SOCIAL AND INFORMATION NETWORKS

REFUGEE MIGRATION ANALYSIS

PROJECT REPORT
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1. Abstract

The Aim of this project is to develop a social network based on refugee migration between different countries. Different types of centralities are used to understand the relationships between the actors. We have used five community detection algorithms in this project to understand the decision making of the refugee migrant to a particular destination. The main usage of this work is to understand the refugee migration in most of the countries. Our analysis could be helpful for the international or local organizations for helping the individuals who are seeking to migrate for a good life.

2. Introduction

The migration of an individual from one society to another society depends on different aspects of the social interaction of the network. The Migration within different societies or countries also affect the markets present in the respective society. This is the reason for discouraging the migrants to enter or exit a current society. Because, the development of an economy depends on the migration across different society.

Problem Statement

When we come to the topic refugee migration, the migrants are refugees in this case. A refugee is a person who migrates to a different place due to the in- acceptance of the society or the conflict between the public and a particular group of people due to various factors, or also could be the lack of basic sanity in their place of origin. So, in these types of cases there is a possibility of the refugee to be migrated, in some cases the international help is required in order to save the lives of refugees across the world.

This study is made to identify the possibility of refugee to migrate from one place to another place so that it could be helpful for any

international or local organization to understand the refugee migration to ease their work in helping refugees in future.

Dataset

The data set is taken from a survey called Humanitarian migration by an international survey agency named Migration policy institute and it is available as an open source in Kaggle online database platform. There are 9 attributes in data set. The nine attributes are year, source, value, target, latitude_dest, longitude_dest, latitude_org, longitude_org, weight. We have eliminated the unwanted data and taken only the useful data that we need i.e. year - in which all the migrations happened, source of the refugee, target or destination the refugee has migrated into, weight attribute depends on the value attribute, where the total number of refugees who have migrated from source county to destination country is given, its range is given between 0 to1.

The latitude and longitude are not considered as we are working on a graph irrespective of the geographical positions. The source of the refugee is about the country from which the refugee has left the place, the destination shows to the country to which the refugee has been migrated.

The data set is quite large enough as it contains above 9000 rows where each row shows the data about the year in which the particular number of refugees have migrated from one source country to the particular destination country.

We have choose a Data Set containing the information regarding Refugee Migration from one country to other in this period (1980-2014). Out of Nine attributes (Year, Source, Value, Target, latitude_destination, longitude_destination, latitude_orgin, latitude_origin, weight) in the data set we chose only four(Year, Source, Target, weight) attributes. Generally, when the number of people leaving a particular country indicates that it is not a good

Country and people are forced to leave that country. W here as when there are more and more people entering a particular Country, indicates that it is a good country and also indicates high chances of better living.

LINK : https://www.kaggle.com/gsaitharunkumar/refugee-migration

3. Literature Survey

3.1. Survey of the Existing Models / Works

[1] Title: Analyzing Refugee Migration Patterns Using Geo-Tagged Tweets
Authors: Franziska Hübl , Sreten Cvetojevic , Hartwig Hochmair and Gernot Paulus
In this paper, the study of refugee migration is made with respect to individuals present in the country called Rwanda. In this country, the economy position is very poor with very low GDP due to very low natural resources. This caused many individuals present in the same country to migrate to different countries seeking a new good life. Therefore, a survey was made to know why the particular individual has chosen a particular destination country to migrate. The survey used data from the mobile phone operator present in that country, and construct a social network based on the connections with the individual. The data is collected before few months from the date when the particular refugee migrated. The method used in this project is strategic cooperation model. The model is based on the connections made by the mobile by the particular migrant during the survey. In this survey it is found that a person who is having more contacts in the destination is likely to migrate to that place when compared to the refugee who is having relatively less contacts in the particular destination.
The total survey is to know the reason behind the refugee has chosen the particular destination based on his social network connections with individuals present in other places.

[2] Title: A comparative study on community detection methods in complex networks
Author: Zhongying Zhao, Shaoqiang Zheng, Chao Li, Jinqing Sun, Liang Chang and Francisco Chiclana
In this project, the decision of the individual migrant is studied based on their gender, position among his household such as mother, father, son, daughter and also the leadership of the household is also considered. The study is conducted in the year 2001 to know whether the gender played a role in making decisions to migrate to a particular country or society.

The study has found that the decision does matters according to the gender with respect to few cases or countries. For example, the migrants from Dominican Republic to the US differ in their savings and expenditure behavior due to the matter of fact that men go to work to earn money, while women take care of the household. The migration between the rural- urban place of the Thailand had shown that even though men and women go for earning money, women are expected to earn more than that of men. Thus, this project has provided an insight that how can gender discrimination can affect the decision of the migrant to choose their destination.
But whatever the parameters are involved in the decision of the individual, the main reason they are likely to migrate is due to lack of good conditions in their respective places.

[3] Title: Community Detection In Social Networks
Author: Jyoti Shokeen, Partibha Yadav, Meenakshi
By considering this perspective in this project, the migration of an individuals is studied from six regions in Asia, Africa and Europe, based on the poverty relation with migration. The survey is based on the data from the migrants about their household position and their contacts present in the destination place where they have migrated.
All types of local and international migrations are present in this data. The survey is made to know what factors made the individual to migrate from the less developed society consisting of poverty in most of the places. The study made to discover the decision of migration took place based on their gender. The Males took the decision based on his contacts present in the destination region, while the females took decision in the cases where they take decisions about the household wealth. The results showed that the decisions made by the male is a lot different from that of females. Individual interaction with the migrants found that about 75% of the females out of all female migrant shave decided to migrate based on the work. Whereas, the 92% of the males have decided to migrate to work.

[4] Title: Trends and Patterns of Global Refugee Migration
Author: Sonja Fransen and Hein De Haas
In other study, from individuals in Bangladesh is done to find the factors made him to migrate. Secondly, the return migration of the individual who have migrated from south Italy to the Germany previously is also studied. The main theme of this project is to find why the individual are migrating and return migrating from one county to another. In the first case the migration factors are based on lack of wellbeing due to poverty in their area, while in the second case the migration is based on the social per capita, as it had negative impact of the of the Italian migrant in Germany.

[5] Title: Collaboration mechanisms and community detection of statisticians based on ERGMs and kNN-walktrap

Author: Jie Liu, Huilin Ge

In order to help a refugee, costs involved in helping them out is also one of the important and major one to consider for the organizations. The management of migration has also come to a stable state according to a study, where it analyzed to major networks in Asia and Europe. Many restrictive rich Asian countries are helping refugees recently. This study mainly focused on feasibility of flight to help refugees with respect to different governments. In the same way the culture of the society also depends to find whether it is feasible for that refugee or not.

[6] Title: Forecasting asylum-related migration flows with machine learning and data at scale

Author: Carammia, M., Iacus, S. M., & Wilkin, T.

This paper presents a method for forecasting the number of asylum-related migration flows using machine learning and big data. The authors develop a model that incorporates a wide range of variables, such as the number of refugees in neighbouring countries, economic indicators, and political instability. They also use a novel approach that combines multiple machine learning algorithms to improve the accuracy of their predictions.

The authors apply their model to the case of Italy, where they use data from the years 2014-2018 to train the model and then make forecasts for the year 2019. They find that their model performs better than traditional forecasting methods, achieving a mean absolute percentage error of around 20%. The authors also conduct sensitivity analyses to test the robustness of their model to different parameterizations and find that it is generally stable across a range of scenarios.

[7] Title: The climate crisis, migration, and refugees.

Author: Podesta, J.

It is an article that highlights the link between climate change and forced migration. The author argues that as the planet warms, extreme weather events, droughts, and rising sea levels are likely to displace more and more people, especially those living in vulnerable regions such as small island states, coastal areas, and arid regions. The author notes that the number of climate refugees could reach 200 million by 2050 if no action is taken to address the root causes of climate change.

The paper also discusses the challenges facing refugees and displaced persons who are forced to migrate due to climate-related reasons. These challenges include a lack of legal recognition as refugees under international law, inadequate protection, and limited access to essential services such as healthcare, education, and livelihoods. The author argues that the international community needs to do more to recognize and

address the unique needs of climate refugees, including through the development of new legal frameworks, increased funding for adaptation and mitigation measures, and support for climate-resilient development.

[8] Title: Asylum migration to the developed world: Persecution, incentives, and policy
Author: Hatton, T. J.
This paper explores the drivers of asylum migration to developed countries. The author argues that asylum migration is driven by a combination of push factors, such as persecution and violence in the home country, and pull factors, such as the availability of economic opportunities and welfare benefits in the destination country.

The paper also discusses the impact of policy on asylum migration. The author notes that restrictive policies, such as border controls and caps on asylum seekers, can reduce the number of asylum seekers but may also have unintended consequences, such as encouraging irregular migration and increasing the risk of exploitation and abuse. The author argues that a more effective approach to managing asylum migration involves a combination of policies that address both the push and pull factors driving migration, as well as providing protection and support to those seeking asylum.
The paper draws on a range of empirical evidence to support these arguments, including data on asylum applications and outcomes, as well as studies on the impact of policy on migration. The author concludes that a more nuanced approach to asylum migration is needed that takes into account the complex drivers of migration and the need to provide protection and support to those seeking asylum.

[9] Title: The refugee wave to Germany and its impact on crime.
Author: Dehos, F. T.
This paper examines the relationship between the influx of refugees to Germany and crime rates. The author argues that while the arrival of a large number of refugees may have initially caused concerns about crime and security, the available evidence suggests that the impact of refugees on crime has been minimal.
The paper draws on a range of empirical studies and official crime statistics to support this argument. The author notes that while there have been some high-profile incidents involving refugees, the overall crime rate among refugees is similar to that of the general population. Moreover, the author argues that the integration of refugees into German society and the provision of support and resources can help to reduce the risk of crime and other social problems.
The paper also discusses the potential factors that may contribute to the low crime rates among refugees. These factors include the fact that many refugees are motivated

to avoid criminal activity in order to maintain their asylum status, as well as the positive impact of social support networks and access to education and employment opportunities.

[10] Title: Religious identity and politics of citizenship in South Asia: A reflection on refugees and migrants in India.
Author: Chapparban, S. N.
This paper explores the complex relationship between religious identity, politics, and citizenship in South Asia, with a focus on refugees and migrants in India. The author argues that the use of religious identity as a basis for citizenship and political representation has created significant challenges for refugees and migrants, particularly those from minority religious groups.

The paper draws on a range of case studies and empirical evidence to support this argument. The author notes that the Indian government's policies towards refugees and migrants have been shaped by a variety of factors, including geopolitical considerations, domestic politics, and the influence of religious and nationalist groups. These policies have often been discriminatory towards refugees and migrants from minority religious groups, who may face greater barriers to accessing citizenship and political representation.
The paper also discusses the impact of these policies on the social and economic well-being of refugees and migrants. The author argues that the exclusion of refugees and migrants from political and economic life can exacerbate social inequalities and contribute to social unrest and political instability.

[11] Title: Transnational solidarity, migration, and the refugee crisis:(in) formal organising and political environments in Greece, Germany, and Denmark
Author: Kanellopoulos, K., Duru, D. N., Zschache, U., Loukakis, A., Kousis, M., & Trenz, H. J.
The paper explores the role of transnational solidarity networks in responding to the refugee crisis in Europe. The authors argue that these networks have emerged as an important force for promoting the rights and well-being of refugees and migrants, particularly in the face of restrictive and exclusionary policies by national governments.
The paper draws on case studies of solidarity networks in Greece, Germany, and Denmark to support this argument. The authors highlight the diversity of these networks, which range from formal organisations to informal networks of individuals and communities. They also note that these networks operate in a variety of political environments, ranging from relatively permissive contexts to those that are more hostile and restrictive towards refugees and migrants.

The paper also discusses the impact of these networks on refugee and migrant rights and well-being. The authors argue that solidarity networks can provide essential support and services to refugees and migrants, including legal assistance, housing, and healthcare. They can also help to create social and political pressure on national governments to adopt more humane and inclusive policies towards refugees and migrants.

3.2. Summary / Gaps / Limitations / Future Work identified in the Survey

So from the survey we can conclude that there are many problems faced by refugees in various countries and there is a need to solve this problem because :

- We want to live in a world where people who are in grave danger have the opportunity to rebuild their lives in safety.
- In a globalized world, sharing global responsibility for global issues is the fair thing to do.
- Host communities benefit from the tremendous energy and drive to start new lives, which these people bring.
- Welcoming people from other countries strengthens host communities by making them more diverse and flexible in our fast-changing world.
- Some of the most inspiring and influential people in the arts, science, politics and technology have been refugees and migrants. They were allowed to rebuild their lives in a new country and they thrived as members of a new community.

So based on all these research works gathered together we can conclude that we should identify the possibility of a migrant refugee to go to the targets present all around the world effectively which is our future work.

By using the dataset available in open source which has the particular number of refugees migrated from one source country to the particular destination country.

4. Overview of the Proposed System

4.1. Introduction

We have used simplification technique to simplify the large amount of data, so that we can develop a simple understandable graph to show the different communities identified in the graph. Each community shows the possibility of particular migrant to go to the counties present in the same community.

To achieve this, we have first started measuring the different centralities by generating a directed graph. The centralities are used to betweenness centrality and closeness centrality, we have also used the cluster coefficient to know the transitive relations and also found shortest paths. After studying the data set we have moved unto the different community detection algorithms.

4.2. Framework, Architecture or Modules of the Proposed System

The algorithms detect communities based on its own method of approach to detect the communities where a migrant present in one source country is having a more possibility to migrate within the same community. The algorithms used in this research are fast greedy algorithm, walktrap algorithm, spinglass algorithm, label propagation algorithm and girvan- newman algorithm.

So we are mainly having 5 modules in our project which are the community detection algorithms. They are :

- Fast greedy algorithm
- Walktrap algorithm
- Spinglass algorithm

- Label propagation algorithm
- Girvan- newman algorithm

4.3. Proposed System Model

In this project we are using community detection as our system model.

Communities are also called as clusters and detecting communities is known to be Clustering. But the main difference is that nodes in this network are connected to other nodes by edges. when it comes to clustering, the data points are not embedded in a network.

Analysis of Communities in Social Networks is very important for many reasons. When it comes to our project, we found out some communities using various community detection algorithms in I-graph. From the date set and communities formed we can easily find out to which countries refugees migrate and the set of countries (a particular community) to which they move.

Now let us relate the above mentioned with our project. Consider a Centrality Measure (Degree Centrality) and assume two countries namely Country A and B. If the in degree of a particular country is more Indicates that more and more Refugees are entering that particular country and vice versa if a particular country has higher out degree which indicates bad conditions of living in that country.

Here, currently we implemented five Community detection algorithms in our project using I-graph in R-Studio.

5. Proposed System Analysis and Design

Girvan- Newman Algorithm :

In this method we find communities based on betweenness of edges. The algorithm was invented by M. Girvan and M. Newman. This community detection algorithm is a hierarchical decomposition process. Firstly, we find betweenness scores of edges and we start removing in the descending order of their betweenness scores. This method gives us out good results, but because of the computational complexity of this algorithm as it finds betweenness for all node sand betweenness should also be found out again after the removal of a particular node and is a slow Process.

Spinglass Algorithm :

Spinglass community detection is an approach from statistical mechanics, based on the so- called Potts model. In this model, each particle (here each country) can be in one of c spin states, and the interactions(edges) between the particles(countries) specify which pair of countries would prefer to stay in the same spin state (same community) and which ones prefer to have different spin states. The model is then simulated for a given number of steps, and the spin states of the particles in the end define the communities. There may be less communities in the end as some of the spin states may become empty. It is not guaranteed that nodes in completely remote (or disconnected) parts of the networks have different spin states.

Walktrap Algorithm :

Walktrap is a community detection model based on random walks. The main idea is that if you perform random walks on the graph, then the walks are more likely to stay within the same community because there are only a few edges that lead outside a given community.

Walktrap runs short random walks of 3- 4- 5 steps depending on one of its parameters and uses the results of these random walks to merge separate communities in a bottom- up manner. Again, you can use the modularity score to select where to cut the dendrogram. It is a bit slower than the fast greedy approach but also a bit more accurate.

Fast greedy Algorithm :

Fast greedy community is another hierarchical approach, but it is bottom- up instead of top- down. It tries to optimize a quality function called modularity in a greedy manner. Initially, every vertex(country) belongs to a separate community, and communities are merged iteratively such that each merge is locally optimal (i.e. yields the largest increase in the current value of modularity). The algorithm stops when it is not possible to increase the modularity any more, so it gives you a grouping as well as a dendrogram. The method is fast and it is the method that is usually tried as a first approximation because it has no parameters to tune. However, it is known to suffer from a resolution limit, i.e. communities below a given size threshold (depending on the number of nodes and edges if I remember correctly) will always be merged with neighbouring communities.

Label propagation Algorithm :

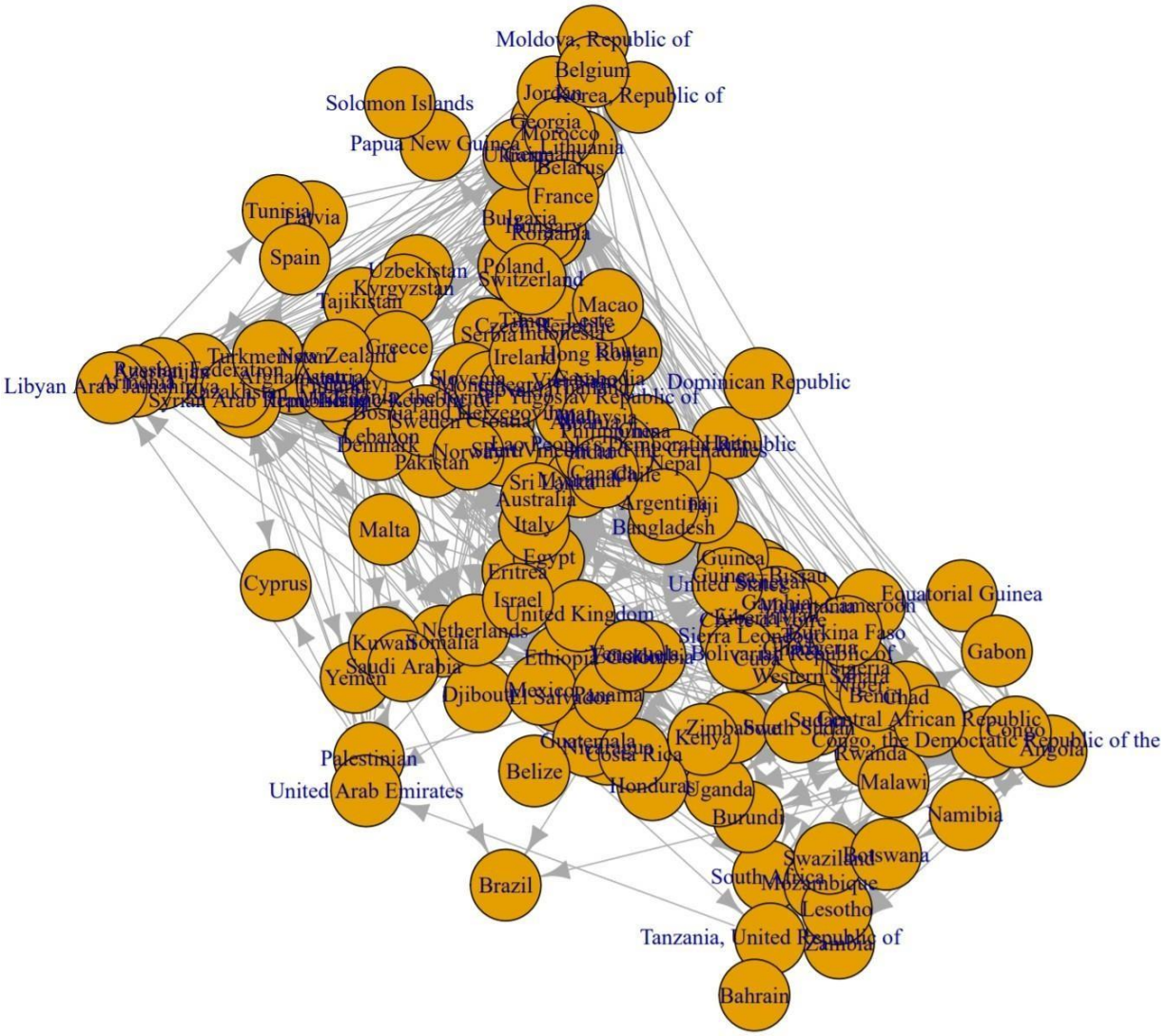
Label propagation community detection. This is a fast, nearly lineartime algorithm for detecting community structure in networks by labelling the vertices(countries) with different labels and then updating the names by voting. This is a simple approach in which every node is assigned one of labels.

The method then proceeds iteratively and re- assigns labels to nodes in a way that each node takes the most frequent label of its neighbours in a synchronous manner. The method stops when the label of each node is one of the most frequent labels in its neighbourhood. It is very fast but yields different results based on the initial configuration (which is decided randomly), therefore one should run the method alarge number of times (say, 1000 times for a graph) and then build a consensus labelling, which could be tedious.

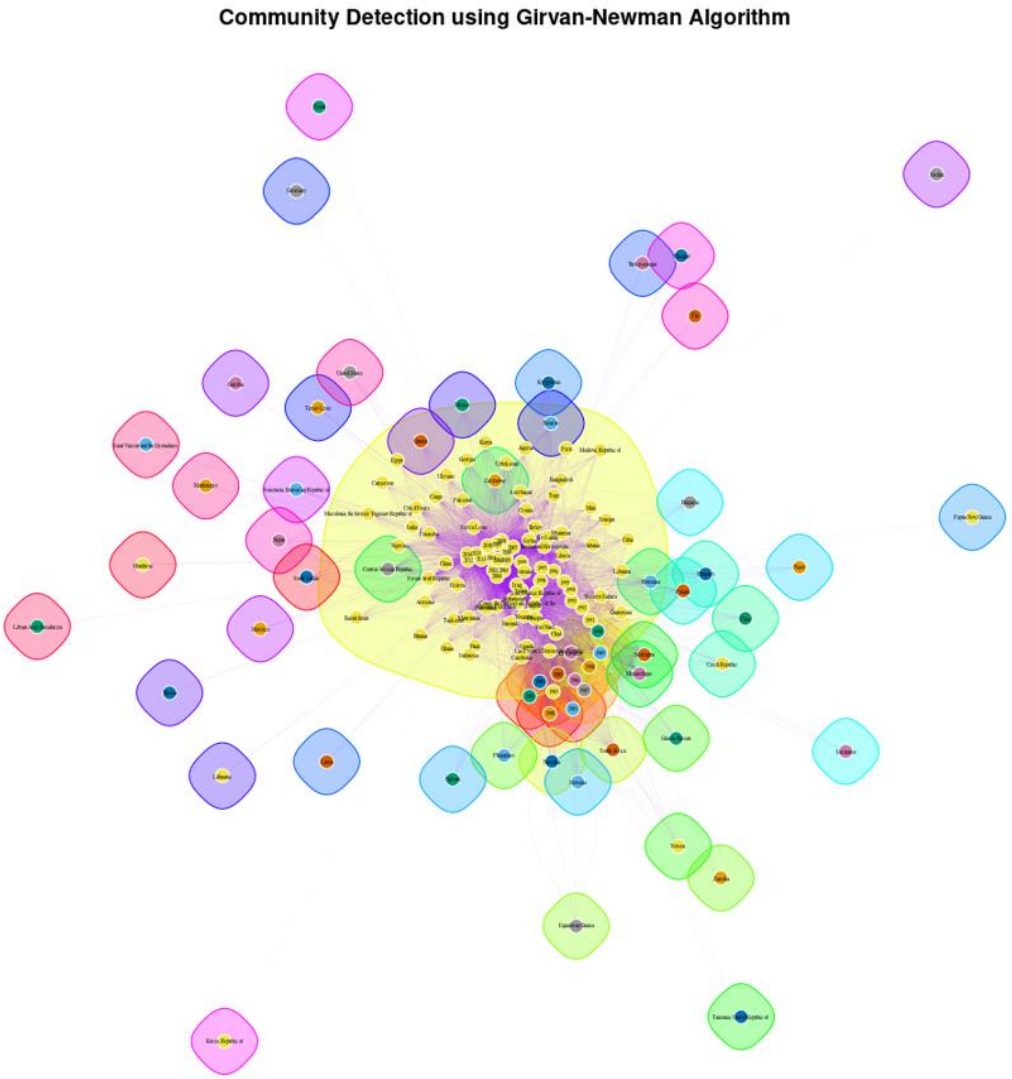
6. Implementation

Sociogram :

A sociogram is a graphic representation of social links that a person has. It is a graph drawing that plots the structure of interpersonal relations in a group situation.

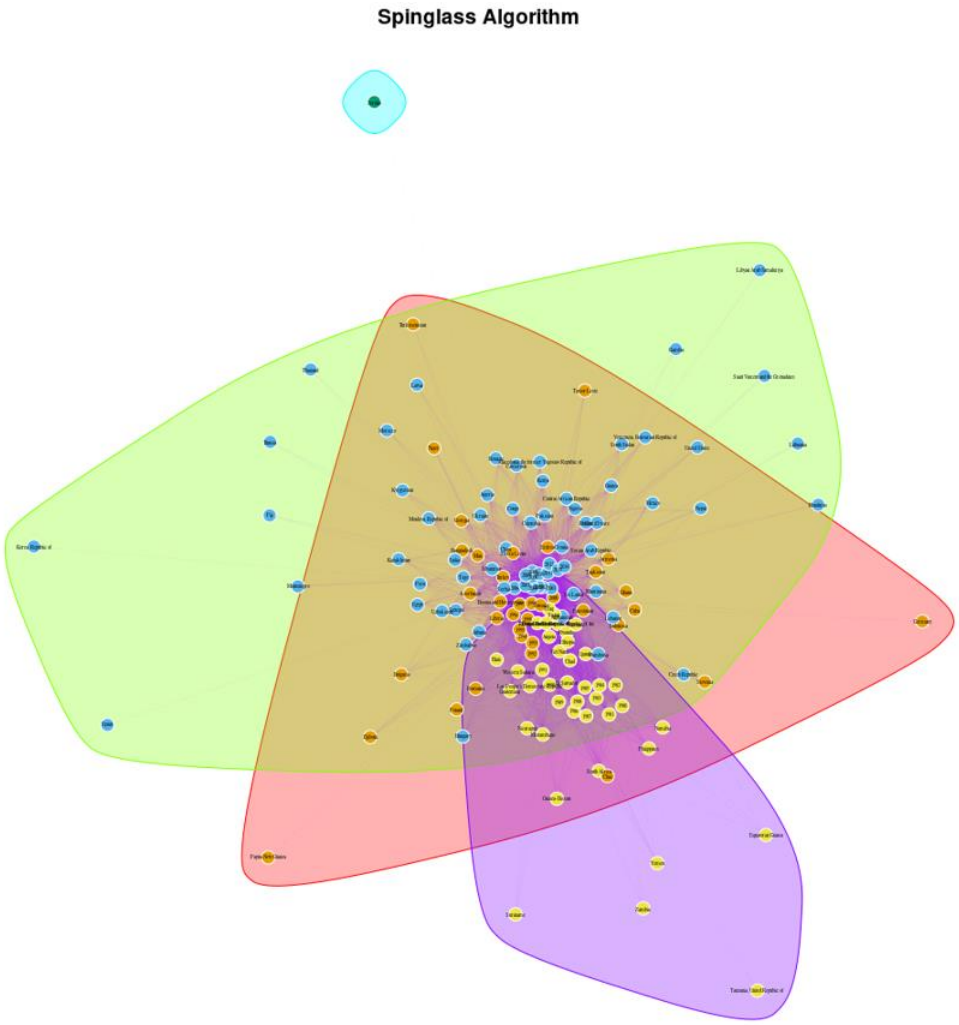


7. Results and Discussions



In Girvan Newman Algorithm these are the detected Communities based on edge betweenness.

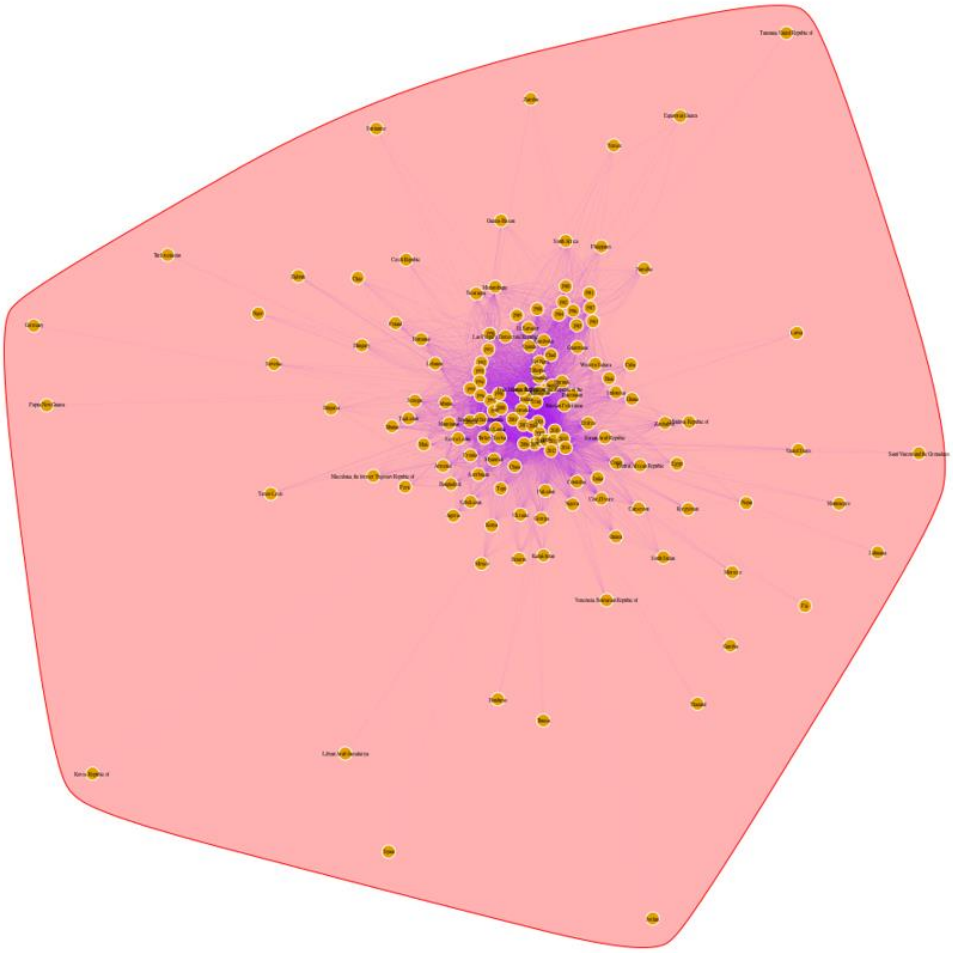
Here, we can see that communities are color coded for better understanding. observe that larger color-coded community which indicates that people of particular countries in that larger community tend to move within that larger community.



In Spinglass Algorithm based on detected Communities,

We can observe that there are three major communities color coded which mean that the people in those countries move in that particular larger community.

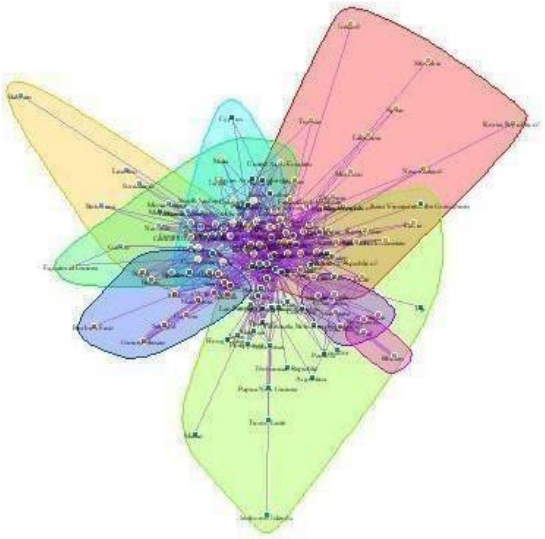
WalkTrap Algorithm

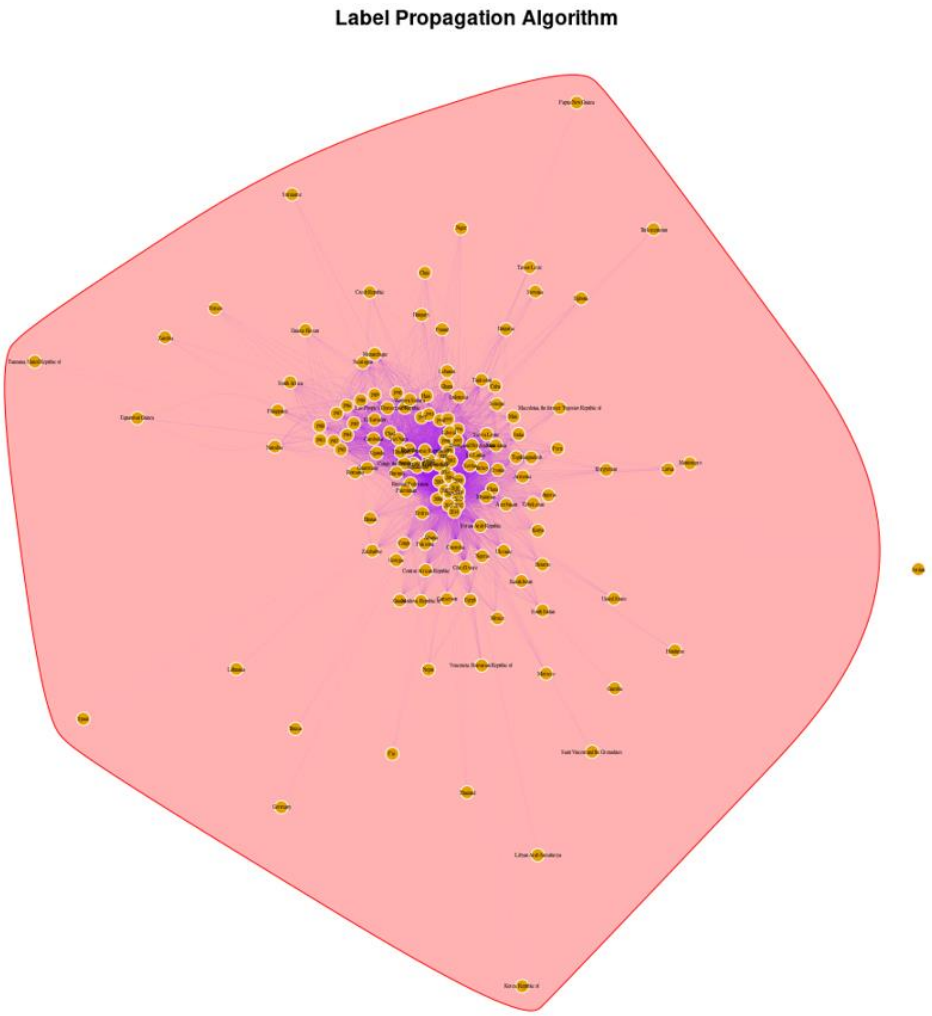


Detected Communities based on random walks:

Here there are many communities of similar sizes.

Fast greedy Algorithm





8. Conclusion, Limitations and Scope for future Work

In this project we have presented different types of community detection methods to understand the refugee migrants. In the community detection-algorithms we infer there are many reasons for refugees to move from one country to another country, in search for food, shelter and safety in turn for their very own survival. Each community detection algorithm depicts a particular reason for a group of refugees to move in that particular community.

This study so that it could be useful for refugees to get help. There are many refugees in this world who are still waiting to get help. Even though many international organizations are present and helping thousands of refugees every year, it is still not being sufficient as the number of refugees are still increasing in every country all across the globe. There have been refugees waiting more than 10 years and still not getting any help due to the lack of sufficient funds or could be any

reason for not being accepted by any society or country. few countries now like America not encouraging any kind of migration into their country. It could be of many reasons as it can affect the development or security of the economy. We hope this research could help the organizations and thus save humanity.

The limitations of our project is about the size of the dataset if it isvery big we will not be able to get a correct idea from the communities detected by using various algorithms.

The future scope of our work is to get a perfect algorithms in-order to get the communities from the dataset and to help the refugees and thereby maintain balance in our society.

9. References

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10. https://refugeesmigrants.un.org/

10. Appendix - Sample Code

```
getwd()

dirpath <- "C:\\Users\\Sai Tharun\\Documents\\SIN PROJECT"

setwd(dirpath)

library(igraph)

refugee <- read.csv("resettlement.csv", header = TRUE, sep = ",")

#Create Graph
g_refugee=graph.data.frame(graph.data, directed = TRUE, vertices=
NULL)

#USe the Largest Connected Component
g.decompose <- decompose(g_refugee)
g.refugee <- g.decompose[[1]]
ecount.full <- c("Edge Count Full",ecount(g.refugee))
vcount.full <- c("Vertex Count Full",vcount(g.refugee))
is.simple(g.refugee)

#Community detection

g_refugee_commun=graph.data.frame(graph.data, directed = FALSE,
vertices= NULL)
#USe the Largest Connected Component
g.decompose <- decompose(g_refugee_commun)
g.refugee.commun.undir <- g.decompose[[1]]
```

```
ecount(g.refugee.commun.undir)

g.refugeerefugee.commun.undir <- simplify(g.refugee.commun.undir)

ecount(g.refugee.commun.undir)

g.refugee.commun.dir <- g.refugee.simplify
```

#Community Detection using Fast Greedy

```
g.refugee.fast <- fastgreedy.community(g.refugee.commun.undir,
weights=E(g.refugee.commun.undir)$weight

V(g.refugee.commun.undir)$label.cex= 0.3

plot(g.refugee.fast,g.refugee.commun.undir, vertex.color="purple",
vertex.frame.color="#ffffff",

    vertex.size = 3,edge.width =
E(g.g.refugee.commun.undir)$weight/5,edge.arrow.size = 0.3,

    vertex.label.color="black",edge.color =
adjustcolor("purple",alpha.f =0.4 ))

title("Fast greedy Algorithm")

c.m.fast <- membership(g.refugee.fast)
```

#Community Detection using Walktrap

```
g.refugee.walktrap <-
walktrap.community(g.refugee.commun.dir,step = 6,
weights=E(g.refugee.commun.dir)$weight)

length(g.refugee.walktrap)

c.m.walktrap <- membership(g.refugee.walktrap)

V(g.refugee.commun.dir)$label.cex= 0.3

plot(g.refugee.walktrap,g.refugee.commun.dir, vertex.color="purple",
vertex.frame.color="#ffffff",
```

```
    vertex.size = 3,edge.width =
E(g.refugee.commun.undir)$weight/5,edge.arrow.size = 0.3,
    vertex.label.color="black",edge.color =
adjustcolor("purple",alpha.f =0.4 ))
title("WalkTrap Algorithm")
```

#Community Detection using Spinglass

```
g.refugee.spinglass<-
spinglass.community(g.refugee.commun.dir,spins = 60,
weights=E(g.refugee.commun.dir)$weight)
length(g.refugee.spinglass)
c.m.spinglass <- membership(g.refugee.spinglass)
V(g.refugee.commun.dir)$label.cex= 0.3
plot(g.refugee.spinglass,g.refugee.commun.dir, vertex.color="purple",
vertex.frame.color="#ffffff",
    vertex.size = 3,edge.width =
E(g.refugee.commun.undir)$weight/5,edge.arrow.size = 0.3,
    vertex.label.color="black",edge.color =
adjustcolor("purple",alpha.f =0.4 ))
title("Spinglass Algorithm")
```

#Community Detection using Label Propogation

```
g.refugee.label<-
label.propagation.community(g.refugee.commun.dir,weights=E(g.refu
gee.commun.dir)$weight)
length(g.refugee.label)
c.m.label <- membership(g.refugee.label)
V(g.refugee.commun.dir)$label.cex= 0.3
```

```
plot(g.refugee.label,g.refugee.commun.dir, vertex.color="purple",
vertex.frame.color="#ffffff",
    vertex.size = 3,edge.width =
    E(g.refugee.commun.undir)$weight/5,edge.arrow.size = 0.3,
    vertex.label.color="black",edge.color =
adjustcolor("purple",alpha.f =0.4 ))
title("Label Propogation Algorithm")
```

#Community Detection using Girvan-Newman

```
g.refugee.gn<-
edge.betweenness.community(g.refugee.commun.dir,weights=E(g.ref
ugee.commun.dir)$weight)
length(g.refugee.gn)
c.m.gn <- membership(g.refugee.gn)
V(g.refugee.commun.dir)$label.cex= 0.3
plot(g.refugee.gn,g.refugee.commun.dir, vertex.color="purple",
vertex.frame.color="#ffffff",
    vertex.size = 3,edge.width =
E(g.refugee.commun.undir)$weight/5,edge.arrow.size = 0.3,
    vertex.label.color="black",edge.color =
adjustcolor("purple",alpha.f =0.4 ))
title("Community Detection using Girvan-Newman")
```