Forecasting CO Emissions Using Machine Learning to Support SDG 13: Climate Action

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1. SDG Problem Addressed

The world is facing an alarming rise in carbon dioxide (CO) emissions, a leading cause of global warming and climate change. This challenge aligns with Sustainable Development Goal (SDG) 13: **Climate Action**, which calls for urgent action to reduce emissions and build climate resilience.

Predicting future CO emissions enables policymakers, environmental agencies, and governments to design better climate strategies and monitor progress toward sustainability targets.

2. Machine Learning Approach

A **Supervised Machine Learning (Regression)** approach was used to forecast CO emissions for various countries. Two models were trained and compared:

- **Linear Regression** – to establish a baseline trend.
- **Random Forest Regressor** – to capture non-linear relationships between population, year, and past emissions.

Dataset Used: CO Emissions by Country (1750–2022) from Kaggle.
Key Features: Year, Population, and Previous Year Emissions.

The model was developed in **Python** using the following libraries:

- `Pandas` – data handling and preprocessing.
- `Scikit-learn` – model training and evaluation.
- `Matplotlib` – data visualization.

3. Results

The Random Forest model outperformed Linear Regression with an **R^2 score of 0.94** and a **Mean Absolute Error (MAE) of 0.032**, indicating strong predictive accuracy.
Visual Insights:

- Global emissions have risen sharply since the 1950s.
- Kenya's emissions remain low but are steadily increasing due to industrialization.
- The model can forecast emissions for future years, aiding decision-makers in tracking and reducing environmental impact.

4. Ethical Considerations

AI applications in climate analysis must follow strong ethical principles:

- **Data Fairness:** Some developing countries have incomplete or inconsistent data, which can affect prediction accuracy.
- **Transparency:** Open data and reproducible methods are vital for accountability.
- **Sustainability Impact:** The model promotes responsible AI use by supporting climate awareness and environmental policy innovation.

5. Conclusion

Machine Learning offers a powerful, data-driven approach to combat climate change. By forecasting emissions, this project contributes to **SDG 13: Climate Action**, empowering communities, governments, and organizations to make informed and sustainable environmental decisions.

Keywords: CO Emissions, Machine Learning, Regression, Climate Change, SDG 13