**1. Project Idea:** Predicting Future Temperatures Using Machine Learning and Earth Surface Temperature Data

This project aims to employ machine learning techniques to predict future temperatures based on historical Earth Surface Temperature Data. The goal is to understand and forecast the impact of climate change on global and regional temperatures, contributing to effective climate action planning.

**2. Relevance to Sustainable Development Goals (SDGs):** This research directly contributes to SDG 13 (Climate Action) by enhancing understanding and predictability of climate change. Accurate temperature forecasts are crucial for informing adaptation and mitigation strategies across multiple SDGs, including SDG 11 (Sustainable Cities and Communities), SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-being), and SDG 15 (Life on Land).

**3. Literature Examples:**

* "Predicting Global Patterns of Long-term Climate Change from Short-term Simulations Using Machine Learning" (npj Climate and Atmospheric Science): Demonstrates using machine learning to predict long-term surface temperature response from short-term climate data​​. [1]
* "Forecasting Climatic Trends Using Neural Networks: An Experimental Study Using Global Historical Data" (Frontiers): Employs neural networks for climate forecasting using global mean monthly temperature data, illustrating the potential of AI in climate studies​​. [2]

**4. Describe Your Data:** The primary dataset will be the Earth Surface Temperature Data, (<https://www.kaggle.com/datasets/berkeleyearth/climate-change-earth-surface-temperature-data>) which includes historical temperature records. The data format is in CSV, covering global geographic locations over an extended period. Data preprocessing will include cleaning, normalization, and temporal alignment.

**5. Approach (Machine Learning or Deep Learning):** The project will focus on employing straightforward and interpretable machine learning methods to analyze and predict future temperatures based on Earth Surface Temperature Data. The primary techniques will include:

* **Linear Regression**: To establish baseline models for temperature trend analysis and predictions.
* **Autoregressive Integrated Moving Average (ARIMA)**: For time series forecasting, especially useful for capturing patterns and trends over time in temperature data.
* **Decision Trees and Random Forests**: To explore non-linear relationships in the data while maintaining model simplicity and interpretability.
* **Support Vector Machines (SVM)**: Used for regression (SVR) to model complex but identifiable trends in the temperature data.

These methods are chosen for their effectiveness in handling time series data and their relative simplicity compared to deep learning models. They offer a good balance of predictive power and interpretability, which is crucial for understanding and communicating the outcomes of the analysis in the context of climate change and its broader implications.

[1] Mansfield, L.A., Nowack, P.J., Kasoar, M. *et al.* Predicting global patterns of long-term climate change from short-term simulations using machine learning. *npj Clim Atmos Sci* **3**, 44 (2020). <https://doi.org/10.1038/s41612-020-00148-5>

[2] Ise T and Oba Y (2019) Forecasting Climatic Trends Using Neural Networks: An Experimental Study Using Global Historical Data. *Front. Robot. AI* 6:32. doi: 10.3389/frobt.2019.00032