Running in Circles

Spatial Optimisation with OSRM and R

Megan Beckett
Exegetic Analytics
satRday 2020
3 (relevant) things:
3 (relevant) things:
I like green spaces
3 (relevant) things:
I like green spaces
I like R
3 (relevant) things:
I like green spaces
I like R
I like running
Maps and location for developers

Precise location data and powerful developer tools to change the way we navigate the world.

Start mapping for free
Partagez plus qu'un voyage
Covoiturage Fiable & Moderne au Maroc

06 00 00 00 00
Envoyer
Recevoir le lien par SMS pour télécharger l'app

Pourquoi voyager avec Yala ?
Building OSRM

# Necessary infrastructure.
sudo apt update
sudo apt install -y git cmake build-essential jq htop \  
liblua5.2-dev libboost-all-dev \  
libprotobuf-dev libtbb-dev \  
libstxxl-dev libbz2-dev

# Grab the source on GitHub.
git clone https://github.com/Project-OSRM/osrm-backend.git

# Create a build folder and then run cmake.
cd osrm-backend/
mkdir build
cd build/
cmake ..

# Next initiate the build.
# This will take some time - grab a cup of coffee!
make

# When the build completes,
# make the install target for OSRM.
sudo make install
Getting the data - www.openstreetmap.org

OpenStreetMap data is licensed under the Open Data Commons Open Database License (ODbL).

If the above export fails, please consider using one of the sources listed below:

- **Overpass API**
  Download this bounding box from a mirror of the OpenStreetMap database

- **Planet OSM**
  Regularly-updated copies of the complete OpenStreetMap database

- **Geofabrik Downloads**
  Regularly-updated extracts of continents, countries, and selected cities

- **Other Sources**
  Additional sources listed on the OpenStreetMap wiki
Getting the data - www.openstreetmap.org

You requested too many nodes (limit is 50000). Either request a smaller area, or use planet.osm
Getting the data - www.openstreetmap.org

Download OpenStreetMap data for this region:

South Africa

The OpenStreetMap data files provided on this server do not contain the user names, user IDs and changedet IDs of the OSM objects because these fields are assumed to contain personal information about the OpenStreetMap contributors and are therefore subject to data protection regulations in the European Union. Extracts with full metadata are available to OpenStreetMap contributors only.

Commonly Used Formats

- south-africa-latest.osm.pbf, suitable for Osmois, Osmosis, Imposifier, osm2pgsql, mkmap, and others. This file was last modified 8 hours ago and contains all OSM data up to 2020-09-02T21:59:01Z. File size: 174 MB; MD5 sum: 43ee0ad0b60a415beff804c76a8b31a
- south-africa-latest-free.osm.pbf, yields a number of RSR compatible shape files when unzipped (Format description PDF) This file was last modified 4 hours ago. File size: 334 MB; MD5 sum: 52214d4f2a5d967273a8e0653d9b72

Other Formats and Auxiliary Files

- south-africa-latest.xml.bz2, yields OSM XML when decompressed; use for programs that cannot process the .pbf format. This file was last modified 2 days ago. File size: 526 MB; MD5 sum: d96d6ebe77b34a6a5bc0f394b7b165a
- south-africa-history.osm.pbf The history file contains personal data and is available on the internal server only. See notice above for further information.
- area.shp that describes the extent of this region.
- area.dxf files that contain all changes in this region, suitable e.g. for Osmosis updates
- area directory index allowing you to see and download older files

Sub Regions

No sub regions are defined for this region.
Preparring the data

Extract the map

- car
- bike
- foot

```
osrm-extract map.xml -p profiles/foot.lua
```
Preparing the data

Extract the map

- car
- bike
- foot

```
osrm-extract map.xml -p profiles/foot.lua
```

Create the hierarchy

```
osrm-contract map.xml.osrm
```
Preparing the data

Extract the map

- car
- bike
- foot

```
osrm-extract map.xml -p profiles/foot.lua
``` 

Create the hierarchy

```
osrm-contract map.xml.osrm
``` 

Launch the service

```
osrm-routed map.xml.osrm
```
How long and far to walk from here to the nearest park?
How long and far to walk from here to the nearest park?

```sh
```
How long and far to walk from here to the nearest park?


```json
{
  "code": "Ok",
  "waypoints": [
    {
      "hint": "9lAqgBf7LYArAAAAALQAAALwBAABWAQAAPxLCQHeHpEGs9nZCSEgAfw88ZVXO",
      "distance": 2.634498,
      "location": [
        28.053251,
        -26.113252
      ],
      "name": "Discovery Place"
    },
    {
      "hint": "eNMGgITTBoBfBQAAAZAEAAAAABIDAAA99A-Q8MARUIAAAAAWBPaQ1",
      "distance": 0.447755,
      "location": [
        28.0735,
        -26.105385
      ],
      "name": "Grayston Drive"
    }
  ]
}
```
How long and far to walk from here to the nearest park?

```
"routes": [
    {
      "legs": [
        {
          "steps": [],
          "weight": 1997.1,
          "distance": 2756.8,
          "summary": "",
          "duration": 1997.1
        }
      ],
      "weight_name": "duration",
      "geometry": "xfk-CycfjD_EeNu0}OcCoEoNme@]}@WJ_JiXgAOWiBOMqCVw@UcAbCj@{Bv@_BtMuN",
      "weight": 1997.1,
      "distance": 2756.8,
      "duration": 1997.1
    }
  ]
}
```

- The **duration** is in seconds.
- The **distance** is in metres.
The osrm R package

install.packages('osrm')
The osrm R package

install.packages('osrm')

Two important questions:

1. What's the **optimal route** to visit the parks in the surrounding area?

2. What can I possibly see within certain **time intervals**?
The osrm R package

install.packages('osrm')

With my running shoes on!
# Libraries
library(osrm)
library(leaflet)
library(dplyr)

# Point to osrm server
options(osrm.server = "http://127.0.0.1:5000/")

# Create dataframe of (unordered points)
locs <- data.frame(id = c("bnb", "jhb_botanical_gardens", ...),
                   lon = c(28.045374, 28.062958, 27.998316, ...),
                   lat = c(-26.100931, -26.137748, -26.159879, ...))

# Calculate the shortest round trip
trip <- osrmTrip(locs)

# Plot with Leaflet
leaflet(data = trip[[1]]$trip) %>%
  addTiles() %>%
  addMarker() %>%
  addPolylines()

Notebook - bit.ly/satrday-osrm
2. What can I see within certain time intervals?

```r
# Libraries
library(osrm)
library(leaflet)
library(dplyr)

# Point to osrm server
options(osrm.server = "http://127.0.0.1:5000/")

# Set location
loc <- c(28.045374, -26.100931)

# Generate isochrones at time intervals
iso <- osrmIsochrone(loc,
                      breaks = seq(from = 0, to = 30, by = 5),
                      res = 300)

# Plot with Leaflet
leaflet(data = iso) %>%
  addTiles() %>%
  addMarkers() %>%
  addPolygons()
```

Notebook - bit.ly/saturday-osrm
Application: Delivery area compromise

- A store location
Application: Delivery area compromise

- A store location
- A delivery area of max 8 min - isochrone
Application: Delivery area compromise

- A store location
- A delivery area of max 8 min - *isochrone*
- A delivery area of max 2.5 km - *isodistance*
Application: Delivery area compromise

- A store location
- A delivery area of max 8 min - *isochrone*
- A delivery area of max 2.5 km - *isodistance*
- An intersection
Application: Delivery area compromise

- A store location
- A delivery area of max 8 min - *isochrone*
- A delivery area of max 2.5 km - *isodistance*
- An intersection
- Everyone is **happy**!
So, who's coming for a run at 6am tomorrow?!

@mbeckett_za
megan@exegetic.biz

Notebook -> bit.ly/saturday-osrm