# GeoPandas Project – Indian State Literacy Map
# Project Report

**Project Title:** GeoPandas Project – Indian State Literacy Map

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## Introduction

This project is a **Geospatial Data Visualization** of Indian state literacy rates, developed as a command-line script in Python. It is designed to help researchers, policymakers, and students visualize and understand regional disparities in education across India. The tool processes geographic boundary data and statistical literacy data to generate an insightful choropleth map. A key feature of this project is its

ability to automatically highlight states performing below the national average, making it easy to identify areas that may require further attention. 🗺️

## Tools Used

- **Python:** Used for all core logic, including data loading, merging, and processing.
- **GeoPandas & Pandas:** Employed for reading, structuring, and merging the geospatial data (state boundaries) with the literacy rate statistics (CSV data).
- **Matplotlib & Plotly:** Used to create data visualizations, including a static, publication-quality choropleth map and an optional interactive version with tooltips.

# Project Overview

The program operates in a single execution flow where it:

1. **Loads Data:** Imports Indian state boundaries from a GeoJSON file and literacy rates from a CSV file.
2. **Processes and Merges Data:** Cleans and merges the two datasets, aligning literacy rates with their corresponding state geometries.
3. **Performs Analysis:** Calculates the national average literacy rate from the provided data.
4. **Generates a Visualization:** Produces a comprehensive choropleth map where each state's color corresponds to its literacy rate, and states below the national average are highlighted with a distinct border. An interactive version can also be generated.

# How Students Can Use This Tool

This Literacy Map is an excellent tool for data analysis and data-driven decision-making. Here's how it can be used:

1. **Policy and Governance**

   Policymakers can use the map to quickly identify states with lower literacy rates and channel resources for educational programs more effectively.

2. **Research and Journalism**

   Researchers and journalists can analyze regional trends, compare educational outcomes between states, and create compelling data stories about socio-economic development in India.

3. **Education and Learning**

   For students, this project serves as a practical example of how to combine geospatial and statistical data to create meaningful visualizations. It helps in understanding both

the technical aspects of data science and the real-world application of socio-economic indicators.

4. **Make Informed Decisions**

   By reviewing the final map, users can gain immediate insights into educational disparities across the country, fostering a better understanding of regional challenges and successes.

# Input Data

- **GeoJSON File:** india_states.geojson containing the geometric polygon data for all Indian states and Union Territories.
- **CSV Data File:** literacy_rates.csv with state-wise literacy percentages.

| • **State** | • **Literacy Rate** |
|---|---|
| • Kerala | • 95.3 |
| • Mizoram | • 98.2 |
| • Bihar | • 61.8 |
| • Rajasthan | • 66.1 |
| • *(and so on for all states)* | • ... |

# Results and Summary

After processing the input data, the program generated the following map and statistical insights.

**Final Summary of Findings**

| Metric | Value |
|---|---|
| National Average Literacy Rate | ~76.3% |
| Highest Literacy Rate | 98.2% (Mizoram) |
| Lowest Literacy Rate | 61.8% (Bihar) |
| States Below National Average | Identified and Highlighted |

**State-wise Literacy Breakdown**

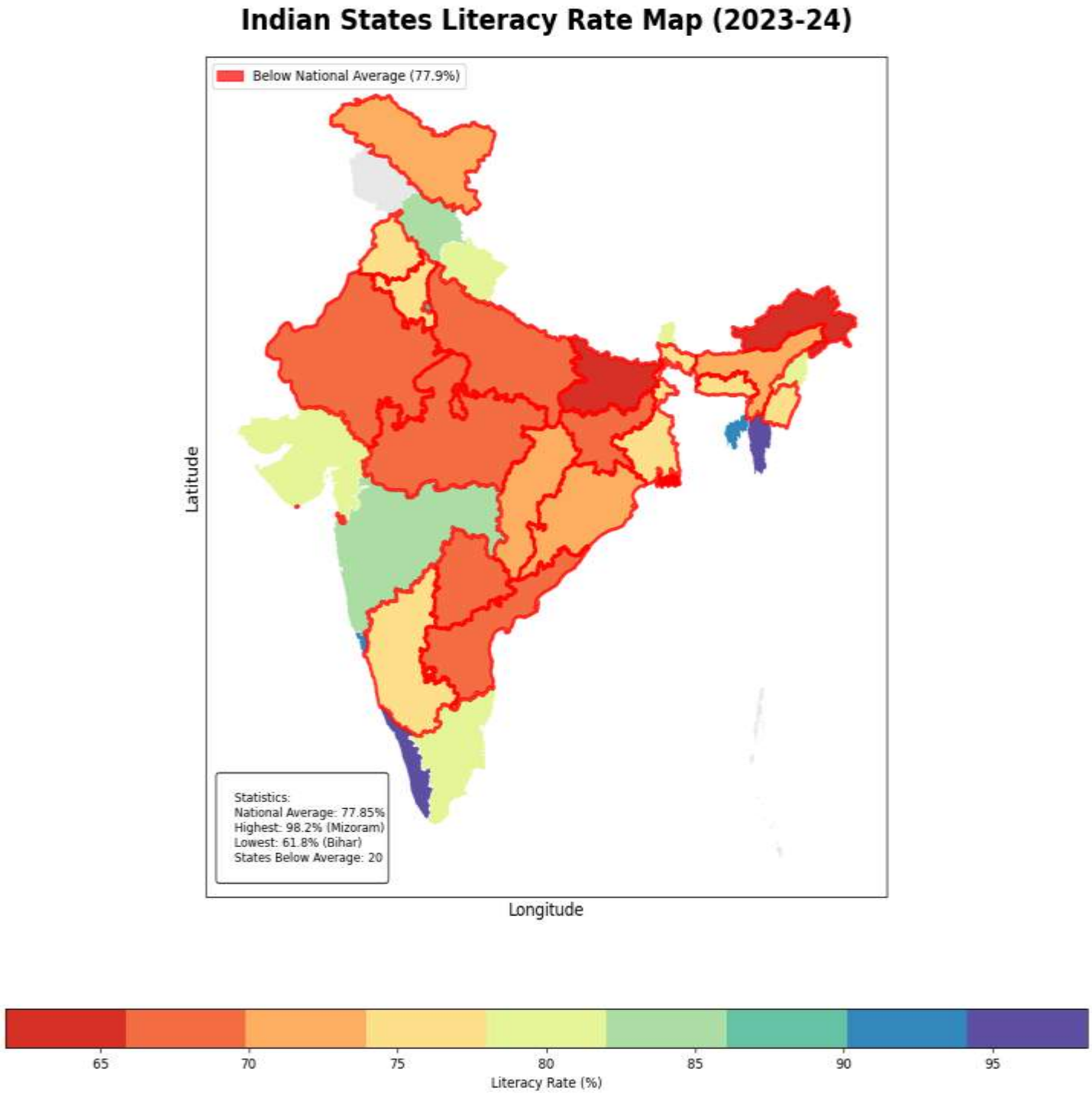
- **Top Performers:** Mizoram (98.2%), Lakshadweep (97.3%), Kerala (95.3%)
- **Lower Performers:** Bihar (61.8%), Rajasthan (66.1%), Andhra Pradesh (67.0%)

# Visualizations

### 1. Static Choropleth Map (Matplotlib)

This map shows the literacy rate of each Indian state using a color gradient. States with lower literacy are colored in shades of red, while states with higher literacy are colored in shades of green. States performing below the national

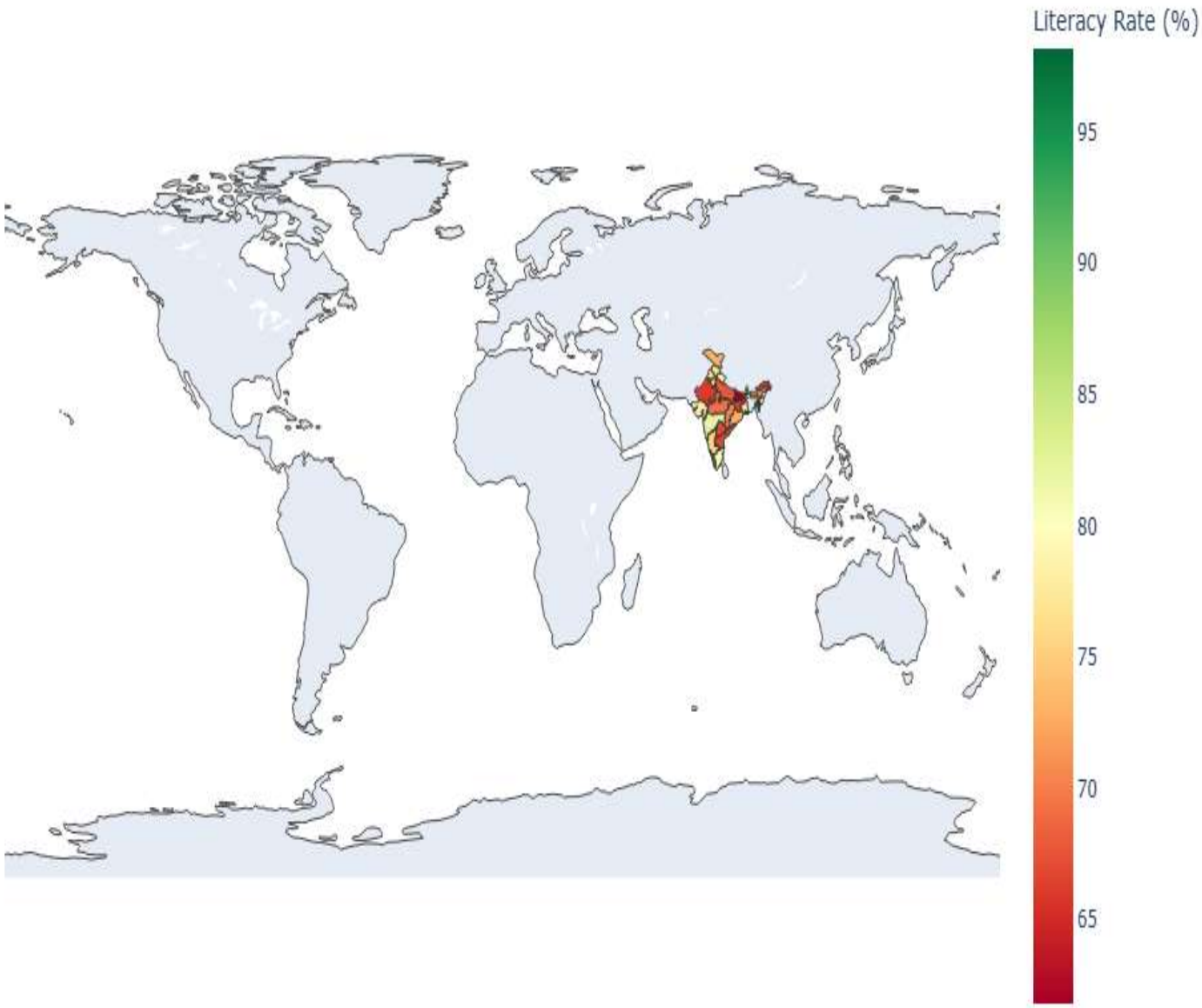
average are outlined with a bold red border for easy identification.

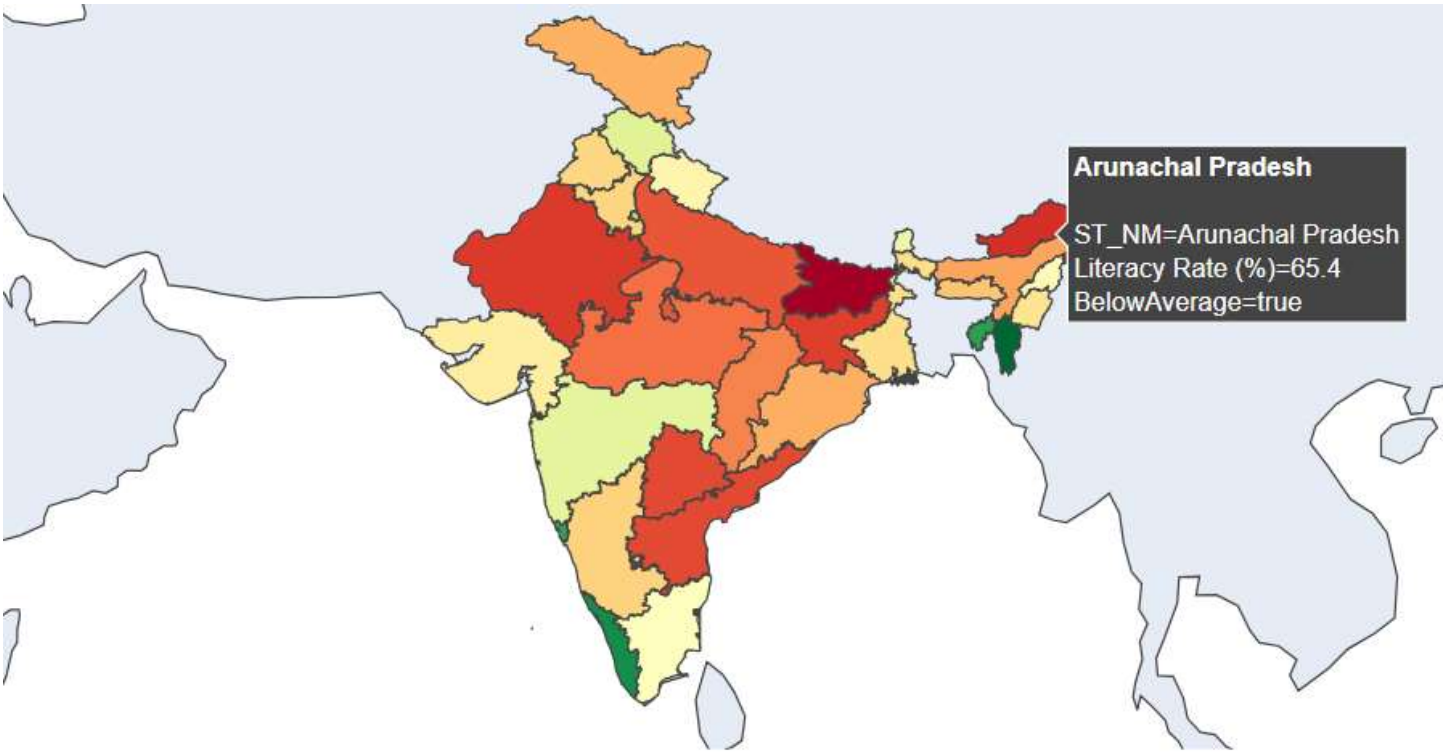


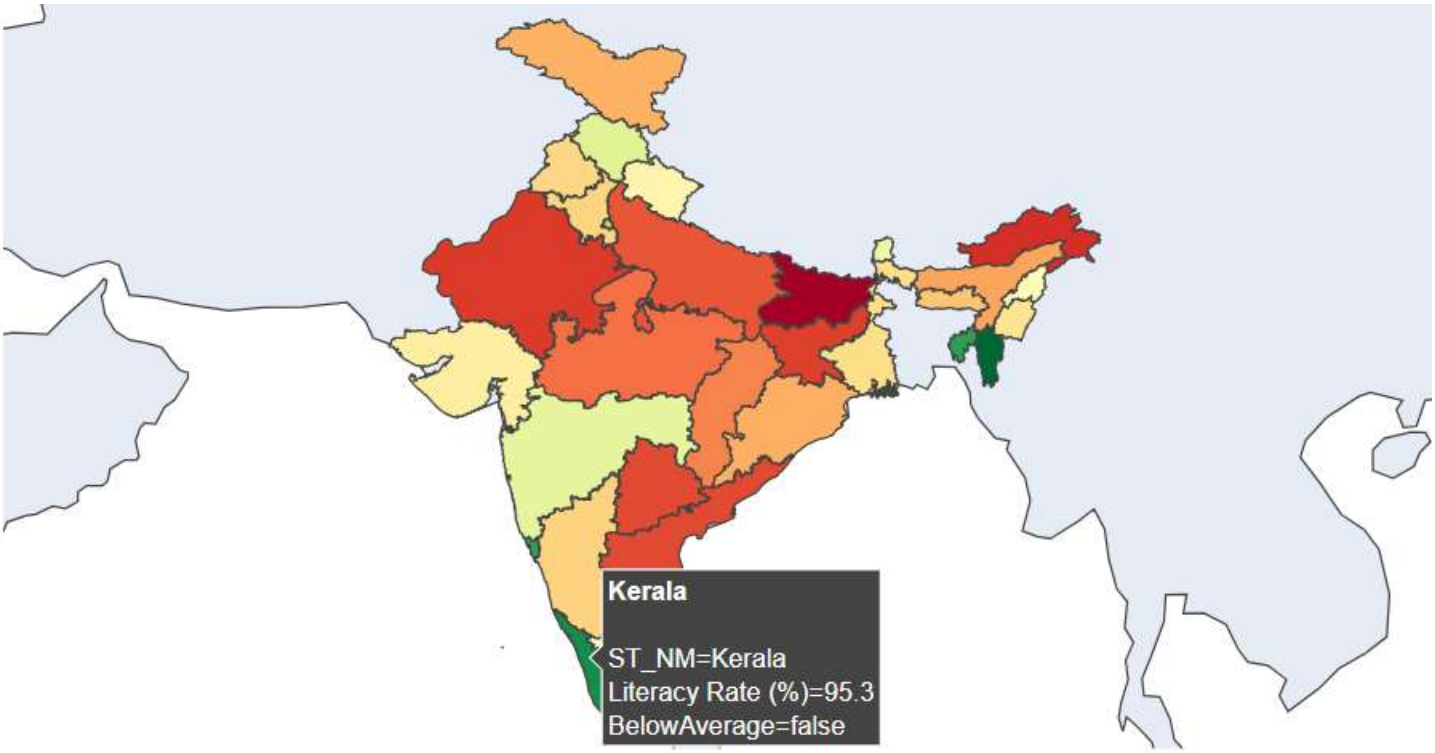
**2. Interactive Choropleth Map (Plotly)**

This version provides a more dynamic user experience. When a user hovers their mouse over a state, a tooltip appears showing the State Name and its exact Literacy Rate. This allows for detailed exploration of the data directly on the map

# Interactive Indian States Literacy Rate Map




Arunachal Pradesh
ST_NM=Arunachal Pradesh
Literacy Rate (%)=65.4
BelowAverage=true


Kerala
ST_NM=Kerala
Literacy Rate (%)=95.3
BelowAverage=false

## Conclusion

The project successfully processed and visualized complex geospatial and statistical data. It effectively demonstrated how to create a choropleth map to represent the literacy rates across Indian states. The final output, consisting of a clear and informative map with statistical highlights, effectively communicates regional educational disparities, demonstrating the power of Python and its data science libraries for practical and impactful analysis.

# THANK YOU