Concept Note: AI-Driven Approach to Model the Intersection of Gender Inequality and Climate Change Using Knowledge Graph and Machine Learning

1. Background

The United Nations Sustainable Development Goals (SDGs), highlight two critical global issues: the persistent gender inequalities and the increasing threats posed by climate change. While these issues are often examined independently, they intersect in many ways. **Climate change exacerbates gender disparities**, particularly in marginalized communities, where women, girls, and gender minorities face heightened vulnerability during environmental crises.

For example, natural disasters disproportionately impact women's livelihoods, education, health, and personal safety. Women in rural and agricultural communities often bear the brunt of climate change-induced disruptions, such as droughts and floods, that intensify poverty and reduce access to resources.

Addressing this issue is a key focus of the **United Nations Sustainable Development Goals (SDGs)**, specifically **SDG 5 (Gender Equality)** and **SDG 13 (Climate Action)**. Understanding how climate change affects gender inequalities and vice versa is critical to formulating policies that promote resilience and gender equity in climate adaptation strategies.

This project proposes a **data-driven approach** using a combination of **Knowledge Graphs**, **Large Language Models (LLMs)**, and **Traditional Machine Learning** techniques. This hybrid approach will allow us to model the relationship between climate change and gender inequality by leveraging **structured and unstructured data sources**, including reports, publications, and climate datasets.

2. Objectives

The main objectives of this project are:

1. **Developing a Knowledge Graph**: Create a **gender-climate knowledge graph** that maps the intricate relationships between climate change impacts, gender disparities, and socio-economic factors across various regions and sectors.
2. **Applying Machine Learning**: Leverage **ML algorithms** to analyze patterns and predict gender-specific outcomes from climate change scenarios (e.g., the effect of droughts on female labor force participation).
3. **Building Tools**: Create a **dashboard or AI-powered decision-making tool.**

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3. Methodology

3.1 Data Collection

- **Gender Inequality Data**:
    - Data on gender gaps in education, health, employment, and political participation etc will be collected from various sources.
- **Climate Change Data**:
    - Climate vulnerability and risk data will be collected from sources such as **NASA's Socioeconomic Data and Applications Center (SEDAC)**.
- **Policy Documents and Reports**:
    - Relevant reports, research papers and documents that highlight the **gendered impacts** of climate change.

3.3 Machine Learning Modeling

- **Graph Databases** for relational context.
- **LLMs** for qualitative insights.
- **Traditional ML** for quantitative predictions.

3.4 Dashboard Development

- An interactive **AI-powered dashboard** will be created to visualize the data.

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4. Expected Outputs and Outcomes

4.1 Outputs

- A **comprehensive model** that maps the relationship between climate change and gender inequality.
- **An AI-powered decision support tool** (dashboard) that visualizes gendered climate impacts and provides actionable insights.
- **Policy briefs and recommendations** for governments and NGOs on how to design gender-sensitive climate actions.
- **Published reports** summarizing the findings and data gaps.

4.2 Outcomes

- Increased use of **gender-disaggregated data** in climate change research, ensuring that future policies are more inclusive.
- **Enhanced decision-making capacity** for governments, NGOs, and international organizations aiming to create equitable climate action plans.
- **Increased awareness** among governments, NGOs, and international organizations on the need for gender-responsive climate policies.

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5. Solution Proposal

5.1 Gender-Responsive Policy Recommendations

The insights derived from the knowledge graph and ML models will inform:

- **Climate adaptation strategies** that prioritize female-led projects in agriculture and other key sectors.
- **Economic policies** that provide targeted relief and training for women impacted by climate disasters.
- **Improved access to education** for girls in climate-vulnerable regions.

5.2 Community-Based Solutions

- **AI for Empowerment**: Use AI-based tools to provide **real-time insights and recommendations** for local communities on adapting to climate change while promoting gender equality.

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6. Ethical Considerations

- **Bias and Fairness**: Ensure that machine learning models are not biased against marginalized gender groups. Perform fairness checks and apply debiasing techniques where necessary.
- **Data Privacy**: Safeguard the privacy of individuals and communities when collecting and processing gender-disaggregated data.
- **Inclusion of Traditional Knowledge**: Collaborate with local and indigenous communities to integrate their knowledge and experiences into the modeling process.
