Geographic Visualization by ggmap :: **CHEAT SHEET**

Benefit of Use

Although there are several packages by which we can create geographic visualization, some of them seem to be complicated to use, and cannot choose popular map tiles like Google Maps.

The R package "ggmap" makes it easy to download and choose various kinds of map tiles. In addition, you might feel it is easy to plot data since you can do it using the ggplot2 framework you are familiar with!

Basic Process

When you use the ggmap, you can take **one preparation + two steps** below to create a great graphic:

0. (Preparation) Register a Google API

- Register with Google: https://mapsplatform.google.com

- Provide ggmap with your API key by "register_google(key = "[your key]")"

1. Choose a raster map tile (based on the get_map() function)

- Set the longitude/latitude coordinates you want to display at a center of the image

- Choose a source for map tiles from "google"(Google Maps), "stamen"(Stamen Maps), "osm"(OpenStreetMap)

- Choose a map type like "terrain" and "satellite."

2. Plot data and visualize

- Choose a raster according to step 1 and plot it by the "ggmap" function

- Describe what you want to show by adding the "geom_xx()" function with ggmap()

- If you want to determine the route between two locations, you can apply "route" and "trek" function

CITATION

D. Kahle and H. Wickham. ggmap: Spatial Visualization with ggplot2. The R Journal, 5(1), 144-161.

URL http://journal.r-project.org/archive/2013-1/kahle-wickham.pdf

1. Choose a raster map tile

To download a raster map tile, you can use the "get_map()" function. The major arguments are below:

**get_map(location, source, maptype,...)**

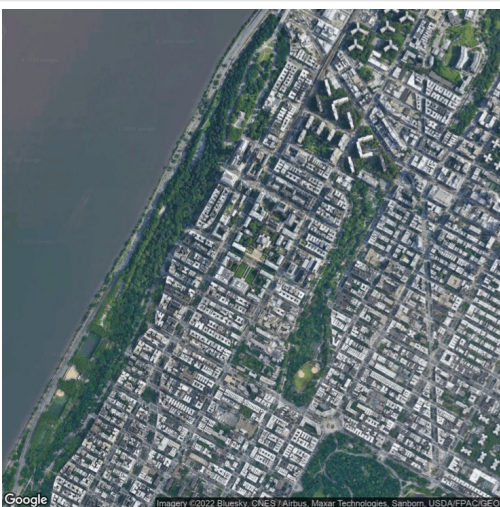| argument	Description
location	an address, longitude/latitude pair (in that order), or left/bottom/right/top bounding box * You can obtain long/lat coordinates from the location name/address by using the "geocode" function
source	"google"(Google Maps), "osm"(OpenStreetMap), "stamen"(Stamen Maps)
maptype	character string providing map theme. "terrain", "terrainbackground", "satellite", "roadmap", and "hybrid" for google maps, "terrain", "watercolor", and "toner" for stamen maps

Source: https://cran.r-project.org/web/packages/ggmap/ggmap.pdf

source: **"google" (Google Maps)**
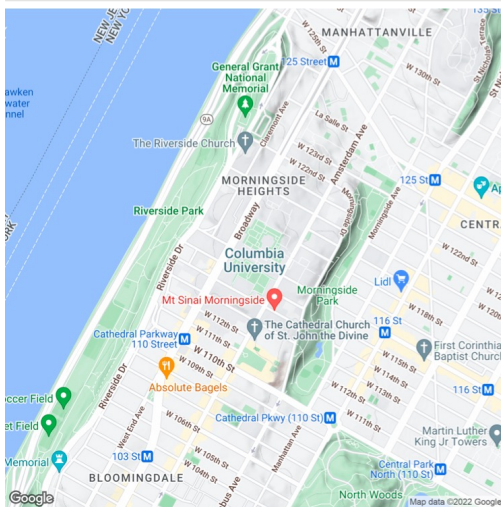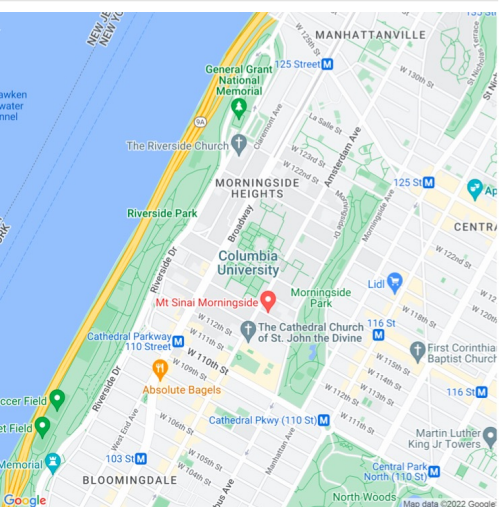
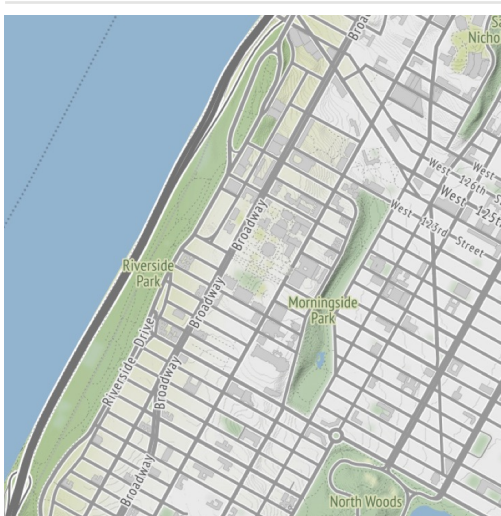maptype: terrain   maptype: satellite   maptype: roadmap

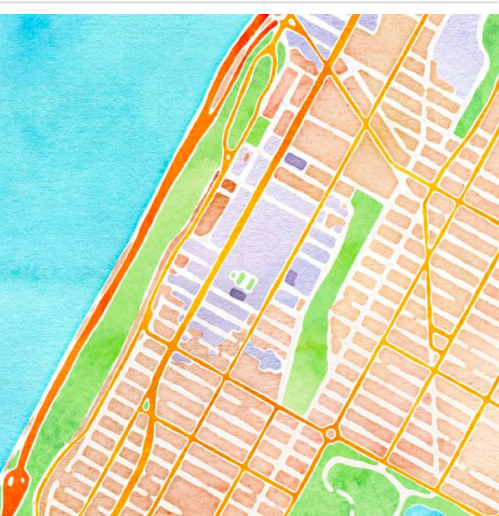

source: **"stamen" (Stamen Maps)**

maptype: terrain   maptype: toner   maptype: watercolor

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2. Plot data and Visualize

I'll show you how to create a graphic while Introducing three geographic visualization examples by using the ggmap.

You can choose a raster flexibly according to what you want to describe.

For example,
- Route map: choose source = "google", maptype = "roadmap", because it's easy to see roads
- Scatter plot with color: choose source = "stamen", maptype = "toner", because the scatter plot isn't distracted by the map background


A. Route between two locations

You can visualize a route between two locations using the "trek" and "geom_path" functions.

These functions enable you to create a route image such that you can see it in Google Maps Apps.

Route from MoMA to Grand Central Terminal

```
trek_df <- trek("MoMA", "Grand Central Terminal")
moma <- geocode("MoMA")
map_moma <- get_map(location=moma, source="google",
          maptype="roadmap", zoom=15)

ggmap(map_moma) +
  geom_path(aes(x = lon, y = lat),  colour = "blue",
          mode = "walking", data = trek_df, lineend = "round")
```
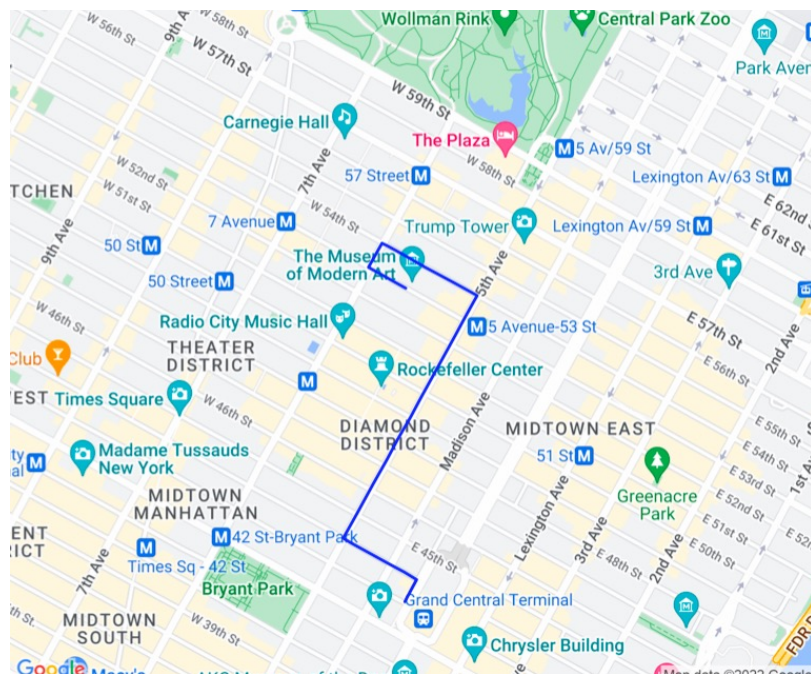

B. Map x Scatter plot

To describe where an incident (like crimes) is likely to occur, you can apply scatter plot with the ggmap.

Since Google Maps and Stamen Maps can be deployed as a background, it might be easier to imagine the relationship between the incident and geographic factors.

Scatter Plot for Crime Incidents by Level of Offense

```
nyc_crime <- read.csv('https://data.cityofnewyork.us/resource/5uac-w243.csv')
nyc_crime <- mutate(nyc_crime, lat = latitude, lon = longitude)

nyc_map <- get_map(location = "manhattan",
            maptype = "toner",
            zoom = 12)

ggmap(nyc_map) +
  geom_point(data = nyc_crime, aes(color = law_cat_cd), alpha=.7)
```


law_cat_cd
- FELONY
- MISDEMEANOR
- VIOLATION
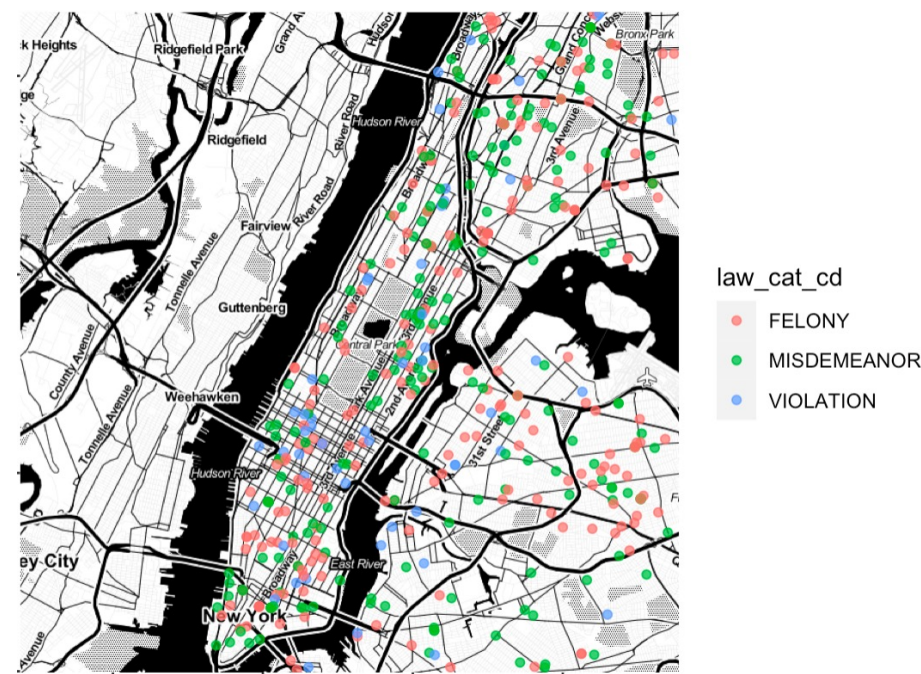
Data Source: NYC Open Data "NYPD Complaint Data Current (Year To Date)"

C. Map x 2d Density Estimation

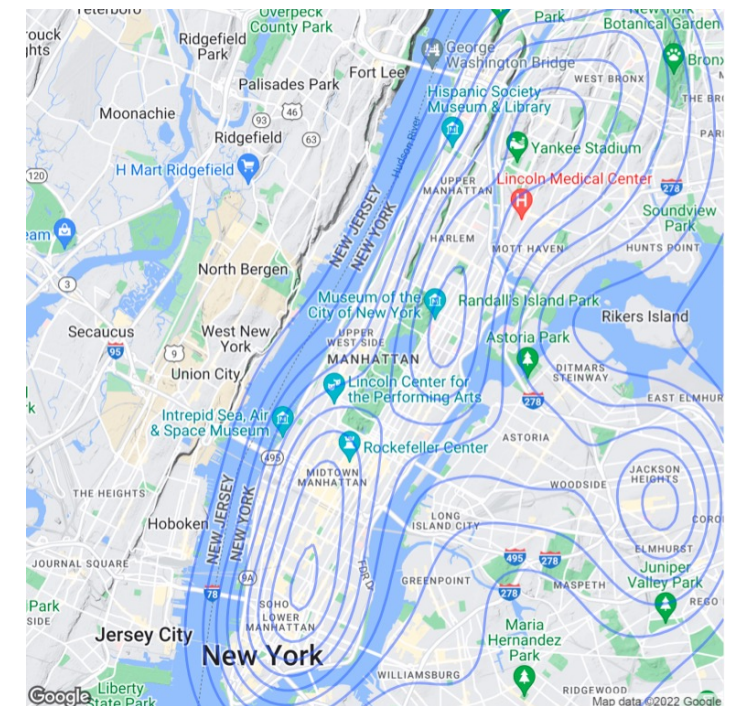You can also utilize a 2d density plot to show where an incident occurs most often.

As you can see below, all you have to do is 1) create the ggmap() and 2)add the "stat_density2d()" function.

2d Density Plot for Crime Incidents

```
nyc_crime <- read.csv('https://data.cityofnewyork.us/resource/5uac-w243.csv')
nyc_crime <- mutate(nyc_crime, lat = latitude, lon = longitude)

nyc_map <- get_map(location = "manhattan",
            maptype = "terrain",
            zoom = 12)

ggmap(nyc_map)+
  stat_density2d(data = nyc_crime,
          aes(x = lon, y = lat, alpha = .5, fill = ..level..))
```


Data Source: NYC Open Data "NYPD Complaint Data Current (Year To Date)"

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