5 IoT EDA and GIS

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5.0 Introduction to EDA and GIS

In this lab we will perform EDA (Exploratory Data Analysis) and examine GIS (Geographical Information Systems) via Python. Refer to the presentation material and link resources for help.

Requirements
Python editor and a web browser.

5.1 EDA with Python

Examine the bundled data files gathered from a weather station during a 3 month period.

- weatherstation.json (zipped)
  - timestamp
  - precipitation in mm
  - humidity in %
  - radiation in R
  - sunshine in w/sqm
  - pressure in atm/mbar
  - temperature in celsius degrees
- 3 x wind_data_(month).csv
  - timestamp
  - wind_speed in ms/s
  - wind_direction in 0-359 degrees

Explanation of a weather station: https://en.wikipedia.org/wiki/Weather_station and Guide to Meteorological Instruments and Methods of Observation values: https://www.weather.gov/media/epz/mesonet/CWOP-WMO8.pdf

Task
Perfom an EDA on the weather station data. This means reporting all the steps you took to handle the data, your analysis and your conclusion.

Begin with handling the data sets with regard to missing data and outliers.
Merge the wind data with the other weather variables. Re-sample if necessary to another time base and so on.
Do we need values every 5 minutes? Should they be avaraged, removed or accumulated etc?
What is a suitable time period without loosing information in the data?
Summarize the main characteristics of your conclusions for the data set.

Help
See the presentation material, attached links.txt file and Learn > Uppgifter

Report:
A single “fixed” sensor data file data file which one can perform further analysis on if necessary in the future.
Also completing the EDA you will have plots, heat-maps, frequency distribution, graphs, correlation matrix along with the hypothesis by which any individual can understand what your data is all about and what insights you got on the way.

5.2 GIS with folium (Leaflet)

Inspect (examine all the functions as popups, live data and layers) the bundled \GIS\ sensors_gateways.html solution have with your web browser.

Task
With input data as the sensors csv file and gateway info from json via the TTN API. Try to create a similar IoT GIS solution with your additional IoT resources using Python and folium (as in the bundled sensors_gateways.html example).

A suitable TTN REST API call for Gateways is: https://www.thethingsnetwork.org/gateway-data/location?latitude=60.48746&amp;longitude=15.409658&amp;distance=200000

Help
Methods and imports I used to solve the task

- import pandas as pd, folium, os, sys, json, requests
- folium.Map
- folium.FeatureGroup
- folium.LatLngPopup
- folium.Marker
- folium.Popup
- folium.features.CustomIcon
- requests.get
- req.json

GIS book
Introduction to Web Mapping (free web book), chapter 6: http://geobgu.xyz/web-mapping/ or https://web-mapping.surge.sh/

TTN Gateway API:
https://www.bjoerns-techblog.de/2018/07/gateway-status-abfragen-ueber-ttn-api/

Links with useful examples
folium: https://github.com/python-visualization/ > folium

folium quickstart: https://python-visualization.github.io/folium/quickstart.html

Intro to folium: https://github.com/jtemporal/intro-folium

folium layer control: https://nbviewer.jupyter.org/github/python-visualization/folium/blob/master/examples/Plugins.ipynb#Sub-categories

folium FeatureGroupSubGroup:
https://nbviewer.jupyter.org/github/python-visualization/folium/blob/master/examples/Plugins.ipynb#Sub-categories

Add href to marker? https://github.com/python-visualization/folium/issues/616

Creating a legend for a Folium map: https://medium.com/@bobhaffner/creating-a-legend-for-a-folium-map-c1e0ffc34373

Beautiful, Interactive, and Portable Maps using Folium and Live API Data:
https://www.youtube.com/watch?v=xN2N-p33V1k

Extra voluntary work
Plotting time-series sensor data as folium popups. Example:
https://github.com/SECOORA/skill_score/issues/65

Report:
Show that you have a working and correct implementation of the task above. I.e. a similar IoT GIS solution using Python and folium as in the bundled sensors_gateways.html example but with your additional IoT resources.

5.3 Lab feedback

a) Were the labs relevant and appropriate and what about length etc?
b) What corrections and/or improvements do you suggest for these labs?