R. Notebook

Resources

Here are some links I found helpful:

- https://www.computerworld.com/article/3175623/mapping-in-r-just-got-a-whole-lot-easier.html
- $\bullet \ \ https://cran.r-project.org/web/packages/tmap/vignettes/tmap-getstarted.html$
- $\bullet \ \, \text{http://zevross.com/blog/2018/10/02/creating-beautiful-demographic-maps-in-r-with-the-tidy$ $census-and-tmap-packages/} \\$
- https://geocompr.robinlovelace.net/adv-map.html#introduction-5

Imports

These are the libraries I'm using (I silence masking warnings):

Show the current software versions I'm working with.

sessionInfo()

```
## R version 3.6.2 (2019-12-12)
## Platform: x86_64-apple-darwin15.6.0 (64-bit)
## Running under: macOS High Sierra 10.13.6
##
## Matrix products: default
           /Library/Frameworks/R.framework/Versions/3.6/Resources/lib/libRblas.0.dylib
## LAPACK: /Library/Frameworks/R.framework/Versions/3.6/Resources/lib/libRlapack.dylib
##
## locale:
## [1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8
##
## attached base packages:
## [1] stats
                 graphics grDevices utils
                                               datasets methods
                                                                    base
## other attached packages:
                           RColorBrewer_1.1-2 spDataLarge_0.3.1
##
   [1] reshape2_1.4.3
                                                                 spData_0.3.2
   [5] tmaptools_2.0-2
                                              raster_3.0-7
##
                           tmap_2.3-1
                                                                  sp_1.3-2
##
   [9] sf_0.8-0
                           ggplot2_3.2.1
                                              knitr_1.27
                                                                  dplyr_0.8.3
##
## loaded via a namespace (and not attached):
   [1] tidyselect_0.2.5
                           xfun_0.11
                                              purrr_0.3.3
                                                                  lattice_0.20-38
   [5] colorspace_1.4-1
                           viridisLite_0.3.0 htmltools_0.4.0
                                                                  yaml_2.2.0
                                              e1071_1.7-3
                                                                  pillar_1.4.2
   [9] XML_3.98-1.20
                           rlang_0.4.2
## [13] later_1.0.0
                           glue_1.3.1
                                              withr_2.1.2
                                                                  DBI_1.1.0
## [17] plyr 1.8.5
                           lifecycle 0.1.0
                                              stringr 1.4.0
                                                                  rgeos 0.5-2
                           gtable_0.3.0
                                              htmlwidgets_1.5.1 codetools_0.2-16
## [21] munsell_0.5.0
## [25] leafsync 0.1.0
                           evaluate 0.14
                                              fastmap_1.0.1
                                                                  httpuv 1.5.2
## [29] crosstalk_1.0.0
                           class_7.3-15
                                              Rcpp_1.0.3
                                                                  KernSmooth_2.23-16
```

```
## [33] xtable_1.8-4
                           scales_1.1.0
                                               promises_1.1.0
                                                                  classInt_0.4-2
                                               mime_0.8
                                                                  digest_0.6.23
## [37] lwgeom_0.1-7
                           leaflet_2.0.3
## [41] stringi_1.4.3
                           shiny_1.4.0
                                               grid_3.6.2
                                                                  rgdal_1.4-8
## [45] tools_3.6.2
                           magrittr_1.5
                                               lazyeval_0.2.2
                                                                  tibble_2.1.3
## [49] dichromat_2.0-0
                           crayon_1.3.4
                                               pkgconfig_2.0.3
                                                                  assertthat_0.2.1
## [53] rmarkdown 2.0
                                               units_0.6-5
                                                                  compiler_3.6.2
                           R6_2.4.1
```

Load Raw Data

This data was available from: https://www.kaggle.com/mikejohnsonjr/united-states-crime-rates-by-county/data with the following licesnse: CC0 1.0 Universal (CC0 1.0)

```
df <- read.csv("crime_data.csv")
head(df)</pre>
```

		county	_name c	rime_rate	e_per_:	100000 f	index	EDITION	PART	IDNO	CPOPARST
								1	. 4	1612	318667
2	Crittende	en Count	y, AR		175	54.915	2	1	. 4	130	50717
	Alexande	er Count	y, IL		166	34.700	3	1	. 4	604	8040
4	Kened	dy Count	y, TX		145	56.311	4	1	. 4	2681	444
5	De Sot	to Paris	sh, LA		144	47.402	5	1	. 4	1137	26971
6	Baltin	nore cit	y, MD		14:	19.538	6	1	. 4	1227	625474
	CPOPCRIM	AG_ARRS	T AG_OF	F COVIND	INDEX	MODINDX	K MURI	DER RAPI	ROBBI	ERY A	GASSLT
1	318667	1	.5 1	5 100	5706	22329) :	119 200	1	778	3609
2	50717		4	4 100	873	3424	1	8 38	3	165	662
3	8040		2	2 100	127	278	3	1 2	?	5	119
4	444		1	1 100	6	13	3	0 3	3	1	2
5	26971		3	3 100	392	703	3	3 4		17	368
6	625474		9	9 100	8831	29868	3 2	216 317	30	338	4660
	BURGLRY I	LARCENY	MVTHEFT	ARSON p	opulat:	ion FIPS	S_ST E	FIPS_CTY	•		
1	4995	13791	3543	464	3184	116	29	510)		
2	1482	1753	189	28	497	746	5	35	•		
3	82	184	12	2	76	329	17	3	3		
4	5	4	4	0	4	112	48	261			
5	149	494	60	0	270	083	22	31			
6	7804	18055	4009	251	622	104	24	510)		
	2 3 4 5 6 1 2 3 4 5 6 1	1 St. Lo 2 Crittende 3 Alexande 4 Kenec 5 De So 6 Baltin	1 St. Louis cit 2 Crittenden Count 3 Alexander Count 4 Kenedy Count 5 De Soto Paris 6 Baltimore cit CPOPCRIM AG_ARRS 1 318667 1 2 50717 3 8040 4 444 5 26971 6 625474 BURGLRY LARCENY 1 4995 13791 2 1482 1753 3 82 184 4 5 4 5 149 494	1 St. Louis city, MO 2 Crittenden County, AR 3 Alexander County, IL 4 Kenedy County, TX 5 De Soto Parish, LA 6 Baltimore city, MD CPOPCRIM AG_ARRST AG_OF 1 318667 15 1 2 50717 4 3 8040 2 4 4444 1 5 26971 3 6 625474 9 BURGLRY LARCENY MVTHEFT 1 4995 13791 3543 2 1482 1753 189 3 82 184 12 4 5 4 4 5 149 494 60	1 St. Louis city, MO 2 Crittenden County, AR 3 Alexander County, IL 4 Kenedy County, TX 5 De Soto Parish, LA 6 Baltimore city, MD	1 St. Louis city, MO 175 2 Crittenden County, AR 175 3 Alexander County, IL 166 4 Kenedy County, TX 145 5 De Soto Parish, LA 146 6 Baltimore city, MD 147 CPOPCRIM AG_ARRST AG_OFF COVIND INDEX 1 318667 15 15 100 5706 2 50717 4 4 100 873 3 8040 2 2 100 127 4 444 1 1 1 100 6 5 26971 3 3 100 392 6 625474 9 9 100 8831 BURGLRY LARCENY MVTHEFT ARSON populat: 1 4995 13791 3543 464 3184 2 1482 1753 189 28 495 3 82 184 12 2 76 4 5 4 4 0 4 5 149 494 60 0 276	1 St. Louis city, MO 1791.995 2 Crittenden County, AR 1754.915 3 Alexander County, IL 1664.700 4 Kenedy County, TX 1456.311 5 De Soto Parish, LA 1447.402 6 Baltimore city, MD 1419.538	1 St. Louis city, MO 1791.995 1 2 Crittenden County, AR 1754.915 2 3 Alexander County, IL 1664.700 3 4 Kenedy County, TX 1456.311 4 5 De Soto Parish, LA 1447.402 5 6 Baltimore city, MD 1419.538 6 CPOPCRIM AG_ARRST AG_OFF COVIND INDEX MODINDX MURI 1 318667 15 15 100 5706 22329 2 50717 4 4 100 873 3424 3 8040 2 2 100 127 278 4 444 1 1 1 100 6 13 5 26971 3 3 100 392 703 6 625474 9 9 100 8831 29868 3 BURGLRY LARCENY MVTHEFT ARSON population FIPS_ST 1 1 4995 13791 3543 464 318416 29 2 1482 1753 189 28 49746 5 3 82 184 12 2 7629 17 4 5 4 4 0 412 48 5 149 494 60 0 27083 22	1 St. Louis city, MO 1791.995 1 1 2 2 Crittenden County, AR 1754.915 2 1 3 Alexander County, IL 1664.700 3 1 4 Kenedy County, TX 1456.311 4 1 5 De Soto Parish, LA 1447.402 5 1 6 Baltimore city, MD 1419.538 6 1 CPOPCRIM AG_ARRST AG_OFF COVIND INDEX MODINDX MURDER RAPE 1 318667 15 15 100 5706 22329 119 200 2 50717 4 4 100 873 3424 8 38 3 8040 2 2 100 127 278 1 2 4 444 1 1 1 100 6 13 0 3 5 26971 3 3 100 392 703 3 4 6 6 625474 9 9 100 8831 29868 216 317 BURGLRY LARCENY MVTHEFT ARSON population FIPS_ST FIPS_CTY 1 4995 13791 3543 464 318416 29 510 2 1482 1753 189 28 49746 5 35 35 3 82 184 12 2 7629 17 3 3 3 82 184 12 2 7629 17 3 3 5 5 149 494 60 0 27083 22 31 5 5 149 494 60 0 27083 22 31 5 5 149 494 60 0 27083 22 31 5 5 149 494 60 0 27083 22 31 5 5 149 494 60 0 27083 22 31 5 5 149 494 60 0 27083 22 31 5 5 149 494 60 0 27083 22 31 5 5 149 494 60 0 27083 22 31 5 5 149 494 60 0 27083 22 31 5 5 149 494 60 0 27083 22 31 5 5 149 494 60 0 27083 22 31 5 5 149 494 60 0 27083 22 31 5 5 149 494 60 0 27083 22 31 5 149 494 60 149 494 60 149 494 60 27083 22 31 5 149 494 60 27083 22 31 5 149 494 60 27083 22 31 5 149 494 60 27083 27	1 St. Louis city, MO	1 St. Louis city, MO 1791.995 1 1 4 1612 2 Crittenden County, AR 1754.915 2 1 4 130 3 Alexander County, IL 1664.700 3 1 4 604 4 Kenedy County, TX 1456.311 4 1 4 2681 5 De Soto Parish, LA 1447.402 5 1 4 1137 6 Baltimore city, MD 1419.538 6 1 4 1227 CPOPCRIM AG_ARRST AG_OFF COVIND INDEX MODINDX MURDER RAPE ROBBERY AG 1 318667 15 15 100 5706 22329 119 200 1778 2 50717 4 4 100 873 3424 8 38 165 3 8040 2 2 100 127 278 1 2 5 4 444 1 1 1 100 6 13 0 3 1 5 26971 3 3 100 392 703 3 4 17 6 625474 9 9 9 100 8831 29868 216 317 3638 BURGLRY LARCENY MUTHEFT ARSON population FIPS_ST FIPS_CTY 1 4995 13791 3543 464 318416 29 510 2 1482 1753 189 28 49746 5 35 3 82 184 12 2 7629 17 3 4 5 4 4 0 412 48 261 5 149 494 60 0 27083 22 31

Data Preparation

Notice how the state name is part of the "county name" variable? I'll create a new column for the state name.

```
# note that we trim whitespace and explicitly convert
# to a factor
df$state_abbr <- as.factor(trimws(sub('.*,\\s*', '', df$county_name)))
head(df)</pre>
```

```
##
               county_name crime_rate_per_100000 index EDITION PART IDNO CPOPARST
        St. Louis city, MO
                                        1791.995
                                                      1
                                                                   4 1612
                                                                            318667
                                                              1
                                                                   4 130
## 2 Crittenden County, AR
                                        1754.915
                                                      2
                                                              1
                                                                             50717
## 3 Alexander County, IL
                                        1664.700
                                                      3
                                                                   4 604
                                                                              8040
                                                      4
## 4
        Kenedy County, TX
                                        1456.311
                                                              1
                                                                   4 2681
                                                                               444
## 5
       De Soto Parish, LA
                                        1447.402
                                                      5
                                                                   4 1137
                                                                             26971
                                        1419.538
                                                      6
                                                                   4 1227
                                                                            625474
## 6
       Baltimore city, MD
                                                              1
```

```
CPOPCRIM AG_ARRST AG_OFF COVIND INDEX MODINDX MURDER RAPE ROBBERY AGASSLT
## 1
       318667
                      15
                              15
                                     100
                                          5706
                                                   22329
                                                             119
                                                                  200
                                                                          1778
                                                                                    3609
## 2
                                                                    38
         50717
                       4
                               4
                                     100
                                            873
                                                    3424
                                                               8
                                                                            165
                                                                                     662
                                                                                     119
## 3
          8040
                       2
                               2
                                     100
                                            127
                                                     278
                                                                     2
                                                                              5
                                                               1
## 4
           444
                       1
                               1
                                     100
                                              6
                                                      13
                                                               0
                                                                     3
                                                                              1
                                                                                       2
## 5
                       3
                               3
                                     100
                                            392
                                                     703
                                                               3
                                                                     4
                                                                             17
                                                                                     368
         26971
## 6
                       9
                               9
                                     100
                                           8831
                                                   29868
                                                             216
                                                                  317
                                                                           3638
       625474
                                                                                    4660
     BURGLRY LARCENY MVTHEFT ARSON population FIPS_ST FIPS_CTY state_abbr
##
## 1
         4995
                 13791
                           3543
                                   464
                                            318416
                                                         29
                                                                  510
## 2
         1482
                                    28
                                                          5
                                                                    35
                  1753
                            189
                                             49746
                                                                                AR
## 3
           82
                   184
                             12
                                     2
                                              7629
                                                         17
                                                                     3
                                                                                IL
## 4
            5
                                     0
                                               412
                                                         48
                                                                  261
                                                                                TX
                     4
                              4
## 5
          149
                   494
                             60
                                     0
                                             27083
                                                         22
                                                                    31
                                                                                LA
## 6
         7804
                 18055
                           4009
                                   251
                                            622104
                                                         24
                                                                  510
                                                                                MD
```

But this gives us abbreviations, we really want the names. There's a file in this directory with the mapping.

```
states <- read.csv("state.csv")
# note that we trim whitespace and explicitly convert
# to a factor
states$state_abbr <- as.factor(trimws(states$state_abbr))
head(states)</pre>
```

```
state_name state_abbr
## 1 District of Columbia
## 2
                   Alabama
                                    AL
## 3
                                    AK
                    Alaska
## 4
                   Arizona
                                    AZ
## 5
                                    AR
                  Arkansas
## 6
                California
                                    CA
```

We'll add the state names using a right join:

```
df <- merge(x = df, y = states, by = "state_abbr", all.x = TRUE)
head(df)</pre>
```

```
county_name crime_rate_per_100000 index EDITION
##
     state_abbr
## 1
              AK
                    Anchorage Municipality, AK
                                                                824.7217
                                                                              50
                                                                                        1
## 2
                   Juneau City and Borough, AK
                                                                             667
              AK
                                                                352.1127
                                                                                        1
## 3
              AK
                     Kodiak Island Borough, AK
                                                                856.0311
                                                                              44
                                                                                        1
## 4
                    Sitka City and Borough, AK
                                                                133.0377
                                                                           2018
                                                                                        1
## 5
              AK Northwest Arctic Borough, AK
                                                               1014.9642
                                                                              21
                                                                                        1
## 6
              AK
                          Nome Census Area, AK
                                                                232.5111
                                                                                        1
##
     PART IDNO CPOPARST CPOPCRIM AG_ARRST AG_OFF COVIND INDEX MODINDX MURDER RAPE
## 1
        4
             71
                   299143
                             299143
                                            3
                                                    3
                                                          100
                                                               2482
                                                                       10728
                                                                                  15
                                                                                       303
                                                                        1099
## 2
        4
             77
                    32553
                              32553
                                                          100
                                                                115
                                                                                   0
                                                                                         9
                                            1
                                                    1
## 3
        4
             80
                     6332
                               6332
                                                          100
                                                                121
                                                                         254
                                                                                   0
                                                                                         8
                                            1
                                                    1
## 4
        4
             87
                     9060
                               9060
                                            1
                                                    1
                                                          100
                                                                 12
                                                                         143
                                                                                   0
                                                                                         1
## 5
             85
                     3334
                               3334
                                                          100
                                                                 78
                                                                                        23
                                            1
                                                    1
                                                                         210
                                                                                   0
                                                                                   0
## 6
        4
             83
                     3776
                               3776
                                            1
                                                    1
                                                          100
                                                                 23
                                                                          44
                                                                                         3
##
     ROBBERY AGASSLT BURGLRY LARCENY MVTHEFT ARSON population FIPS_ST FIPS_CTY
          488
                                             845
                                                     98
                                                                           2
## 1
                 1676
                          1159
                                   8724
                                                             300950
                                                                                    20
                                                      9
                                                                           2
## 2
           16
                    90
                             94
                                     975
                                              30
                                                              32660
                                                                                   110
                                                                           2
## 3
           10
                   103
                             23
                                     200
                                              31
                                                      3
                                                              14135
                                                                                   150
## 4
            1
                    10
                             17
                                    120
                                               6
                                                      0
                                                               9020
                                                                            2
                                                                                   220
## 5
           12
                    43
                             46
                                     126
                                              38
                                                      2
                                                               7685
                                                                            2
                                                                                   188
## 6
                                     23
                                               9
                                                      2
                                                               9892
                                                                           2
                                                                                   180
            2
                    18
                             12
```

```
## state_name
## 1 Alaska
## 2 Alaska
## 3 Alaska
## 4 Alaska
## 5 Alaska
## 6 Alaska
```

Next we need some aggregates by state. I'll just take the sum here, but we could choose different functions if we wanted to.

```
data <- df %>%
          dplyr::select(state_name, population, ARSON, ROBBERY, MURDER) %>%
          group_by(state_name) %>%
          summarise_all(sum)
head(data)
## # A tibble: 6 x 5
##
     state_name population ARSON ROBBERY MURDER
##
     <fct>
                     <int> <int>
                                    <int>
                                           <int>
## 1 Alabama
                   4833722 1025
                                     4988
                                             341
## 2 Alaska
                    718165
                             136
                                      591
                                              21
## 3 Arizona
                   6626624 1405
                                     7263
                                             325
## 4 Arkansas
                   2959373
                             564
                                     2302
                                             173
## 5 California
                  38332521 7395
                                    56484
                                            1879
## 6 Colorado
                             909
                   5268367
                                     3372
                                             152
```

Maps!

First we append our data into the map object. Note the warning that we only have data for the lower 48.

```
## Warning: This function is deprecated and has been migrated to github.com/
## mtennekes/oldtmaptools
```

Over coverage: 2 out of 51 data records were not appended. Run over_coverage() to get the correspond

Now we can plot this bad boi!

