396  
##   cluster size ave.sil.width  
## 1       1 2610      0.50  
## 2       2 2742      0.48
```

Clusters silhouette plot  
Average silhouette width: 0.49



```
## [1] "Cluster profiles:"  
## [1] "Num of DBs:"  
##   Cluster 1 Cluster 2  
##       7170      7520  
##  
##  
##  
##   DB Population:  
##   Cluster 1 Cluster 2  
##       74.7      70.5  
##  
##  
##  
##   CSD Population:  
##   Cluster 1 Cluster 2  
##       233333.7  235242.4  
##  
##  
##  
##   CMA Type:  
##   Cluster 1 Cluster 2  
##       3167      3271  
##   B       2961      3154  
##   D       787       831  
##   K       255       264
```

```

##
##
##
## Index of Remoteness:
## Cluster 1 Cluster 2
##      0.228      0.228
##
##
##
## Provinces:
##                  Cluster 1 Cluster 2
## Alberta            239      219
## BritishColumbia   363      360
## NewBrunswick       56       66
## NorthwestTerritories 4       3
## NovaScotia        219      231
## Ontario           1088     1152
## Quebec            433      425
## Saskatchewan      32       39
## NA's              4736     5025
##
##
##
## Amenity dense:
## Cluster 1 Cluster 2
## 0      6448      6846
## 1      560       524
## 2       74       73
## F       88       77
##
##
##
## PMS_prox_idx_emp :
## Cluster 1 Cluster 2
##      0.02634    0.02439
##
##
##
## PMS_prox_idx_pharma :
## Cluster 1 Cluster 2
##      0.04765    0.04232
##
##
##
## PMS_prox_idx_childcare :
## Cluster 1 Cluster 2
##      0.07864    0.07451
##
##
##
## PMS_prox_idx_health :
## Cluster 1 Cluster 2
##      0.01443    0.01317
##

```

```
##  
##  
## PMS_prox_idx_grocery :  
## Cluster 1 Cluster 2  
## 0.07246 0.06937  
##  
##  
##  
## PMS_prox_idx_educpri :  
## Cluster 1 Cluster 2  
## 0.11866 0.11528  
##  
##  
##  
## PMS_prox_idx_educsec :  
## Cluster 1 Cluster 2  
## 0.10648 0.10063  
##  
##  
##  
## PMS_prox_idx_lib :  
## Cluster 1 Cluster 2  
## 0.11008 0.11661  
##  
##  
##  
## PMS_prox_idx_parks :  
## Cluster 1 Cluster 2  
## 0.06952 0.0674  
##  
##  
##  
## PMS_prox_idx_transit :  
## Cluster 1 Cluster 2  
## 0.0186 0.01745
```

---

## Conclusion

text

