Rule Mining

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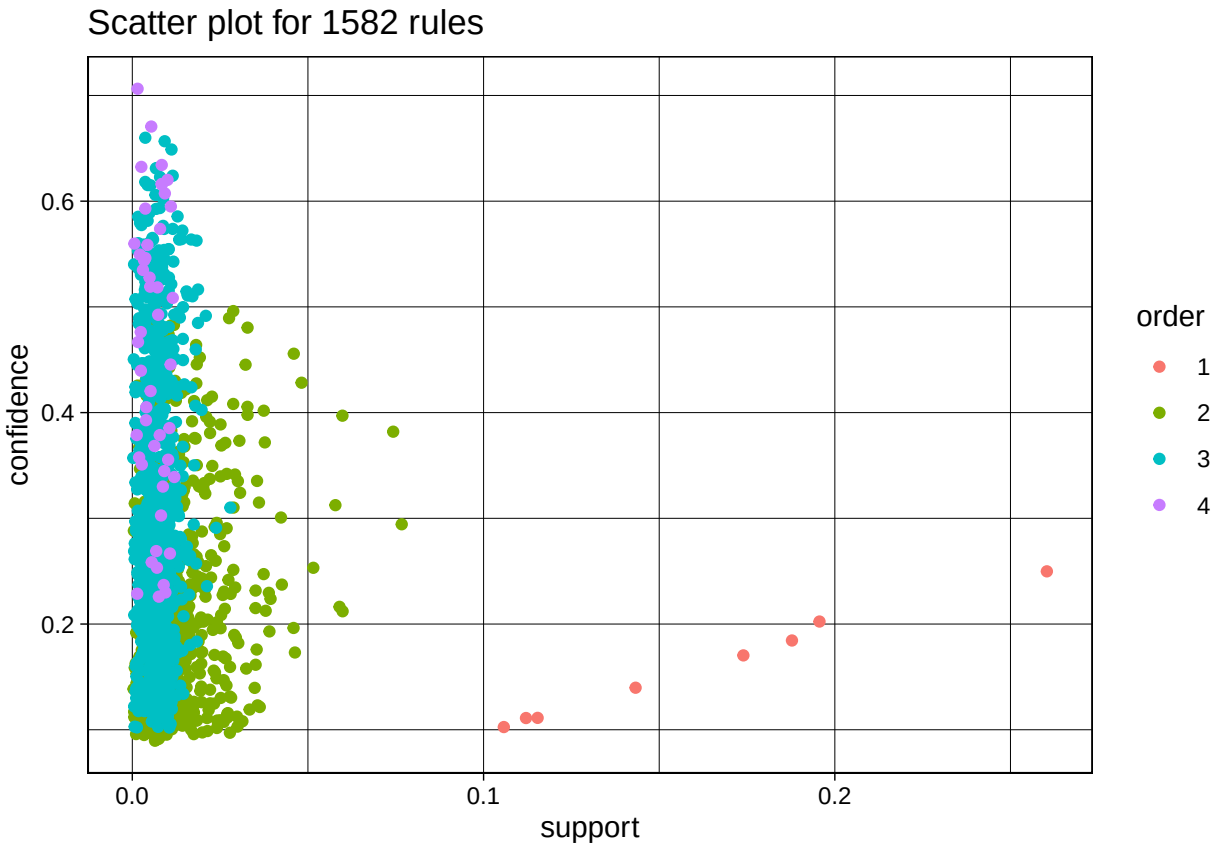
First we separated the data out into a format that the code could easily read. Then we put parameters on the data and are only looking at the data that has at more than a confidence of 0.005 and a support of 0.1.

The pertinent information from the summery of this subset from the groceries.txt file is that in all there are 1582 rules.

This is a plots of the rules where the groceries data is grouped off into 4 orders.

```
## To reduce overplotting, jitter is added! Use jitter = 0 to prevent jitter.
```



These are the rules where the support is larger than 0.05.

```
##      lhs                rhs                support    confidence coverage
## [1]  {}              => {bottled water}    0.11052364 0.1105236  1.0000000
## [2]  {}              => {tropical fruit}   0.10493137 0.1049314  1.0000000
## [3]  {}              => {root vegetables}  0.10899847 0.1089985  1.0000000
## [4]  {}              => {soda}             0.17437722 0.1743772  1.0000000
## [5]  {}              => {yogurt}           0.13950178 0.1395018  1.0000000
```

```
## [6]  {}                 => {rolls/buns}       0.18393493 0.1839349  1.0000000
## [7]  {}                 => {other vegetables} 0.19349263 0.1934926  1.0000000
## [8]  {}                 => {whole milk}       0.25551601 0.2555160  1.0000000
## [9]  {yogurt}           => {whole milk}       0.05602440 0.4016035  0.1395018
## [10] {whole milk}       => {yogurt}           0.05602440 0.2192598  0.2555160
## [11] {rolls/buns}       => {whole milk}       0.05663447 0.3079049  0.1839349
## [12] {whole milk}       => {rolls/buns}       0.05663447 0.2216474  0.2555160
## [13] {other vegetables} => {whole milk}       0.07483477 0.3867578  0.1934926
## [14] {whole milk}       => {other vegetables} 0.07483477 0.2928770  0.2555160
##      lift     count
## [1]  1.000000 1087
## [2]  1.000000 1032
## [3]  1.000000 1072
## [4]  1.000000 1715
## [5]  1.000000 1372
## [6]  1.000000 1809
## [7]  1.000000 1903
## [8]  1.000000 2513
## [9]  1.571735  551
## [10] 1.571735  551
## [11] 1.205032  557
## [12] 1.205032  557
## [13] 1.513634  736
## [14] 1.513634  736
```

You can see from these rules which items are the top 8 grocery items bought on there own. Each item bought at least 1000 times a piece. (There are 9835 entrys in the data).

These are the rules where the confidence is larger than 0.6. While it might look overwhelming due to formatting issues, the reason this is being included is to point out the rhs column.

```
##      lhs                          rhs                    support confidence    coverage     lift count
## [1]  {onions,
##       root vegetables}       => {other vegetables} 0.005693950  0.6021505 0.009456024 3.112008    56
## [2]  {curd,
##       tropical fruit}        => {whole milk}       0.006507372  0.6336634 0.010269446 2.479936    64
## [3]  {domestic eggs,
##       margarine}             => {whole milk}       0.005185562  0.6219512 0.008337570 2.434099    51
## [4]  {butter,
##       domestic eggs}         => {whole milk}       0.005998983  0.6210526 0.009659380 2.430582    59
## [5]  {butter,
##       whipped/sour cream}    => {whole milk}       0.006710727  0.6600000 0.010167768 2.583008    66
## [6]  {bottled water,
##       butter}                => {whole milk}       0.005388917  0.6022727 0.008947636 2.357084    53
## [7]  {butter,
##       tropical fruit}        => {whole milk}       0.006202339  0.6224490 0.009964413 2.436047    61
## [8]  {butter,
##       root vegetables}       => {whole milk}       0.008235892  0.6377953 0.012913066 2.496107    81
## [9]  {butter,
##       yogurt}                => {whole milk}       0.009354347  0.6388889 0.014641586 2.500387    92
## [10] {domestic eggs,
##       pip fruit}             => {whole milk}       0.005388917  0.6235294 0.008642603 2.440275    53
## [11] {domestic eggs,
##       tropical fruit}        => {whole milk}       0.006914082  0.6071429 0.011387900 2.376144    68
## [12] {pip fruit,
```

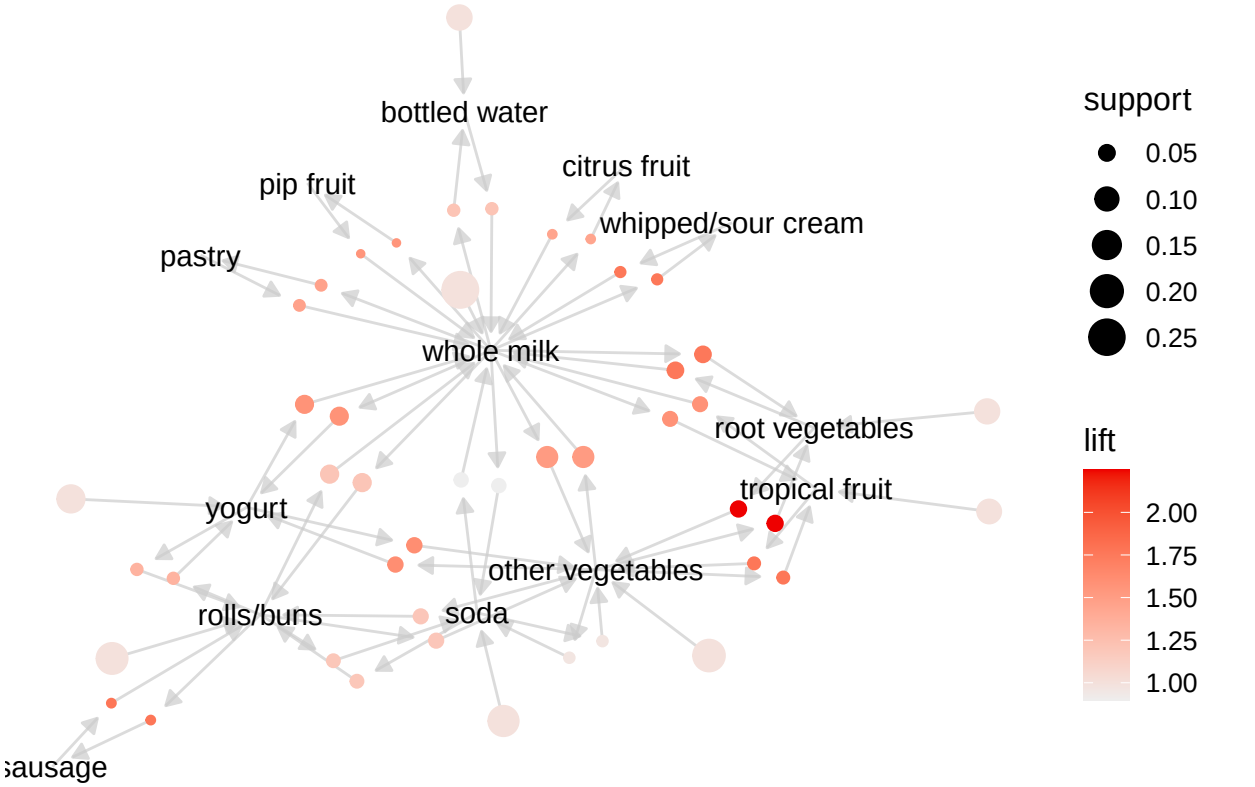
```
##       whipped/sour cream}    => {other vegetables} 0.005592272  0.6043956 0.009252669 3.123610    55
## [13] {pip fruit,
##       whipped/sour cream}    => {whole milk}       0.005998983  0.6483516 0.009252669 2.537421    59
## [14] {fruit/vegetable juice,
##       other vegetables,
##       yogurt}                => {whole milk}       0.005083884  0.6172840 0.008235892 2.415833    50
## [15] {other vegetables,
##       root vegetables,
##       whipped/sour cream}    => {whole milk}       0.005185562  0.6071429 0.008540925 2.376144    51
## [16] {other vegetables,
##       pip fruit,
##       root vegetables}       => {whole milk}       0.005490595  0.6750000 0.008134215 2.641713    54
## [17] {pip fruit,
##       root vegetables,
##       whole milk}            => {other vegetables} 0.005490595  0.6136364 0.008947636 3.171368    54
## [18] {other vegetables,
##       pip fruit,
##       yogurt}                => {whole milk}       0.005083884  0.6250000 0.008134215 2.446031    50
## [19] {citrus fruit,
##       root vegetables,
##       whole milk}            => {other vegetables} 0.005795628  0.6333333 0.009150991 3.273165    57
## [20] {root vegetables,
##       tropical fruit,
##       yogurt}                => {whole milk}       0.005693950  0.7000000 0.008134215 2.739554    56
## [21] {other vegetables,
##       tropical fruit,
##       yogurt}                => {whole milk}       0.007625826  0.6198347 0.012302999 2.425816    75
## [22] {other vegetables,
##       root vegetables,
##       yogurt}                => {whole milk}       0.007829181  0.6062992 0.012913066 2.372842    77
```

These rules show how whole milk is bought with just about everything, as well other vegetables are commonly bought with a wide variety of other items.

This first plot is considering all rules where the confidence and the support are greater than 0.03.

```
## set of 46 rules
##
## rule length distribution (lhs + rhs):sizes
##  1  2
##  8 38
##
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   1.000   2.000   2.000   1.826   2.000   2.000
##
## summary of quality measures:
##     support          confidence        coverage            lift
##  Min.   :0.03010   Min.   :0.1049   Min.   :0.07168   Min.   :0.8991
##  1st Qu.:0.03353   1st Qu.:0.1671   1st Qu.:0.13950   1st Qu.:1.0488
##  Median :0.04230   Median :0.2200   Median :0.19349   Median :1.4424
##  Mean   :0.06175   Mean   :0.2420   Mean   :0.32140   Mean   :1.3938
##  3rd Qu.:0.05648   3rd Qu.:0.3112   3rd Qu.:0.25552   3rd Qu.:1.6007
##  Max.   :0.25552   Max.   :0.4496   Max.   :1.00000   Max.   :2.2466
##      count
##  Min.   : 296.0
```

```
##  1st Qu.: 329.8
##  Median : 416.0
##  Mean   : 607.3
##  3rd Qu.: 555.5
##  Max.   :2513.0
##
## mining info:
##       data ntransactions support confidence
##  groceries          9835   0.005        0.1
```



Following it up we have this graph used in gephi to break it up into 7 orders (each shown as a different color) and how the grocery items are connected.

This second group of plots is when there is a more stict set of rules on the data. Here the confidence has tp be larger than 0.3 and the support has to be larger than 0.03.

```
## set of 14 rules
##
## rule length distribution (lhs + rhs):sizes
##  2
## 14
##
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##       2       2       2       2       2       2
##
## summary of quality measures:
##     support          confidence        coverage            lift
##  Min.   :0.03010   Min.   :0.3079   Min.   :0.07168   Min.   :1.205
##  1st Qu.:0.03249   1st Qu.:0.3298   1st Qu.:0.09021   1st Qu.:1.475
##  Median :0.03910   Median :0.3802   Median :0.10696   Median :1.575
```

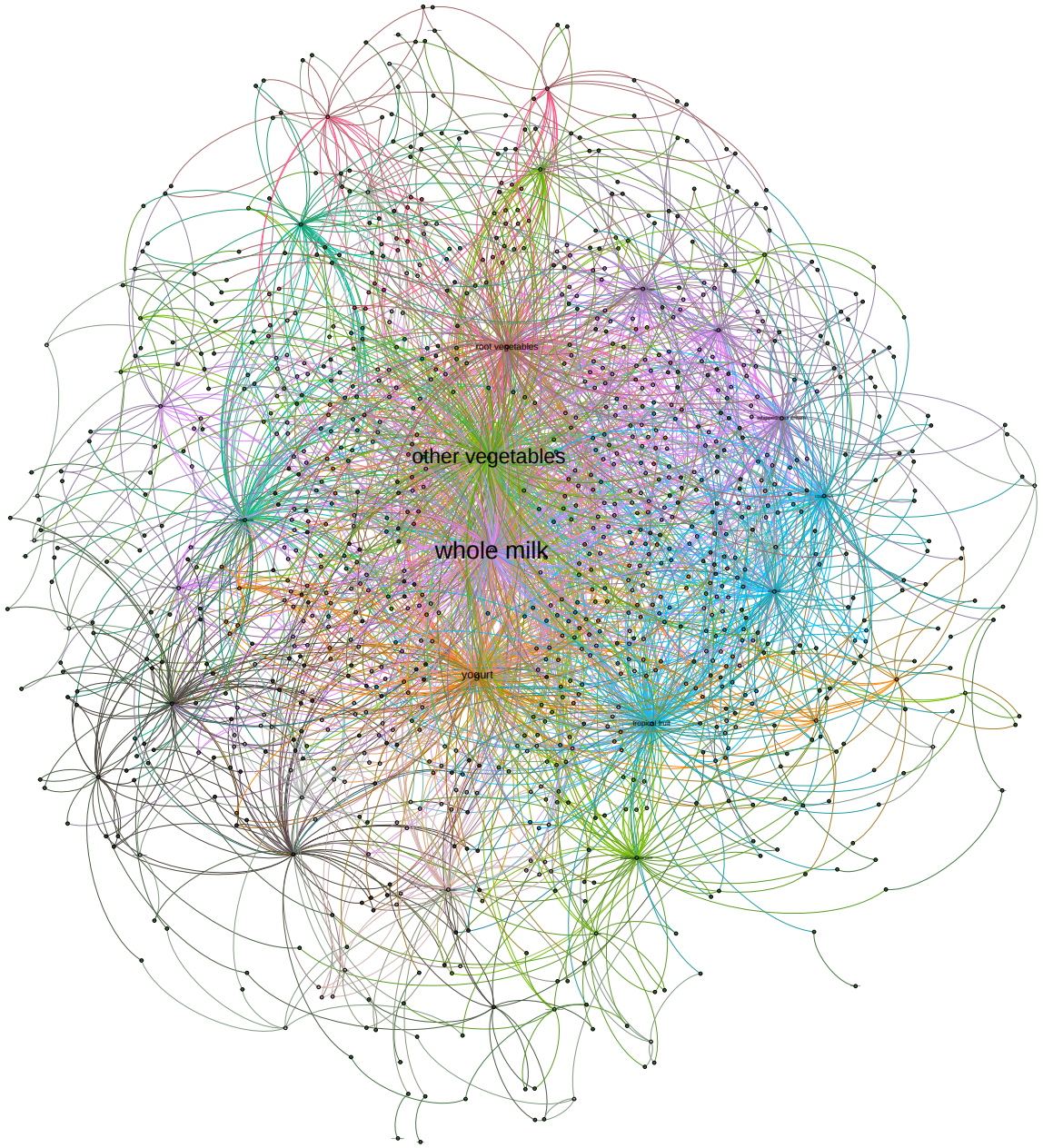
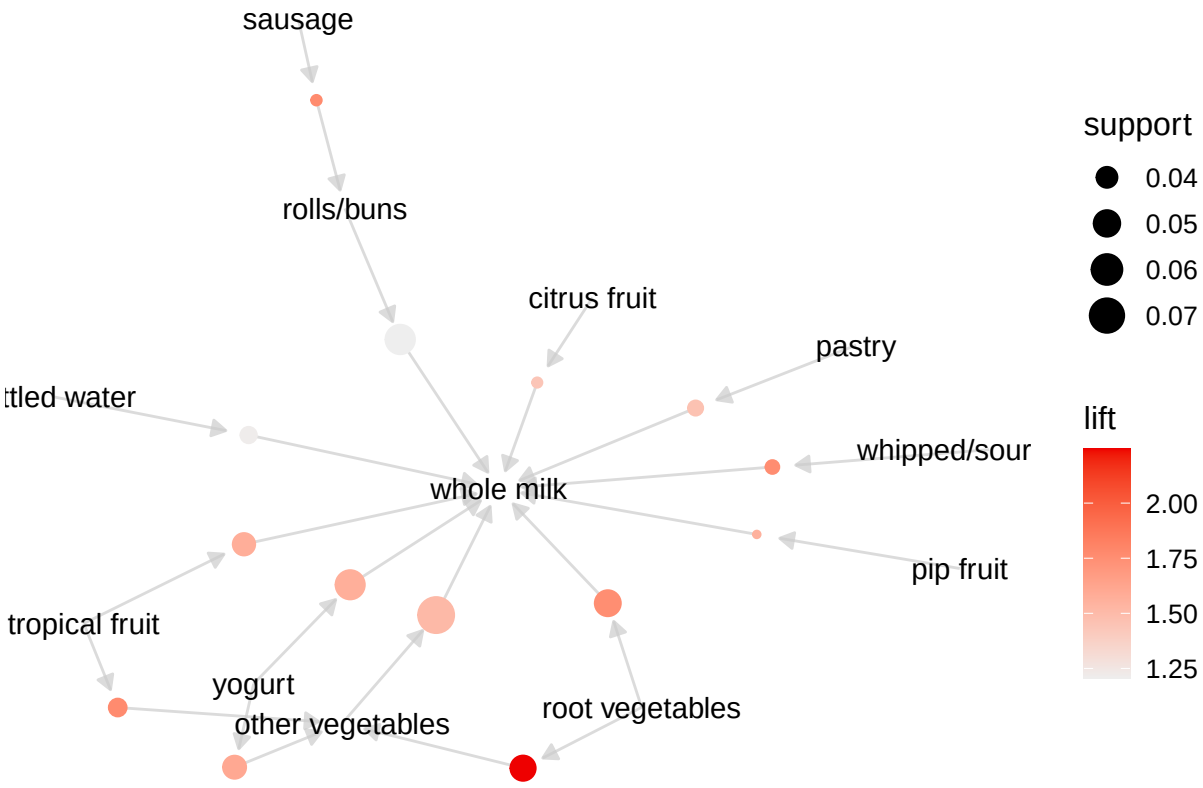


Figure 1: Support > 0.03, Confidence > 0.03

```
##  Mean   :0.04260   Mean   :0.3759   Mean   :0.11484   Mean   :1.604
##  3rd Qu.:0.04853   3rd Qu.:0.4027   3rd Qu.:0.13226   3rd Qu.:1.759
##  Max.   :0.07483   Max.   :0.4496   Max.   :0.19349   Max.   :2.247
##       count
##  Min.   :296.0
##  1st Qu.:319.5
##  Median :384.5
##  Mean   :419.0
##  3rd Qu.:477.2
##  Max.   :736.0
##
## mining info:
##        data ntransactions support confidence
##  groceries          9835   0.005        0.1
```



Once again, the following graph created in gephi breaks up the grocery items into 7 orders (each shown as a different color) and how they items are connected to each other.

As we can see this is a much simpler visual of the data and both versions of the plot can help us easily determine certain things. Such as the first shows some of the other items commonly bought with groceries such as pasties, fruit, and bottle water. While in the second plot it is easier to what items are more connected to items in other groups, and how connected things like vegtables and whole milk are to the rest of the information.

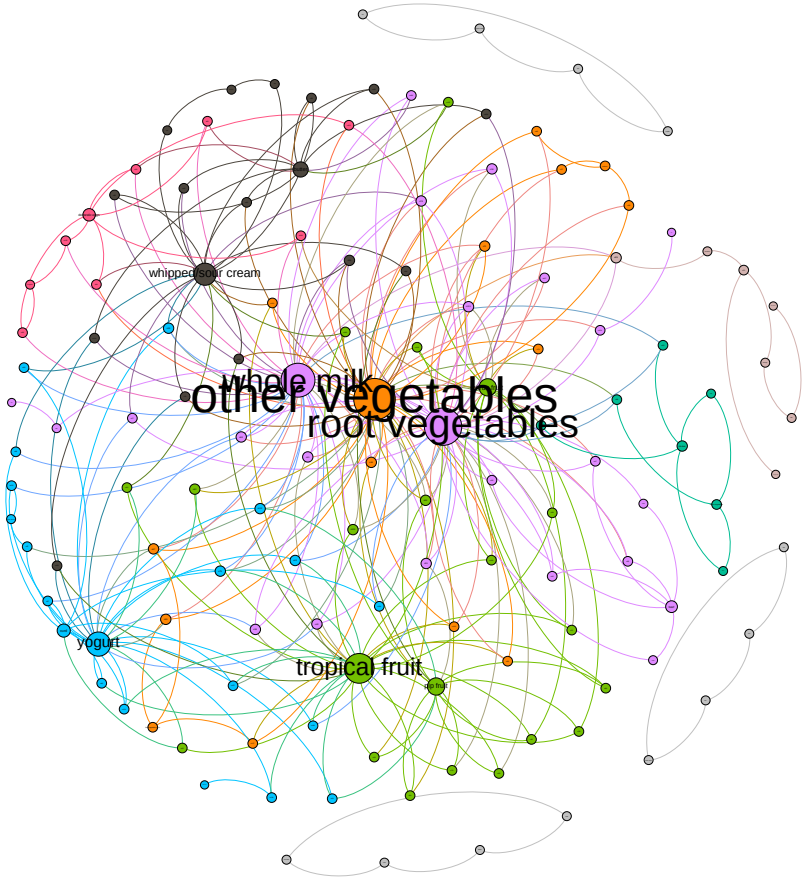


Figure 2: Support > 0.03, Confidence > 0.3