Bharatiya Antariksh Hackathon 2024

Mentor Details

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Problem Statement #2: ***Generation of Rooftop Solar Energy Potential Map Using Machine Learning/Deep Learning Based Building Footprint Extraction***

Description

Develop a geospatial web based portal for estimating the power that can be generated using solar energy based on the size of civilian housing rooftops. The system should have the facility to let the user choose an area and based on this, determine how much solar energy can be generated at building level using existing solar radiation related satellite data and some assumptions on the power related configuration of solar cells used.

Objectives

- Formulate Machine Learning/Deep Learning based methodology for building footprint extraction from satellite images
- Formulate methodology to estimate usable solar energy using (but not limited to) measures of Solar Insolation, Global Horizontal Irradiance (GHI) and Direct Normal Irradiance (DNI) etc.
- Develop a geospatial web portal which if provided an area, performs building footprint extraction, solar energy estimation and power production calculation showing results in terms of daily or early units generated using dynamic, interactive visualization tools and charts

Expected Outcomes

Development of an interactive, geo-web portal for generation of Rooftop Solar Energy Potential map for a given area of interest

Datasets Required

- Optical satellite imagery of NE region of India
- Geospatial solar radiation datasets
- Building footprint dataset for training model

Suggested Tools and Technologies

The solution is to be developed using (but not limited to) the following:

- QGIS
- PostgreSQL
- Leafletjs
- Javascript
- PHP
- Python
- Anaconda

Steps to be Followed to Achieve Objectives

- Literature survey of research papers to determine methodology for building footprint extraction using ML/DL techniques
- Survey of open source and/or free annotated datasets for training ML/DL model to identify buildings
- Procurement of high resolution optical imagery of NER and solar energy data and processing to calculate solar energy output using building footprints

Evaluation Parameters

- **Completeness of Solution:** Fulfillment of all problem objectives by solution developed
- **Ease of Use and User Intelligibility:** How convenient and easy it is to use and understand the system, helpful features, and visualization with display statistics etc.
- **Documentation:** Detailed documentation at code level, and creation of detailed user manual

Some Important Links

Some links on how SAC, ISRO has estimated solar energy calculation and related data

1. https://vedas.sac.gov.in/vstatic_1/rn_global_infodoc/
2. https://solargis.com/maps-and-gis-data/download/india
3. https://globalsolaratlas.info/download/india
4. https://vedas.sac.gov.in/solar-calculator/

The Bhoonidhi portal of ISRO where satellite datasets are available – please familiarize yourself on how to register and download data for free using video tutorials on the portal

1. https://bhoonidhi.nrsc.gov.in/bhoonidhi/home.html

Building footprint dataset from Google Earth Engine

1. https://developers.google.com/earth-engine/datasets/catalog/GOOGLE_Research_open-buildings_v3_polygons

Tutorial on QGIS for spatial data processing

1. https://courses.spatialthoughts.com/introduction-to-qgis.html

Website for looking up research papers on building footprint extraction – if there's some paper or resource you can't download let me know

1. https://scholar.google.com/

Misc

- While forming teams please see that atleast one of the members is familiar with programming otherwise the challenge will be difficult
- Divide the work amongst yourself – with deadlines. Make a very clear date wise plan with milestones
- Use google sheets and google docs for tracking progress or for sharing literature survey papers, methodology etc. amongst yourselves
- Feel free to ping me anytime, I'll definitely get back to you and try to resolve your queries
- Will share any important updates as I get them from organisers