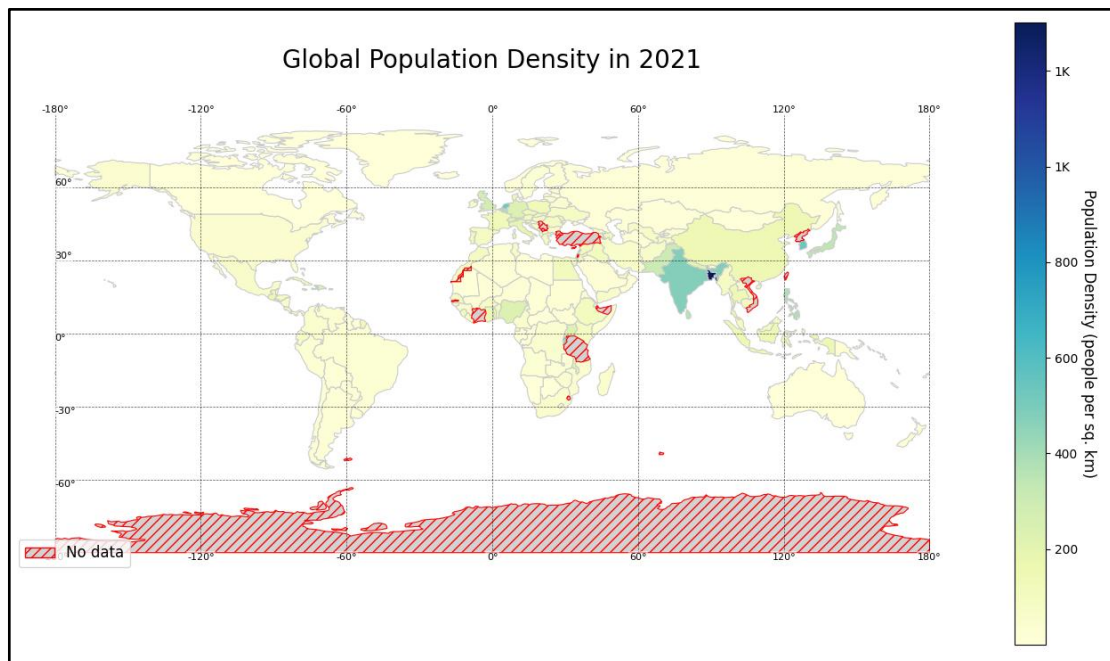
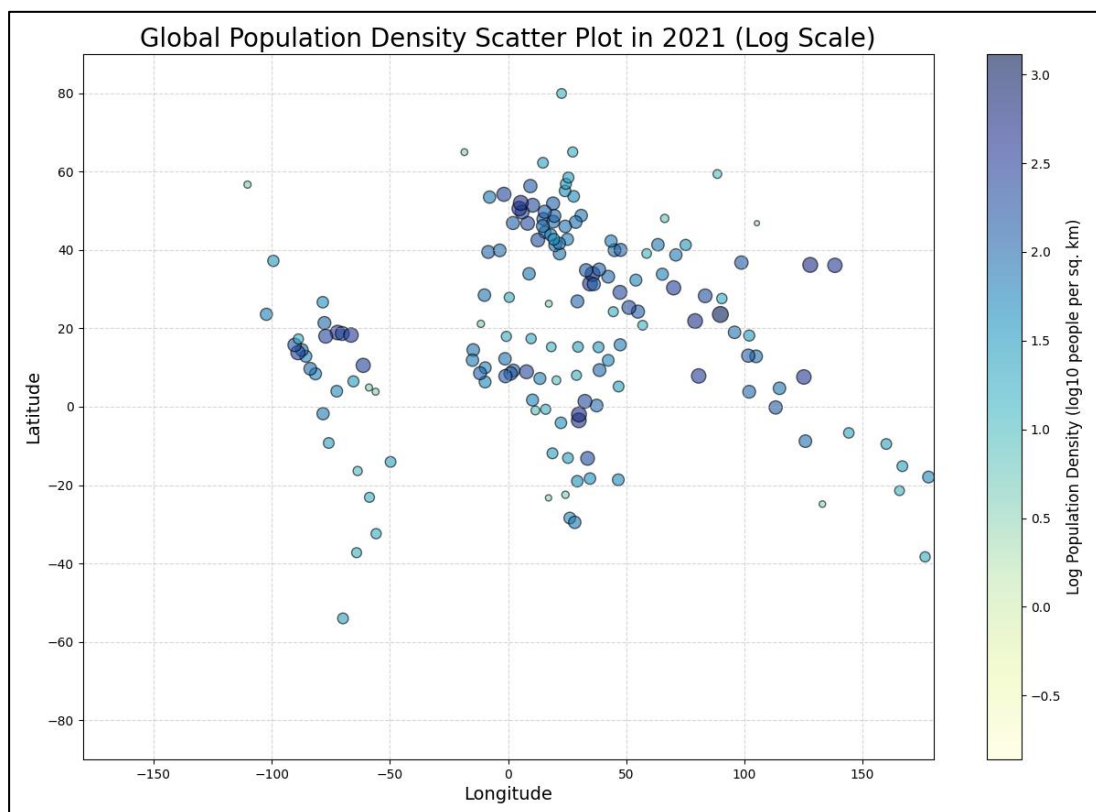


Visualization of Global Population Density



Main Figure: Integrated Global Population Density Choropleth Map



Small panels: Global Population Density Scatter Plot

Legend

Choropleth Map:

- Color Gradient : Represents the population density of each country. Darker shades indicate higher population density.
- Missing Data Patch: A red diagonal grey background is used to distinguish countries with no available population density data.

Scatter Plot:

- Circle Size: Represents the logarithm of population density (Log Population Density). Larger circles indicate higher population density.
- Circle Color: Darker colour indicates higher population density.
- Edge Color: Black borders around circles enhance visibility.

Latitude and Longitude Lines:

- Dashed Black Lines: Represent specific latitudes (-60°, -30°, 0°, 30°, 60°) and longitudes (-180°, -120°, -60°, 0°, 60°, 120°, 180°) to provide geographical reference.

Key Findings

Uneven Distribution of Population Density:

- High Density Regions: Eastern and Southern Asia, particularly countries like China and India, exhibit significantly higher population densities.
- Low Density Regions: Parts of Africa and Latin America show lower population densities with more dispersed distributions.

Geographical Influence:

- Tropical and temperate countries generally have higher population densities, whereas polar and arid regions have lower densities, reflecting the impact of natural environments on population distribution.

Data and Methods

Data Sources

Population Density Data:

Obtained from the worldbank databank, which contains the population density (people per square kilometer) of various countries for the year 2021.

URL: <https://databank.worldbank.org/source/world-development-indicators>

Geographical Data:

Utilized the Natural Earth dataset (ne_110m_admin_0_countries.shp) to acquire the geographical

boundaries of countries worldwide.

URL: <https://www.naturalearthdata.com/downloads/110m-cultural-vectors/110m-admin-0-countries/>

Data Processing

1. Data Cleaning:

- (1) Renamed the 2021 population density column for clarity.
- (2) Converted population density values to numeric types and removed any entries with missing values.

2. Country Name Standardization:

- (1) Applied a replacement dictionary to align country names between the population density data and the geographical dataset, ensuring accurate merging.

3. Data Merging:

- (1) Merged the cleaned population density data with the geographical data using GeoPandas, resulting in a unified GeoDataFrame containing both population density and geographical information.

4. Geographical Coordinates Calculation:

- (1) Calculated the representative point (centroid) for each country's geometry to determine the longitude and latitude coordinates, essential for plotting the scatter plot.

5. Logarithmic Transformation:

- (1) Applied a logarithmic transformation to the population density data to normalize the range and enhance the visual distinction between countries with varying densities.

6. Visualization:

- (1) Choropleth Map: Created using GeoPandas and Matplotlib to display population density through color gradients.
- (2) Scatter Plot: Plotted using Matplotlib, where circle sizes correspond to the logarithm of population density, positioned based on geographical coordinates.
- (3) Latitude and Longitude Lines: Added dashed lines for specific latitudes and longitudes to provide geographical context.
- (4) Legend and Labels: Positioned the legend outside the main plot area to avoid obscuring data and added labels for clarity.

Significance

By presenting population density through both a choropleth map and a scatter plot, this visualization offers a comprehensive view that captures both the geographical spread and the intensity of populations. The integrated approach facilitates a deeper analysis of how population density interacts with geographical factors.

Github link: https://github.com/IBER-CodingVersion/INFSCI2415_FinalProject.git