Drawing maps with Leaflet

Making maps in R

- Spatial data comes with locations (perhaps with information about those locations).
- A good way to draw spatial data is on a map.
- The leaflet package is the easiest way to draw maps in R.
- Install these two packages, with two familiar ones:

```r
library(tmaptools)
library(leaflet)
library(tidyverse)
library(conflicted)
```

Hockey league map

The Ontario hockey divisions (the last example for cluster analysis) came with a very bad map. Can we do better?

- reload the Ontario road distances

```
my_url <-
  "http://ritsokiguess.site/datafiles/ontario-road-distances.c
# my_url <- "ontario-road-distances.csv"
ontario <- read_csv(my_url)
```

```
##
## -- Column specification --------------------------------
## cols(
##   .default = col_double(),
##   place = col_character()
## )
## i Use `spec()` for the full column specifications.
```

Ontario road distances (some)

```
ontario
```

```
## # A tibble: 21 x 22
##    place      Barrie Belleville Brantford Brockville
##    <chr>       <dbl>      <dbl>     <dbl>      <dbl>
##  1 Barrie          0        260       190        405
##  2 Belleville    260          0       290        155
##  3 Brantford     190        290         0        420
##  4 Brockville    405        155       420          0
##  5 Cornwall      500        250       535         95
##  6 Hamilton      145        255        40        405
##  7 Huntsville    125        280       300        405
##  8 Kingston      330         75       340         80
##  9 Kitchener     180        280        40        425
## 10 London        260        360        85        510
## # ... with 11 more rows, and 17 more variables:
## #   Cornwall <dbl>  Hamilton <dbl>
```

Grab the places

- and append province ("ON") for reasons shortly to become clear:

```r
tibble(place = ontario$place) %>%
  mutate(prov = "ON") %>%
  unite(place1, c(place, prov), sep = " ") -> ontario2
ontario2
```

```
## # A tibble: 21 x 1
##    place1
##    <chr>
##  1 Barrie ON
##  2 Belleville ON
##  3 Brantford ON
##  4 Brockville ON
##  5 Cornwall ON
##  6 Hamilton ON
##  7 Huntsville ON
```

Geocode 1/2

- find their latitudes and longitudes (“geocode”; slow).
- Save the geocoded places.

```
ontario2 %>%
  rowwise() %>%
  mutate(ll = list(geocode_OSM(place1))) -> d
d
```

```
## # A tibble: 21 x 2
##     place1        ll
##     <chr>         <list>
##   1 Barrie ON     <named list [3]>
##   2 Belleville ON <named list [3]>
##   3 Brantford ON  <named list [3]>
##   4 Brockville ON <named list [3]>
##   5 Cornwall ON   <named list [3]>
##   6 Hamilton ON   <named list [3]>
```

Geocode 2/2

Untangle the lats and longs:

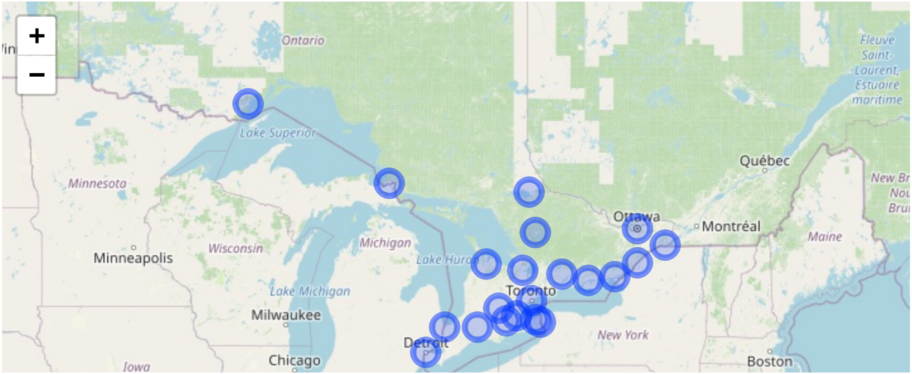
```
d %>%
  unnest_wider(ll) %>%
  unnest_wider(coords) -> ontario3
ontario3
```

```
## # A tibble: 21 x 5
##    place1        query             x     y bbox
##    <chr>         <chr>         <dbl> <dbl> <list>
##  1 Barrie ON     Barrie ON     -79.7  44.4 <bbox [4~
##  2 Belleville ON Belleville ON -77.4  44.2 <bbox [4~
##  3 Brantford ON  Brantford ON  -80.3  43.1 <bbox [4~
##  4 Brockville ON Brockville ON -75.7  44.6 <bbox [4~
##  5 Cornwall ON   Cornwall ON   -74.7  45.0 <bbox [4~
##  6 Hamilton ON   Hamilton ON   -79.9  43.3 <bbox [4~
##  7 Huntsville ON Huntsville ON -79.2  45.3 <bbox [4~
```

Make map

- finally:

```
leaflet(data = ontario3) %>%
  addTiles() %>%
  addCircleMarkers(lng = ~x, lat = ~y) -> locs
locs
```

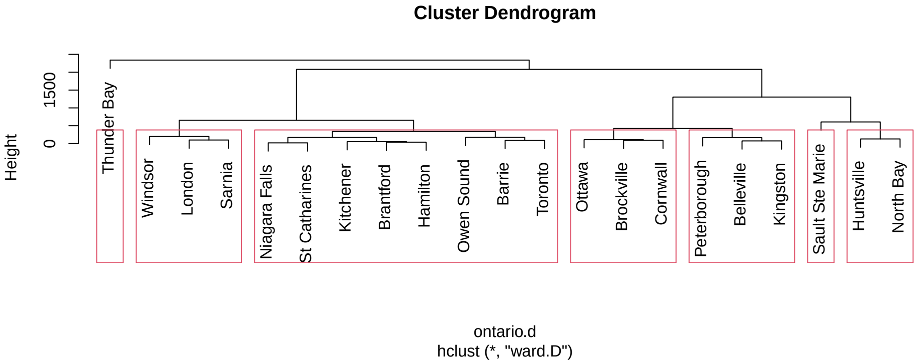


Cluster analysis revisited

```
ontario %>% select(-1) %>% as.dist() -> ontario.d
ontario.hc <- hclust(ontario.d, method = "ward.D")
```

Seven clusters:

```
plot(ontario.hc)
rect.hclust(ontario.hc, 7)
```



Get the clusters

```
tibble(place = ontario$place, cluster = cutree(ontario.hc, 7)) -> clusters
clusters %>% arrange(cluster)
```

```
## # A tibble: 21 x 2
##    place          cluster
##    <chr>            <int>
##  1 Barrie               1
##  2 Brantford            1
##  3 Hamilton             1
##  4 Kitchener            1
##  5 Niagara Falls        1
##  6 Owen Sound           1
##  7 St Catharines        1
##  8 Toronto              1
##  9 Belleville           2
## 10 Kingston             2
## # ... with 11 more rows
```

Combine clusters

- combine clusters 6 and 7 with 4 (“north”)
- combine clusters 2 and 3 (“east”)
- make named divisions

```
clusters %>%
  mutate(division = fct_collapse(factor(cluster),
                                "north" = c("4", "6", "7"),
                                "east" = c("2", "3"),
                                "west" = "5",
                                "central" = "1")) %>%
  arrange(division) -> divisions
```

The divisions

```
divisions
```

```
## # A tibble: 21 x 3
##    place          cluster division
##    <chr>            <int> <fct>
##  1 Barrie               1 central
##  2 Brantford            1 central
##  3 Hamilton             1 central
##  4 Kitchener            1 central
##  5 Niagara Falls        1 central
##  6 Owen Sound           1 central
##  7 St Catharines        1 central
##  8 Toronto              1 central
##  9 Belleville           2 east
## 10 Brockville           3 east
## # ... with 11 more rows
```

Take “ON” off of ontario3

```
ontario3 %>%
  mutate(place = str_replace(place1, " ON$", "")) -> ontario3
ontario3
```

```
## # A tibble: 21 x 6
##    place1     query              x     y bbox    place
##    <chr>      <chr>          <dbl> <dbl> <list>  <chr>
##  1 Barrie ON  Barrie ON  -79.7  44.4 <bbox ~ Barrie
##  2 Bellevill~ Bellevill~ -77.4  44.2 <bbox ~ Bellev~
##  3 Brantford~ Brantford~ -80.3  43.1 <bbox ~ Brantf~
##  4 Brockvill~ Brockvill~ -75.7  44.6 <bbox ~ Brockv~
##  5 Cornwall ~ Cornwall ~ -74.7  45.0 <bbox ~ Cornwa~
##  6 Hamilton ~ Hamilton ~ -79.9  43.3 <bbox ~ Hamilt~
##  7 Huntsvill~ Huntsvill~ -79.2  45.3 <bbox ~ Huntsv~
##  8 Kingston ~ Kingston ~ -76.5  44.2 <bbox ~ Kingst~
##  9 Kitchener~ Kitchener~ -80.5  43.5 <bbox ~ Kitche~
## 10 London ON  London ON  -81.2  43.0 <bbox ~ London
## # ... with 11 more rows
```

Add the divisions, matching by place

- and draw map

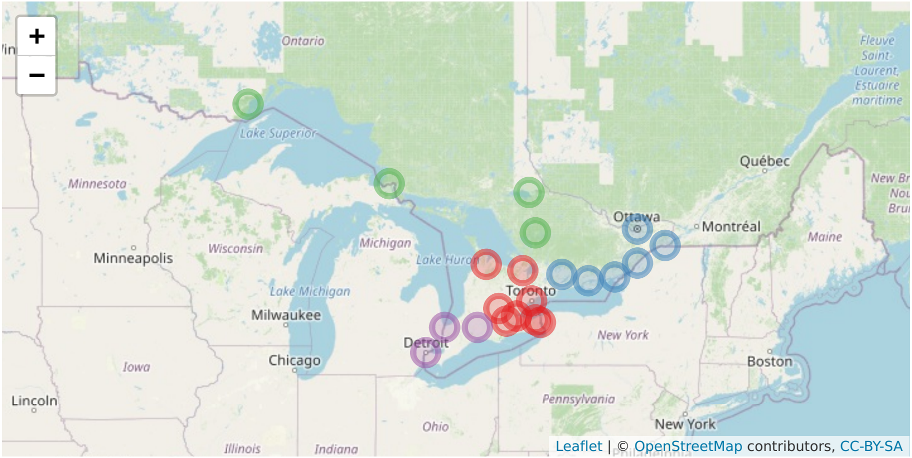
```r
pal <- colorFactor("Set1", divisions$division)

ontario3 %>% left_join(divisions) %>%
  select(place, x, y, division) %>%
  leaflet() %>%
  addTiles() %>%
  addCircleMarkers(lng = ~x, lat = ~y, color = ~pal(division))
```

```
## Joining, by = "place"
```

The map with divisions

```
divmap
```



Original seven clusters

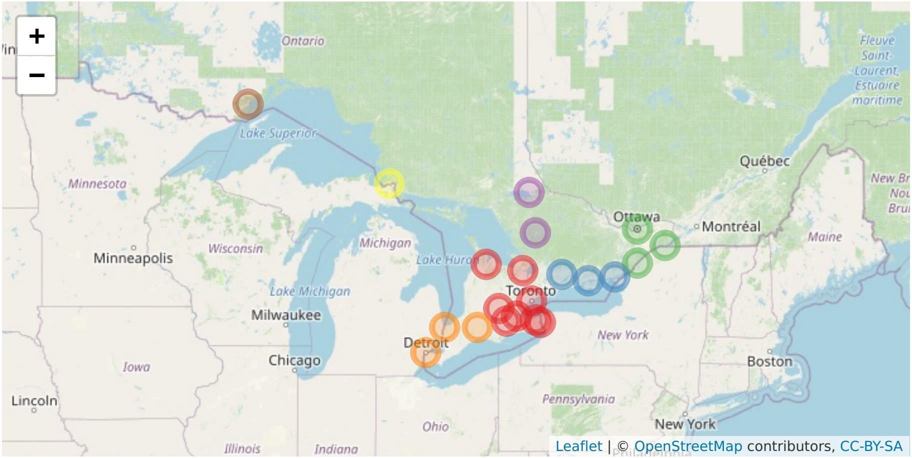
The same idea gets a map of the original seven clusters:

```r
pal <- colorFactor("Set1", divisions$cluster)
ontario3 %>% left_join(divisions) %>%
  select(place, x, y, cluster) %>%
  leaflet() %>%
  addTiles() %>%
  addCircleMarkers(lng = ~x, lat = ~y, color = ~pal(cluster))
```

```
## Joining, by = "place"
```

Map with seven clusters

```
divmap
```



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