Beyond Borders Clustering the Migration Patterns of Filipino Overseas Workers

Jean Angelo Flores
College of Computing and Information Technologies
National University - Philippines
Manila, Philippines
floresjg@students.national-u.edu.ph

Brix Anthony Manzanero
College of Computing and Information Technologies
National University - Philippines
Manila, Philippines
manzanerobg@students.national-u.edu.ph

***Abstract*—This study analyzes labor migration patterns among Filipino workers by employing three clustering methods: K-means, DBSCAN, and Hierarchical Clustering. These techniques are used to identify distinct population segments and analyze trends in migration based on factors such as job classification, educational attainment, gender, age group, and destination countries..**

***Index Terms*—component, formatting, style, styling, insert**

I. Introduction

Since millions of Filipinos leave the country every year in seek of better employment opportunities globally, the Philippines has long been recognized as a major labor producer to the rest of the world. These problems are often referred to as the "Overseas Filipino Worker (OFW) thing." In addition, as developed nations keep trying out professional and skilled workers to address labor shortages, globalization and the demand for labor abroad have contributed to migration.**[3]** These challenges in society include high unemployment rates, low wages, and a lack of career advancement in the local job market. Filipinos have been migrating overseas for a long time because of colonial influences, economic challenges, and labor rules that encourage labor exports.**[2]** Filipino workers have consistently looked for employment.

In 2023, there would be 2.16 million overseas Filipino workers (OFWs), up 9.8% from the previous year, according to the Philippine Statistics Authority (PSA). Of them, 98.1% were Overseas Contract Workers (OCWs) with ongoing work contracts, while 1.9% worked without official work permits. Also, information indicates that women accounted for 55.6% of OFWs, with the largest proportion of migrant workers being 45 years of age or older, closely followed by those in the 30-34 age bracket**[1].** surroundings in alongside the demands of the worldwide labor market.

One of the most essential factors for analyzing migration trends is the availability of jobs elsewhere. About 41.1% of OFWs had basic jobs in 2023, which include manual costly, daily responsibilities including cleaning, maintenance, and cooking**[10]**. At the same time, 14.7% worked in sales and service roles, while 12.1% handled machinery and factories**[4]**. A gender-based analysis revealed that 64.1% of female OFWs worked in basic jobs, whereas 25.4% of male OFWs were mostly involved in plant and machine operations**[7].** Historically, the CALABARZON area produced the most OFWs (19.0%), followed by Central Luzon (15.2%) and the National Capital area (9.6%). The remaining OFWs were from Visayas (16.5%) and Mindanao (17.6%), with Luzon making up 65.9% of the total.**[1]**

This study looks at all of the factors that influence Filipino labor migration and why many people decide to work elsewhere. The report goes over the impact of this mass movement on the regional labor force, the economy, and the Filipino families who are left behind**[8]**. In order to provide knowledge about future migration trends, this study also examines labor demand, historical data, and present laws in the incoming nations**[5].** Identifying these developments provides significance for scholars, politicians, and other groups involved in economic planning and labor migration control.

The effect of the Filipino migration of workers issue is diverse. OFWs and their families benefit financially, often at the expense of social sacrifices**[3]**. The Philippine government has to regulate policy that protects workers and maximizes profits**[10]**. Other host nations profit from migrant labor, but they also have a responsibility to maintain responsible employment practices**[5]**. Possible benefactors of solutions include labor unions, recruitment agencies, politicians, and OFWs themselves.

II. Review of Related Literature

A. Overseas Employment Immigration Trends

The Migration of workers is an important effect of a process that has affected both societies and economies globally**[3].** According to Castles et al. (2014), international labor mobility is determined by political considerations, financial inequalities, especially global market demands. Research show that nations like the Philippines are major labor exporters due to the lack of job prospects and salary disparity between developing and industrialized nations**[9]** (Abella, 2016). Additionally, the host countries' migration policies affect the working conditions and rights in the workplace of migrant workers**[4]** (Hollifield et al., 2020).

B. Review of Other Relevant Study Papers

The previous study on Filipino labor action has primarily focused on increasing trends, social consequences, and economic factors. Orbeta (2013) highlights that the primary cause of migration is financial demand**[6]**. Alburo and Abella (2002) talk on how the Philippine government's employment export policies have contributed to the country's dependence on overseas Filipino workers**[2]**. Pernia also (2021), meanwhile, emphasizes how international pay and working conditions affect migration choices.

Other research examines the social aspects of migration, such as how it affects gender roles and family structures**[7]** (Parreñas, 2015). The growth of digital immigration of workers, where online work allowed Filipinos to work globally without actually leaving, is looked at in recent work by Lehdonvirta (2020)**[5]**.

C. Initial Approaches to Address a Similar Issue

To address the issues related to labor migration, governments and organizations have put in place a number of programs**[10]**. Financial literacy, rehabilitation support, and worker protection are the goals of policies like the Overseas Workers Welfare Administration (OWWA) programs**[4]**. But research shows that there are still gaps in providing returning OFWs with long-term economic stability**[4]** (ILO, 2022).

Based on a contracts and online job portals, technological developments have also improved employment matching**[5]** (McKay, 2018). The issues including contract violations, underemployment, and a lack of return assistance continue despite of all these initiatives**[9]**.

D. Studies Objectives And Progress

There are still limitations in our knowledge of the long-term impacts of migration on workers and the local economy[2], despite the fact that current research offers important information about migration trends and policies**[3]**. By studying new developments including ASEAN labor mobility, digital migration, and changing labor laws, this study aims to make a contribution**[5]**. Additionally, it is to provide evidence-based policy recommendations to improve economic sustainability and worker welfare**[6]**.

III. Methodology

This study use unsupervised machine learning to identify trends in OFW migration. This implementation with **K-means clustering**, **DBSCAN**, **Hierarchical clustering**, and **Principal Component Analysis (PCA)** can help in identifying overlooked patterns in labor migration data while addressing the problems of high volume and regional population size.

A. Data Collection

This Statistics of Filipino Emigrants 2015-2020 data set from Kaggle was used for this study. It is a collection of emigration records with a total of 323,719 rows and 11 columns that have been collected from different sources. Each emigrant is described by a variety of attributes included in the dataset.**[11]**

- **Year** – The year of emigration.
- **Gender** – The gender of the emigrant (*Male*, *Female*).
- **Major Country** – The primary country of destination.
- **Civil Status** – The marital status of the emigrant (e.g., *Single*, *Married*, *Widowed*, *Divorced*).
- **Age Group** – The age range of the emigrant (e.g., *14 and Below*, *15-24*, *25-34*, etc.).
- **Educational Status** – The highest level of education attained by the emigrant (e.g., *College Graduate*, *High School Graduate*, etc.).
- **Occupation Group** – The employment category of the emigrant (e.g., *Employed*, *Unemployed*, *Student*).
- **Job Classification** – The job classification of the emigrant (e.g., *Professional*, *Skilled Worker*, *Laborer*).
- **Region** – The region of origin in the Philippines.
- **Province** – The province of origin.
- **City/Municipality** – The full name of the city or municipality of origin.

B. *Data Preprocessing*

This process data is an important phase, in providing objective, accurate, and consistent analysis. All null values were handled with at this point, and the dataset was modified as needed to prepare it for this study. The measures listed below have been implemented.[**11**]

IV. Results and Discussion

Analyze the findings and their significance.

A. *Principal Component Analysis Results*

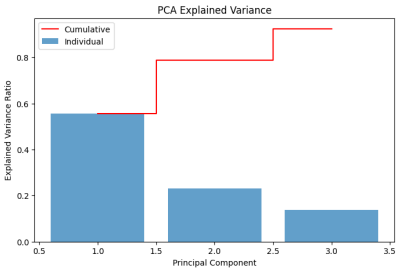
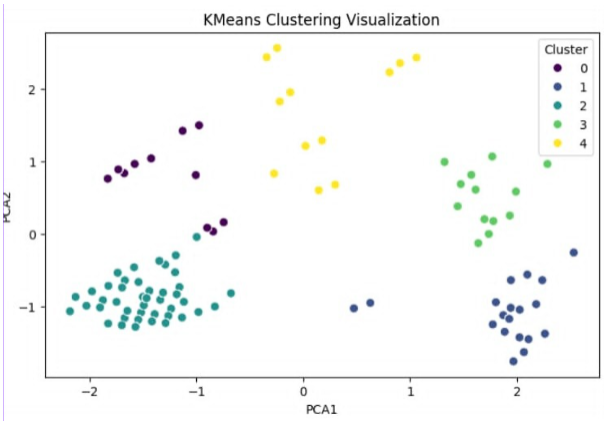


Fig. 1. PCA Explained Variance Result

In Fig. 1, Principal Component Analysis (PCA) was applied to reduce the dimensionality of the dataset. The first two principal components (PC1 and PC2) accounted for approximately 78.68% of the total variance, as shown in Figure X. Although incorporating a third principal component (PC3) increased the cumulative variance to 92.36%, the marginal gain of 13.69% did not justify the added complexity. Thus, a two-dimensional representation was chosen for improved interpretability while preserving most of the information in the data.



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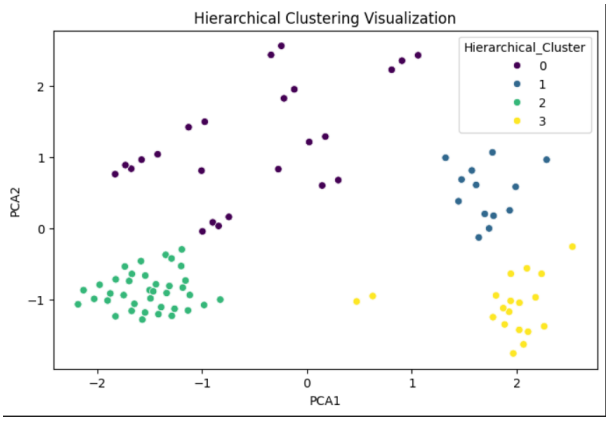

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B. K-Means Result

To uncover meaningful patterns in Filipino migrant workers, KMeans clustering was employed on five selected features: job class, educational status, major country of employment, gender, and age group. The algorithm identified five distinct clusters, each representing a unique profile of migrant workers. The resulting clusters were analyzed to identify trends in employment sectors, skill levels, and demographic distributions

C. DB Scan

Based on density patterns in the dataset, clusters of Filipino migrant laborers were found using DBSCAN (Density-Based Spatial Clustering of Applications with Noise). DBSCAN is appropriate for detecting unevenly shaped clusters and noise points because, in contrast to K-means, it does not require the number of clusters to be predetermined and is robust to outliers. The same five characteristics—job classification, educational attainment, primary country of employment, gender, and age group—were subjected to the algorithm.

D. Hierarchical

To categorize Filipino migrant laborers according to their commonalities across the chosen features, hierarchical clustering was used. By using this technique, a dendrogram is

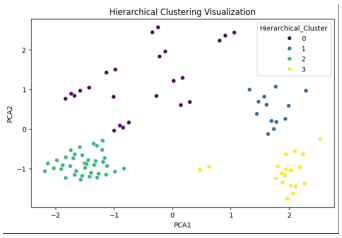
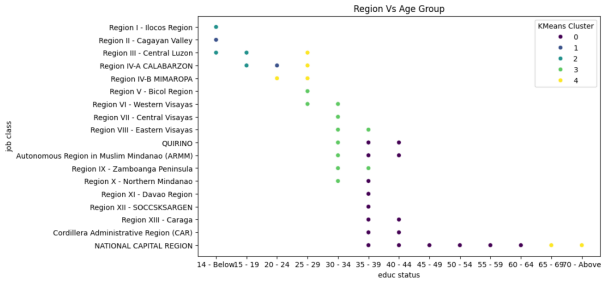


Fig. 4. Fig3



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produced, which shows the connections between data points graphically and enables the discovery of clusters at various granularities. Each data point began as a separate cluster in the agglomerative technique, which merged them iteratively according to similarity.fy trends in employment sectors, skill levels, and demographic distributions

V. Conclusion

Summarize key points, contributions, limitations, and future work.

This study explored the migration patterns of Filipino overseas workers using three clustering techniques: K-means, DBSCAN, and Hierarchical Clustering. The analysis revealed distinct groups of migrant workers based on factors such as job classification, educational attainment, gender, age group, and destination countries

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