## Libraries Used

The packages used in this analysis are the same from the prior analysis, `Tidyverse` for data manipulation, `sf` for modifying spatial data, `tigris` for getting the basemaps to plot my routes and `extrafont` to bring in new fonts for the plots.

```
library(tidyverse) # Data Manipulation
library(sf) # Manipulation Spatial Data
library(tigris) # Getting Tract and Roads Spatial Data
library(extrafont) # Better Fonts For GGPLOT
```

## Data Used

The data is also the same running route data from the prior post. For more details on its creation please reference the prior post.

```
runs_and_routes <- readRDS('data/runs_and_routes.RDS')
all_routes <- readRDS('data/all_routes.RDS')
```

For the basemap I'm again using the `tigris` package however this time getting census tracts rather than roads. According to the package, *Census tracts generally have a population size between 1,200 and 8,000 people, with an optimum size of 4,000 people*. The map is downloaded using the `tracts()` function with inputs for state and county.

```
nyc_tracts <- tracts("NY", "New York", cb = T) %>%
  st_transform(crs = st_crs(runs_and_routes$geometry))
ggplot() + geom_sf(data = nyc_tracts) + ggthemes::theme_map()
```

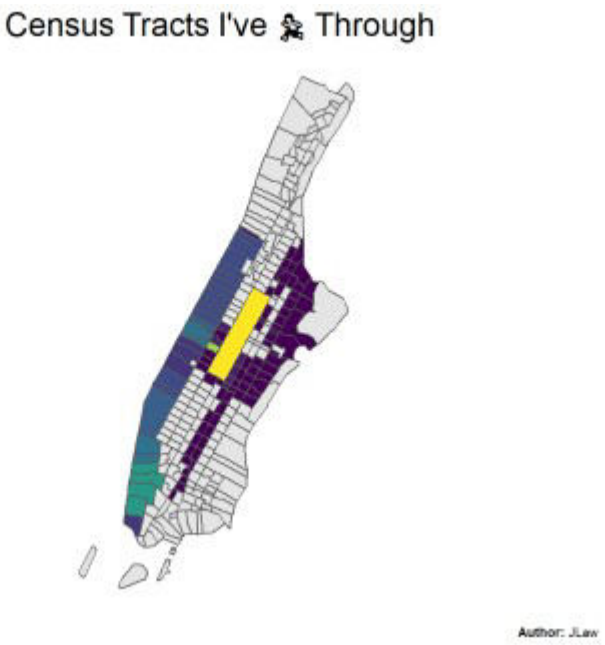
Unlike the prior analysis where the heatmap was just overlaid atop the map, here I need to identify which census tracts contained a route I ran vs. which didn't. This can be done using the `st_join` function, specifying it to be a left join, and specifying the join type as `st_intersects` which joins the route information if the lat/long is contained in the census tract. The data is then grouped by tract_name and some other tract metadata. Then I create a field for the number of routes contained in each census tract, which will be used for the choropleth.

```
#Join Routes to Tracts by Intersecting
nyc_geo_join <- nyc_tracts %>%
  st_join(all_routes %>% distinct(route_id, geometry),
          join = st_intersects,
          left = T
          ) %>%
  group_by(
    TRACTCE, #Census Tract ID
    ALAND, #Land Area
    AWATER #Water Area
  ) %>%
  summarize(num_routes = n_distinct(route_id, na.rm = T), .groups =
'drop') %>%
  #Set 0 Routes to NA colored
  mutate(num_routes = if_else(num_routes == 0, NA_integer_,
num_routes))
```

## Visualization

The choropleth provides an alternative version to the heatmap which will better show each census tract that **at least one** of my routes had passed through. Really rare routes did not show up on the heatmap, but they will be clearer here.

```
ggplot() +
  geom_sf(data = nyc_geo_join,
          aes(fill = num_routes)) +
  scale_fill_viridis_c(na.value = "grey90", guide = F) +
  coord_sf(xlim = c(-74.15, -73.8)) +
  labs(title = paste0("Census Tracts I've ",emo::ji('running')," 
Through"),
       fill = "# of Routes Run",
       caption = "**Author:** JLaw") +
  ggthemes::theme_map() +
  theme(
    plot.title = element_text(size = 18, family = 'Arial Narrow', hjust
= .5),
    plot.caption = ggtext::element_markdown(),
    plot.caption.position = 'plot'
  )
```




Now the East Side routes are clearer.

## What % of Manhattan Did I Run Through?

The island of Manhattan covers 22.7 square miles. I was curious what % of square miles I covered based on census tracts. While this will seriously over-count my distance covered it is easy to calculate. If I ran through the tract I get to count 100% of its land area. If I did not, I count nothing.

The `ALAND` columns from the Census Tract data contains the land area in square kilometers which I convert to square miles.

```
data_summary <- nyc_geo_join %>%
  as_tibble %>%
  mutate(covered = !is.na(num_routes)) %>%
  group_by(covered) %>%
  summarize(tracts = n(),
            #Convert Square KM to Square Miles
            area = sum(ALAND)/2589988) %>%
  mutate(pct_tracts = tracts / sum(tracts),
         pct_area = area/sum(area))
```

During this marathon training, I ran through 101 of Manhattan's 288 Census Tracts (35%) and passed through census tract's covering 8.7 *mi*^2 out of 22.7 *mi*^2 for **38.4%**.