Analyzing Global Human Migration Patterns: A Novel Application Using Advanced Data Analysis Techniques

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Abstract

This proposal outlines a research project to develop a comprehensive application to analyze global human migration patterns, leveraging datasets from the United Nations and similar agencies. The project emphasizes on the importance of understanding migration trends in a rapidly changing world driven by climate change, economic instability, and geopolitical shifts. In the course of this research, the team aims at identifying and using state-of-the-art Information Retrieval and Machine Learning techniques to achieve the goal of a Natural Language application which has a vast knowledge in this field.

Keywords: Information Retrieval, Human Migration, Random Forest Analysis, NLP applications

1 Introduction

The phenomenon of global human migration presents complex patterns that are influenced by a multitude of factors, including environmental changes, socio-political dynamics, and economic opportunities. Accurate analysis and understanding of these patterns are crucial for effective policy making and humanitarian efforts. [1]. This project would be an effort towards identifying major factors determining global migration and building an application to enable users to gain insights for personal growth, in addition to assisting the society as a whole.

2 Problem Statement

Understanding global migration patterns is essential for addressing challenges related to refugee crises, planning for economic development, and ensuring the well-being of millions of migrants worldwide. In addition to solving these problems, the outcome of this research could also benefit individuals who are immigrating and communities as a whole [2]. A tool that provides detailed insights into these patterns can aid in making informed decisions at both the policy and individual levels.

Existing models and applications offer limited insights into migration patterns, often constrained by static datasets and lacking user interactivity. There is a need for a **dynamic tool that not only analyzes but also visualizes migration trends in real-time**, allowing users to *explore scenarios based on various presets and fine-tuning instructions.*

3   Literature Survey

One of the earliest publications in the field of Human Migration is the work of Walter Adams [2]. It covers various factors leading to the refugee crisis on a global scale and issues surrounding it. One key aspect highlighted in the document is the significance of settlement schemes and international assistance in addressing the refugee problem. It underscores the importance of focusing on the numbers of refugees and the quality of support and integration efforts provided to them. The document points out that the refugee issue is not solely quantitative but rather qualitative, requiring a more holistic approach to ensure successful settlement and reintegration of displaced individuals.

The study by Black et al [6] and the Foresight report on Migration and Global Environmental Change depict migration through a relationship between human capacity, vulnerability to environmental change, and various psychosocial and socioeconomic factors. Marotzke et al [4] and Lilleør and van den Broeck [5] explored the poverty-climate-migration nexus in a laboratory setting, focusing on economic factors. The analysis shows that net-negative migration is concentrated in areas with high environmental stress and medium-low to medium-high adaptive capacity. Income, drought risk, and education are primary factors in explaining net-negative migration in areas with high environmental stress. The study highlights the importance of integrating societal dimensions in the quantitative analysis of the environment-migration nexus.

In a report published by Nature, Venla et al [7] have created a global dataset of annual net migration between 2000 and 2019, followed by a study highlighting the magnitude and impact of net migration, differentiating between rural and urban migration and associating migration patterns with socioeconomic factors and climate conditions. The study reveals global trends in net migration, with certain regions experiencing positive net migration due to urbanization and economic opportunities, while others face negative migration influenced by factors like conflict and economic downturns. The report also covers the importance of sub-national analysis for policy design and international cooperation, emphasizing the complex dynamics of migration that vary significantly across different scales and regions.

The key points explored in the literature survey we conducted necessitate a **detailed analysis of global migration caused by various environmental, socioeconomic, and political factors, accompanied by appropriate measures to make this work available to the masses**.

4   Methodology

We would be dealing with the available datasets, like UN's Global Migration Database, World Population Prospects, etc., using suitable Information Retrieval techniques. Furthermore, we plan

to use a combination of machine learning algorithms [3], geospatial analysis, and natural language processing (NLP) techniques to analyze the retrieved migration data. The application will feature a user interface that translates natural language inputs into data queries, offering users a personalized exploration of migration trends.

5   Evaluation

The effectiveness of our tool will be evaluated through user studies, comparing the insights generated by our application with existing data and trends. We will also assess the accuracy of our algorithms through back-testing with historical data.

6   Contributions

The workload, over the course of this semester, would be distributed as follows:

Dharani: Literature Review, Language Model, Information Retrieval

Aryan: Literature Review, Database Creation

Avinash: Language Model, Information Retrieval

Ekansh: Language Model, Front-end/API

Lakshay: Language Model, Front-end/API

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