



Global Search Trends Analysis

Analyzing technology keyword popularity using Google Trends, Python & Plotly

Objective & Scope

Project Goal

To analyze and visualize the global popularity and trend patterns of technology-related keywords including Python, Pandas, Power BI, and Machine Learning using real-world Google search data.

This analysis reveals how interest in data technologies varies across countries and evolves over time, providing actionable insights for marketers, educators, and tech professionals.



Tools & Technologies



Python

Core programming language for data collection, analysis, and automation



Pytrends

Unofficial API wrapper for fetching Google Trends search data programmatically



Pandas & NumPy

Data manipulation, cleaning, transformation, and statistical aggregation



Plotly

Interactive visualization library for maps, treemaps, heatmaps, and charts



Pycountry

Library for mapping country names to standardized ISO codes for geospatial mapping



Jupyter Notebook

Interactive development environment for code execution and visualization



Project Workflow

Steps 1-2: Problem Definition & Data Collection

Define Problem

Understand how interest in data technologies changes across countries and over time

Collect Data

Use Pytrends to fetch Interest Over Time (monthly) and Interest By Region (country-wise scores 0-100)

- ❑ **API Connection Example:** `pytrends.build_payload(keywords, timeframe='today 12-m', geo='')` then retrieve `data_region` and `data_time`

Data Preparation

Step 3: Cleaning & Transformation

01

Data Cleaning

Removed missing or incorrectly formatted country names from raw Google Trends data

02

ISO Conversion

Converted country names to standardized ISO codes using pycountry library for choropleth mapping

03

Aggregation

Calculated monthly averages and aggregated metrics for comprehensive trend analysis

04

Data Export

Saved cleaned datasets as CSV files for reproducibility and future reuse



Visualization Strategy

Created multiple interactive visuals to understand search trends from different analytical perspectives

Choropleth Map

Shows country-wise interest intensity with color gradients. India had the highest interest in Python searches.

Treemap

Displays proportional share of each country. Top 10 countries cover 70% of total search interest.

Heatmap

Compares interest intensity across regions. Python shows strong intensity across multiple geographic areas.

Bar Chart

Ranks top countries by search volume. India leads, followed by USA and UK in Python interest.

Line Chart

Monthly trend progression. Machine Learning searches show steady upward growth pattern.

Donut Chart

Proportion of search volume by country, providing clear visual breakdown of top contributors.

Key Insights & Findings

Python Dominates

Python continues to lead global search interest, with particularly strong engagement in India and the United States, reflecting its widespread adoption in data science and software development.

Machine Learning Rising

Machine Learning shows steady month-over-month growth, indicating expanding curiosity and investment in AI fields across technical and business communities worldwide.

Power BI in Enterprise

Power BI demonstrates high popularity in corporate-heavy regions like the U.K. and U.S., aligning with enterprise adoption of business intelligence tools.

Pandas Adoption

Pandas remains widely searched in developer and analyst communities, cementing its position as the essential data manipulation library.

Global Distribution

Search interest is globally distributed across continents, demonstrating universal adoption of data skills and democratization of technology education.

Challenges & Learnings

Technical Challenges

Rate Limiting

Encountered Google Trends API throttling (HTTP 429 errors). Solved using intelligent caching strategies and retry logic with exponential backoff.

Data Mismatches

Country name inconsistencies required manual ISO code mapping and validation to ensure accurate geospatial visualization.

Normalization Issues

Some regions return equal interest scores due to Google's 100-point normalization, requiring careful interpretation of results.

Skills Developed

- Working with external APIs and handling authentication flows
- Advanced data cleaning and transformation with Pandas
- Building interactive multi-chart dashboards using Plotly
- Interpreting global user behavior patterns from search data
- Designing business-ready insights and visualizations



Future Enhancements



Streamlit Dashboard

Build an interactive web application for live keyword analysis with real-time data updates and user-friendly interface



Dynamic Keywords

Add user input functionality for custom keyword selection and comparison, enabling personalized analysis



Data Integration

Integrate GitHub activity or Stack Overflow data for deeper cross-platform comparison and validation



Automated Refresh

Schedule daily or weekly data refresh using Python scripts and task schedulers for continuous monitoring

Conclusion

This project demonstrates the power of combining real-world data from Google Trends with Python-based analytics and modern visualization tools. It provides actionable insights into how different technologies are trending globally, making it an invaluable resource for business analysts, marketers, educators, and data scientists seeking to understand the evolving technology landscape.