1 Project Overview

This project is an **interactive Streamlit dashboard** that allows users to: ✅ Explore **historical life expectancy trends** across different countries. ✅ Predict **future life expectancy** using **Machine Learning (Polynomial Regression)**. ✅ Compare **life expectancy between two countries**. ✅ Rank **countries based on life expectancy** for a selected year. ✅ Visualize **global life expectancy** on an **interactive world map**.

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2 Dataset Overview

- **Dataset Name:** `dataset.csv`
- **Source:** [Kaggle / globaldata.org]
- **Time Period:** 1990 - 2019
- **Features:**
  - `Country` : Name of the country.
  - `Country_Code` : 3-letter country code.
  - `Level` : National or subnational classification.
  - `Region` : Geographic region.
  - `1990 - 2019` : Life expectancy values for each year.

  Data Processing Steps:

1. **Converted wide-format data to long-format** (so each row represents a country-year pair).
2. **Converted Year & Life Expectancy to numeric values**.
3. **Handled missing values** by filling them with the median of each country.
4. **Applied normalization** for ML models.

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3 Features & User Guide

Life Expectancy Trends

- **How to Use:** Select a country from the dropdown → View the **historical trend** from 1990-2019.

Predict Future Life Expectancy

- **How to Use:** Select a country → Choose a **future year (2025-2100)** → View the **predicted life expectancy**.
- **Method Used:** Polynomial Regression (degree 2).

Country Rankings

- **How to Use:** Use the **slider** to select a year (1990-2040) → View the **ranked list of countries**.
- **Bonus:** Search for a specific country's **rank & life expectancy**.
- **ML Prediction:** If year > 2019, the model predicts the ranking.

Compare Two Countries

- **How to Use:** Select **two countries** → View the **comparison chart**.

Interactive World Map

- **How to Use:** View the latest **global life expectancy map**.

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4 Machine Learning - Model Performance

□? Algorithm Used: Polynomial Regression (Degree 2)

- **Why?** Life expectancy trends are **non-linear**, so polynomial regression fits better than linear.
- **Train/Test Split:** 80% Training - 20% Testing.
- **Evaluation Metrics:**
  - **Mean Absolute Error (MAE):** Measures average prediction error.
  - **Mean Squared Error (MSE):** Penalizes large errors more.
  - **R^2 Score:** Measures how well the model explains the data.

Model Accuracy for India (Example):

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Mean Absolute Error (MAE): 0.92
Mean Squared Error (MSE): 1.74
R-squared (R² Score): 0.98
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✅ **High R^2 Score (~0.98)** → The model accurately predicts life expectancy trends.

5 Deployment & Access

- **Live Dashboard:** Streamlit App Link
- **Repository:** GitHub Link

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6 Future Improvements

✅ Add **more ML models** (e.g., Random Forest, Time Series). ✅ Include **economic & health factors** (GDP, healthcare spending). ✅ Improve **UI with better graphs & interactivity**.

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7 Conclusion

This project provides a powerful **data-driven tool** for analyzing **global life expectancy trends**, forecasting future values, and comparing different countries. The **interactive dashboard** enables users to easily explore and gain insights, while **machine learning models enhance prediction accuracy**.