Geospatial Data Analysis Report 2024

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ThreeSixty SPATIAL

ABSTRACT Task 1 &Task2

Geospatial data was collected from various databases and repositories such as Council for Geosciences, GitHub, API and Geological Society of South Africa. The Geospatial data was collected, scrutinized, processed and manipulated through using various softwares such as QGIS, Python, LeafMap, and Visual Studio Code. The process of data acquisition required substantial knowledge on utilizing information systems and coding to be able to know what data to retain and omit. The data acquisition phase was imperative and crucial as that collected data was going to be the core base with which the web application (Three Sixty Spatial) was going to be based on. The programming language that was utilized was Python for the Geospatial application development. The Geospatial application is web based and houses a database of the entire planet Earth. The Geospatial application has 7 main features which are: Interactive Map, Split Map, Marker Cluster, Heatmap, Basemaps, Web map Services, Raster Comparison. The main objectives which the Web Application fulfil include water resource management, flood management, land use, zoning, transportation route management, landcover and land use management, conservation and protected areas visualization.

Task1

Data Sources:

Geospatial data was collected from various databases and repositories such as Council for Geosciences, GitHub, API and Geological Society of South Africa. The data included datasets which have spatial information which can be mapped and scrutinized utilizing geoprocessing tools. The main file types that were included in the datasets were shapefiles (.shp), geodatabase (.gdb), index files (.shx), attribute data (.dbf).

Methodology:

- Browsing and navigating for Geospatial data on online repositories that were relevant to the development of a Multipurpose Map which maps the entire planet Earth.
- Visualizing the collected data in compatible softwares such as ArcMap and QGIS.

- Comparing the collected data of planet earth to pre-existing and reputable Geospatial Web-applications such as Google Maps and Google Earth to ensure the collected data is accurate and reliable.
- Identifying any anomalies and differences in the quality of the data from Google Earth to my collected data
- Utilization of Python, QGIS, Arcmap for geoprocessing, manipulating and editing the data to make it suitable for the Web application.

Analysis Techniques

To clean the Geospatial data, the following approach was used:

1. Import the necessary libraries:

Imported Geopandas as gpd

from shapely.geometry imported Point

2. Read the geospatial data file:

python

data = gpd.read_file('path_to_your_geospatial_data_file')

3. Checked for missing values or anomalies in the data:

python

data.isnull().sum()

4. Remove any duplicate entries:

python

data = data.drop_duplicates()

5. Check and fix any inconsistencies in the data:

python

Example: Fixing invalid geometries

data['geometry'] = data['geometry'].apply(lambda x: x.buffer(0) if x.is_valid else x)

6. Save the cleaned data to a new file:

python

data.to_file('path_to_save_cleaned_data')

Visualizations:

QGIS and ArcMap were utilized to visualize the data and ensure that the data is correct and suitable to be part of the Geospatial web application. Include screenshots of qgis and armap designing something.

Conclusions

Reputable data sources and datasets were successfully collected for the creation of a Multi-Purpose Geospatial Web application, through searching the internet and online open-source repositories such as the Council for Geosciences, Github and Geological Society of South Africa. Various softwares such as QGIS and ArcMap were utilized for the quality control, geoprocessing and cleaning of the collected data.

Task 2: Geospatial Application Development

Overview

The main objective of the application was to be an interactive web application which included geospatial data for the entire planet Earth.

The Web application has 7 sub-web applications Which are:

- Interactive Map
- Split Map
- Marker Cluster
- Heatmap
- Basemaps
- Web map Services
- Rater Comparison

How to use the application:

Click on the provided link http://192.168.3.15:8501/ to launch the Web application (Three Sixty Spatial).

You will be met with 7 sub web applications on the left pane.

Sub web application main functionalities include:

Interactive Map: Select a basemap on the top right corner of your screen which caters for your analysis needs. Adjust the Zoom Scale by pinching your screen or Keypad. Measure Distances by using the measure function on the bottom left corner of your map. Delineate areas of interest by creating a shape around a feature through using the circle and rectangle tools.

Split Map: Simply drag the centre line to the left or right to view the different landcover types during the year 2020.

Marker Cluster: The number on a cluster indicates how many markers it contains. Notice that as you zoom into any of the cluster locations, the number on the cluster decreases, and you begin to see the individual markers on the map. Zooming out of the map consolidates the markers into clusters again. The purpose of the marker cluster map is to increase readability and increase the performance of the web application.

Heatmap: Scroll to different parts of North America and view the temperature contrast amongst the neighbouring countries. Red indicating warmer temperatures and blue indicating cooler temperatures.

Basemaps: In the top right corner search for any basemap of your choice to add to the blank Earth interactive map.

Web Map Services: This app is a demonstration of loading Web Map Service (WMS) layers. Simply enter the URL of the WMS service in the text box in the top right corner and press Enter to retrieve the layers. Go to https://apps.nationalmap.gov/services to find some WMS URLs if needed.

Raster Comparison: Simply drag the centre line to the left or right to view the satellite imagery or the raster imagery of the flooded coastline Libya in July 2023.
Click on the upper right corner to select the before or after raster image to be overlain on the satellite imagery to be able to analyse the effects of the flooding successfully.
Two interactive Raster Images are overlain on the coast of Libya. This tool shows the before and after of the flooding that occurred in Libya in July 2023. The Before Raster image was taken on the 1st of July 2023 and the After raster image was taken on the 13th of September2023.

Web Application Hosting & Documentation:

The web application Three Sixty Spatial is hosted by Streamlit.