THE GLOW GETTERS

Light Graph

Monitoring human networks across large geographical regions during the COVID-19 pandemic

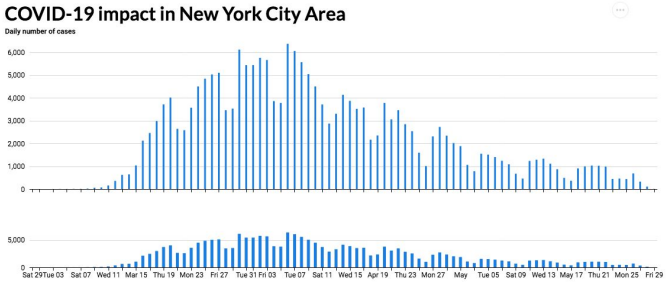
By @TheGlowGetters

Light Graph / Hackathon prototype

For the Space App COVID-19 Challenge we built a protoype data processing server running on AWS. This handles requests to perform our network analysis on a geographic location at a specific time of the Black Marble data set. This analysis is performed and then stored in a database. Previous analysis can then be retrieved using the accompanying REST API. For more details on this workflow please see the final slide *Production technical details.*

In the time available for this Challenge we decided to focus on building a simplified front end web app light-graph-story.glitch.me. This web app is an interactive experience that guides the user through a series of data visualisations that make requests to the AWS REST API to retrieve network analysis information of the Black Marble data set.

Screenshots from the web app are shown on the right. The full source code for the backend server and front end web app can be found at github.com/Ricool06/TheGlowGetters.

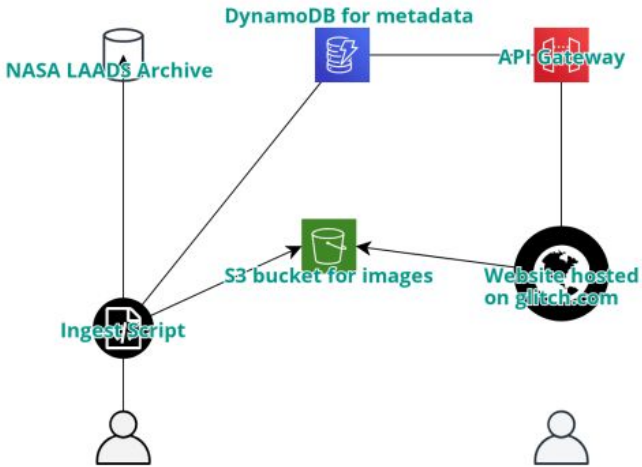


Light Graph / Production implementation

To develop a production implementation that could be used by decision-makers several issues would have to be addressed. The quantity of offline datasets needs to be increased. The computational infrastructure also needs to be able to run the network analysis of the Black Marble luminance data in near real time. However the currently workflow takes minutes to run. We believe that by developing filament detection algorithms tailored to Black Marble data this is achievable.

The image processing and algorithm to translate the luminance network to a graph is also very sensitive to input parameters. More research is needed to understand an optimal set of parameters to ensure a reliable and consistent analysis.

With these changes a real-time web interface can be created that allows decision-makers to freely scrub a timeline while focused on a particular region and see the change in the graph representation of the luminance network of the region and its derived properties.



Light Graph / Production technical details

1

VNP46A1 - VIIRS DNB dataset

From the NASA Black Marble product, we collect nighttime data image using the existing API and GDAL

2

Image preprocessing and Ingest

Edge detection using a Canny Filter and filament structure search is performed using the FilFinder python package
The imagery is uploaded to AWS S3, while the metadata and numerical data is stored in DynamoDB

3

API for Fetching original images, skeletal images, and data

We set up an AWS API Gateway to enable the frontend to fetch the stored data.

Following those steps, a data collection step can be done in order to apply ML/AI approaches. **Image segmentation** could be perform to identify the previous networks more clearly. K-Means seems to be the easiest approach to apply and could be our baseline for this task but recent advances in Deep learning seems to be more adapted and powerful techniques for satellite imagery (U-Net for instance). Also if those images were used in combination with others datasets (other satellite data such as NO2, epidemiological , socio-economic) **others domains** could be tackle using this set of images.