Nearest foreign borders within a selected country

Carl Schmertmann

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Source

This is a modified version of Arthur Welle's idea and code. The original is at

https://raw.githubusercontent.com/arthurwelle/VIS/master/closest_neighbour_git.Rmd

```
library(tidyverse)
library(sf)
library(geobr)
library(ggthemes)
```

Get Data

The working directory contains shapefiles for international boundaries, downloaded from

https://www.naturalearthdata.com/downloads/50m-cultural-vectors/50m-admin-0-countries-2/

Select a **focal country**, get the world map, and save the polygons for the focal country plus any other countries that touch its (land) borders.

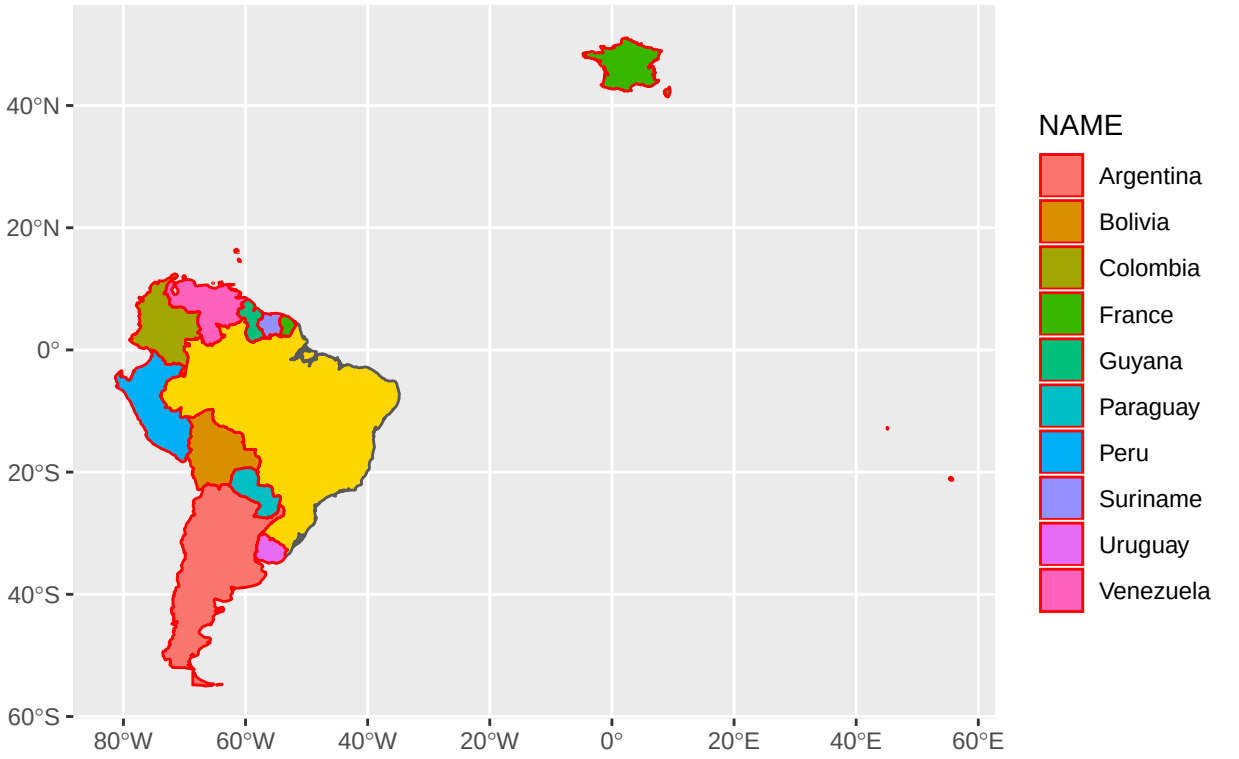
```
focal_country = 'Brazil'

world_map = st_read(dsn='./ne_50m_admin_0_countries',
                    'ne_50m_admin_0_countries')
```

```
## Reading layer `ne_50m_admin_0_countries' from data source `C:\Users\Carl\Downloads\ne_50m_admin_0_cou
## Simple feature collection with 241 features and 94 fields
## geometry type:  MULTIPOLYGON
## dimension:      XY
## bbox:           xmin: -180 ymin: -89.99893 xmax: 180 ymax: 83.59961
## geographic CRS: WGS 84
```

```
national_map = filter(world_map, NAME==focal_country)

touching = st_touches(world_map, national_map) %>%
            sapply(length)

neighbors = filter(world_map, touching==1)

neighbor_codes = unique(neighbors$ADM0_A3)
```

Display a map of the focal country + neighboring countries.

```
M = ggplot() +
      geom_sf(data=national_map, fill='gold') +
      geom_sf(data=neighbors, aes(fill=NAME), color='red')

print(M)
```

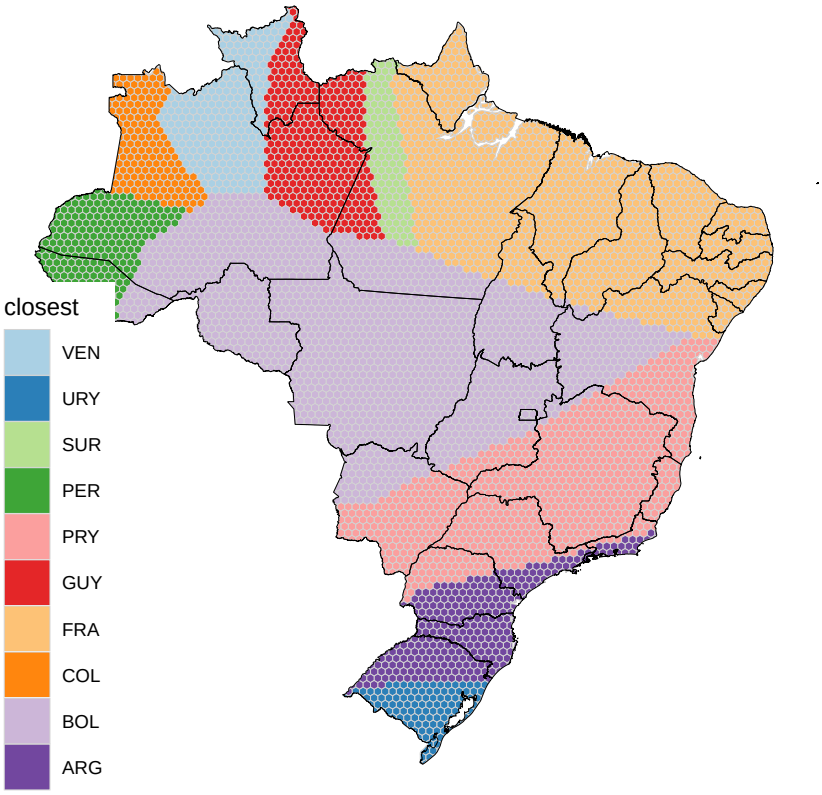


Build a grid of tesselating hexagons over the map of the selected country. Find which neighbor is closest to each.

Do a brute-force check of distances: find the subset of neighbor's boundaries that are within the bounding box of the selected country. Then check the pairwise Euclidean distances between each of those points and the center of each hexagon.

```
# grid of hexagons over national map
# clip parts of any hexagons that fall outside of national map

hex_grid = st_make_grid(national_map,
               n=c(100,100),square=FALSE) %>%
           st_sf() %>%
           st_intersection(., national_map)


hex_centroids = st_centroid(hex_grid) %>%
                st_coordinates()

# the "L3" column will contain the index of the neighboring country
edges = st_coordinates(neighbors$geometry)

national_bbox = st_bbox(national_map)

keep = sapply(1:nrow(edges), function(i) {
               ((edges[i,'X'] >= national_bbox['xmin'])
```

```
            &  (edges[i,'X'] <= national_bbox['xmax'])
            &  (edges[i,'Y'] >= national_bbox['ymin'])
            &  (edges[i,'Y'] <= national_bbox['ymax']))
             })

edges = edges[keep,c('X','Y','L3')]

# brute force, Euclidean
# for each hexagon in the grid
# find the country corresponding to the nearest edge point

i_closest = sapply(1:nrow(hex_centroids), function(i) {
         d = sqrt( (edges[,'X'] - hex_centroids[i,'X'])^2 +
                   (edges[,'Y'] - hex_centroids[i,'Y'])^2)
         ix = which.min(d)
         return(edges[ix,'L3'])
       })

# add a "closest" column to the hex grid
hex_grid$closest = factor(i_closest,
                          levels = seq(neighbor_codes),
                          labels = neighbor_codes)

my_palette = c('#a6cee3','#1f78b4','#b2df8a','#33a02c',
               '#fb9a99','#e31a1c','#fdbf6f','#ff7f00',
               '#cab2d6','#6a3d9a','#ffff99','#b15928')

H = ggplot() +
  geom_sf( data=hex_grid, aes(fill=closest), alpha=.95, size=.05, color='lightgrey') +
  scale_fill_manual(values=my_palette[seq(neighbor_codes)]) +
  ggthemes::theme_map()


# custom addition for Brazil: add state boundaries
# Thanks, {geobr}!
if (focal_country == 'Brazil') {

    state_map = read_state('all',
                           simplified=TRUE,
                           showProgress = FALSE)

    H = H +
      geom_sf(data=state_map, color='black',
              size=.05, fill=NA)
}

print(H)
```




```
ggsave(filename='nearest-country-map.pdf', plot=H,
       width=11, height=8.5)


ggsave(filename='nearest-country-map.png', plot=H,
       width=11, height=8.5)
```