**AI-MLInternship** **IBM SkillsBuild**

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**Report**

**Title: Development of a Predictive Model for Analyzing Global Land Temperature Trends by City Using Machine Learning**

**Introduction:**

Climate change is one of the most pressing challenges of our time. Cities around the globe are experiencing unusual variations in land temperature due to urbanization, greenhouse gas emissions, and other anthropogenic factors. Traditional monitoring systems are limited in scope and fail to capture localized trends effectively. However, advancements in machine learning and data analytics offer an intelligent, scalable approach to analyze and forecast land temperature trends.  
This report outlines the development of a predictive model to analyze global land temperature patterns by city using historical data, contributing to early warnings and climate adaptation strategies.

**Problem Statement:**

The primary challenge addressed by this project is the **lack of localized, data-driven analysis** of global land temperature variations. While global climate trends are tracked, **city-level insights** are often missing. This makes it difficult for urban planners, climate scientists, and policymakers to take **targeted and timely action**.

**Objective:**

The main objective of this project is to **develop and evaluate a machine learning model** capable of identifying **trends, anomalies, and seasonal patterns** in land temperature data by city. The model will help in **forecasting temperature shifts**, facilitating **climate resilience**, and improving **local-level policy decisions**.

**Why This Problem?**

Urban heat effects and local temperature surges are **increasing health risks**, energy demands, and environmental stress in cities.  
Analyzing city-wise land temperatures is **critical for SDG 13 – Climate Action**, as it enables governments and organizations to take **location-specific climate measures**, plan **green infrastructure**, and prevent **climate-related disasters**.

**Solution Overview:**

The solution involves building a **data-driven temperature prediction model** using machine learning algorithms such as **Extra Trees Regressor or LSTM**. The model will analyze city-wise temperature data, identify trends, and visualize climate shifts. Results can be integrated into web dashboards or alert systems for **real-time awareness and long-term planning**.

**Features:**

* 🔎 **Trend Detection:** Detects rising temperature trends and anomalies for each city.
* 🧪 **Data-Driven Forecasting:** Uses historical datasets to forecast future temperature changes.
* 🌍 **City-Level Insights:** Offers granular insights for urban policymakers and researchers.
* 🧠 **Scalable and Adaptive:** Can be extended to other cities or regions globally.
* 📊 **Visualization:** Creates easy-to-read graphs, heatmaps, and dashboards.

**Technical Implementation:**

1. **Data Collection and Preprocessing:**  
   Use Kaggle’s “Global Land Temperatures by City” dataset. Clean and preprocess it by handling missing values, aggregating seasonal data, and converting date formats.
2. **Feature Engineering:**  
   Create new features like average seasonal temperature, temperature deviation from mean, and urban vs rural identifiers.
3. **Model Development:**  
   Train regression or time-series models (e.g., Extra Trees, LSTM) to analyze and predict temperature trends.
4. **Model Evaluation:**  
   Use evaluation metrics like **RMSE**, **MAE**, and **R² score** to assess model accuracy.
5. **Visualization & Deployment:**  
   Develop a web-based dashboard (e.g., using Flask, Streamlit, or Power BI) for users to interact with city-specific predictions and trends.

**Why IBM Cloud and Watson Studio?**

* ⚙️ **Watson Studio:** Provides robust tools for data processing, visualization, and model deployment in one platform.
* ☁️ **IBM Cloud:** Offers scalable infrastructure to manage and process large historical datasets efficiently.
* 🔐 **Security:** Ensures data privacy and compliance with data protection standards.
* 📈 **AI & Analytics Tools:** Helps streamline model development and visualization pipelines.

**Conclusion:**

This project presents a machine learning-based approach for **analyzing global land temperature trends by city**, leveraging the IBM Cloud and Watson Studio. The model provides a **non-invasive, cost-effective, and scalable** solution to understand the impacts of climate change at the city level.  
By empowering **data-driven climate action**, the project supports **SDG 13: Climate Action** and contributes to **urban resilience and environmental planning**.