

Refugee Movement Around the World Analysis

MIDS 205 Fall 2024 - Final Project

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The background of the slide features a stylized landscape illustration. In the foreground, three black silhouettes of people are walking from left to right. The person on the left is carrying a bag, the person in the middle is a child, and the person on the right is carrying a large bundle on their head and a bag. The landscape consists of rolling hills in shades of brown and orange, with some pinkish-red bushes in the foreground. The sky is a light beige color with a few white clouds and three black birds flying in the upper left and right areas.

01

Refugee Dataset Overview

Data source and key questions
for analysis

Dataset Overview

Refugee Movement Around the World (2010–2022)

- Movement of Refugees and forcibly displaced populations
 - 200+ countries; sending country and receiving country and # of individuals per row
- Analyzed movement in 2014, 2018, and 2022 (~5k observations per year)
 - Middle of (former) US president's terms

Source: <https://github.com/rfordatascience/tidytuesday/blob/master/data/2023/2023-08-22/readme.md>



Questions of Interest

For each of 3 years of interest (2014, 2018, 2022):

- Which countries received the largest number of refugees, and which countries sent the most refugees?
- Which countries were places of temporary refuge in between starting and final destinations?
- How did the first two years of a U.S. president's term impact the number of asylum cases approved in the U.S. and from which countries?



The background of the slide features a stylized landscape with silhouettes of people and birds. In the foreground, three silhouetted figures are walking: an adult on the left carrying a bag, a child in the middle, and another adult on the right carrying a large barrel on their head and a bag. The landscape consists of rolling hills in shades of orange and brown, with some pinkish-red bushes in the foreground. The sky is a light beige color, decorated with white clouds and black silhouettes of birds in flight. A large blue square containing the number '02' is positioned on the left side of the slide.

02

Neo4j

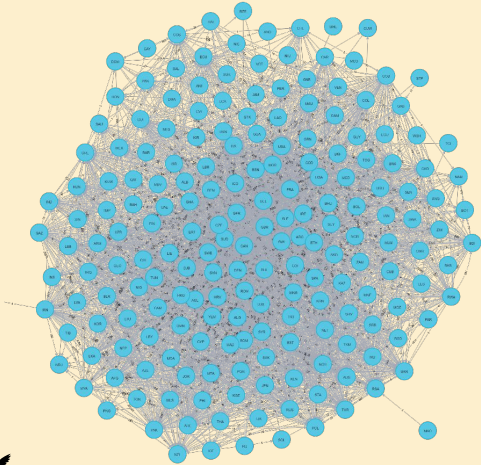
NoSQL Graph Database

Leveraged Graph Data Science (GDS) library
to answer questions of interest

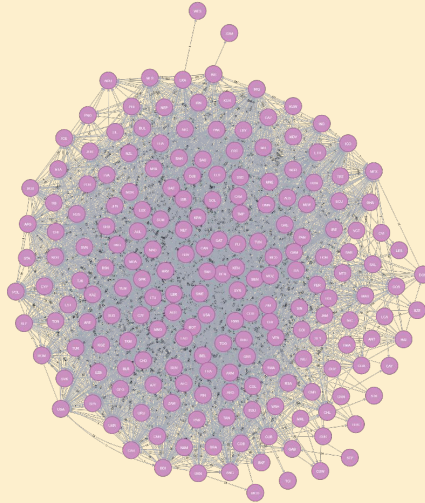
Raw Graph Data Visual

Lot of countries (nodes) and refugee movement (edges) - need algorithms to draw insights

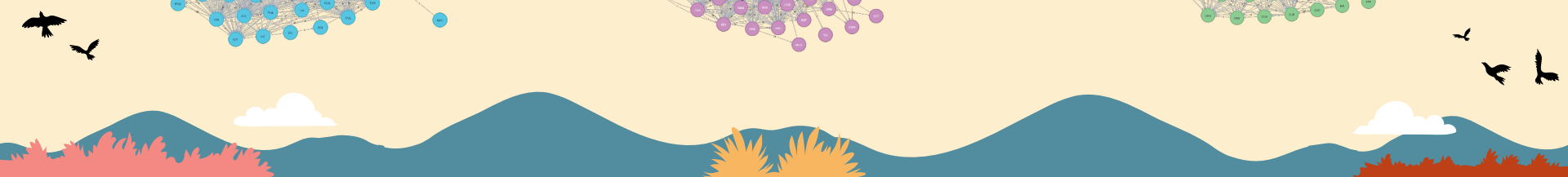
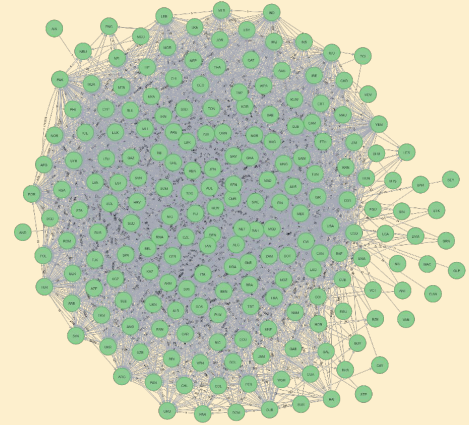
2014



2018



2022



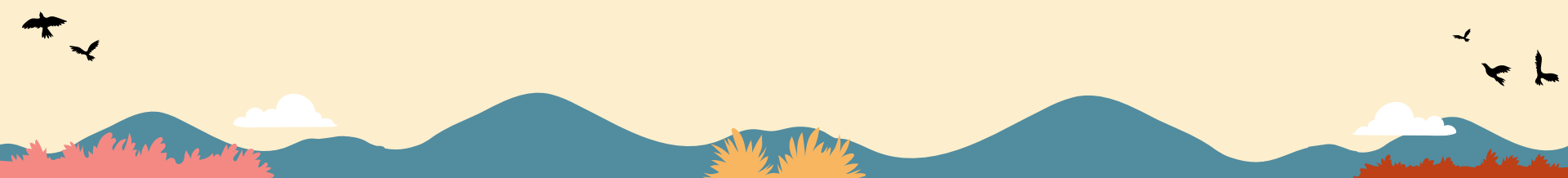
PageRank Algorithm

Which countries received the largest number of refugees?

Top Countries (2014)	Page Rank
USA (United States of America)	2.36
CAN (Canada)	2.16
GFR (Germany)	1.54
GBR (Great Britain)	1.49
AUL (Australia)	1.40
SWE (Sweden)	1.33
FRA (France)	1.31
ITA (Italy)	1.20

Top Countries (2018)	Page Rank
USA (United States of America)	2.27
CAN (Canada)	1.91
GFR (Germany)	1.69
GBR (Great Britain)	1.60
AUL (Australia)	1.42
FRA (France)	1.36
ITA (Italy)	1.27
SWE (Sweden)	1.24

Top Countries (2022)	Page Rank
USA (United States of America)	1.97
GFR (Germany)	1.68
CAN (Canada)	1.59
GBR (Great Britain)	1.53
AUL (Australia)	1.45
FRA (France)	1.34
MDA (Republic of Moldova)	1.30
SWI (Switzerland)	1.23



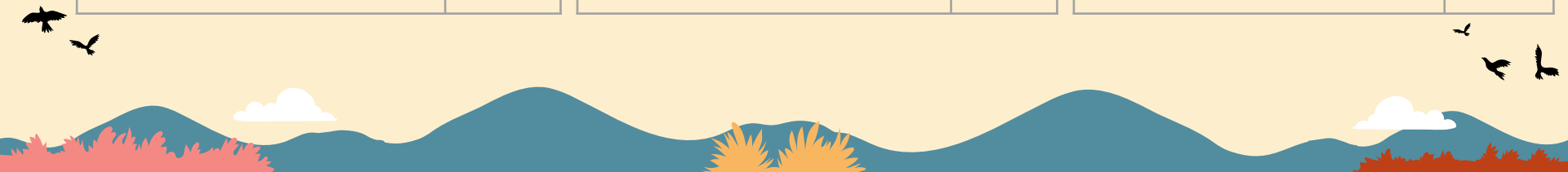
Degree Centrality Algorithm

Which countries sent the most refugees?

Top Countries (2014)	Degree
SYR (Syrian Arab Rep.)	98.0
SOM (Somalia)	96.0
IRQ (Iraq)	92.0
COD (Democratic Republic of the Congo)	90.0
SUD (Sudan)	81.0
IRN (Iran (Islamic Rep. of))	79.0
AFG (Afghanistan)	77.0
ERT (Eritrea)	71.0

Top Countries (2018)	Degree
SYR (Syrian Arab Rep.)	112.0
IRQ (Iraq)	97.0
SOM (Somalia)	95.0
COD (Democratic Republic of the Congo)	94.0
SUD (Sudan)	88.0
AFG (Afghanistan)	83.0
ERT (Eritrea)	83.0
IRN (Iran (Islamic Rep. of))	81.0

Top Countries (2022)	Degree
SYR (Syrian Arab Rep.)	115.0
SOM (Somalia)	96.0
IRQ (Iraq)	95.0
COD (Democratic Republic of the Congo)	93.0
AFG (Afghanistan)	91.0
SUD (Sudan)	89.0
YEM (Yemen)	88.0
ERT (Eritrea)	86.0



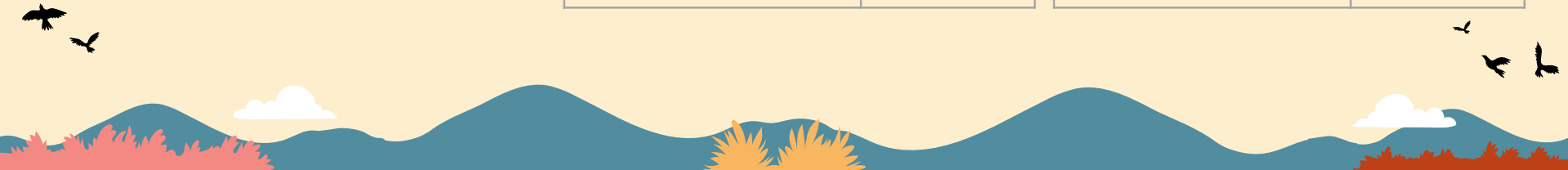
RA-Brandes Algorithm

Which countries were the most common temporary refuges?

Top Countries (2014)	Betweenness
USA (United States of America)	202.49
RUS (Russia)	192.43
PAK (Pakistan)	108.54
SYR (Syrian Arab Rep.)	81.83
ARE (United Arab Emirates)	70.44
ANG (Angola)	64.95
TUR (Turkey)	64.55
ZAM (Zambia)	59.29

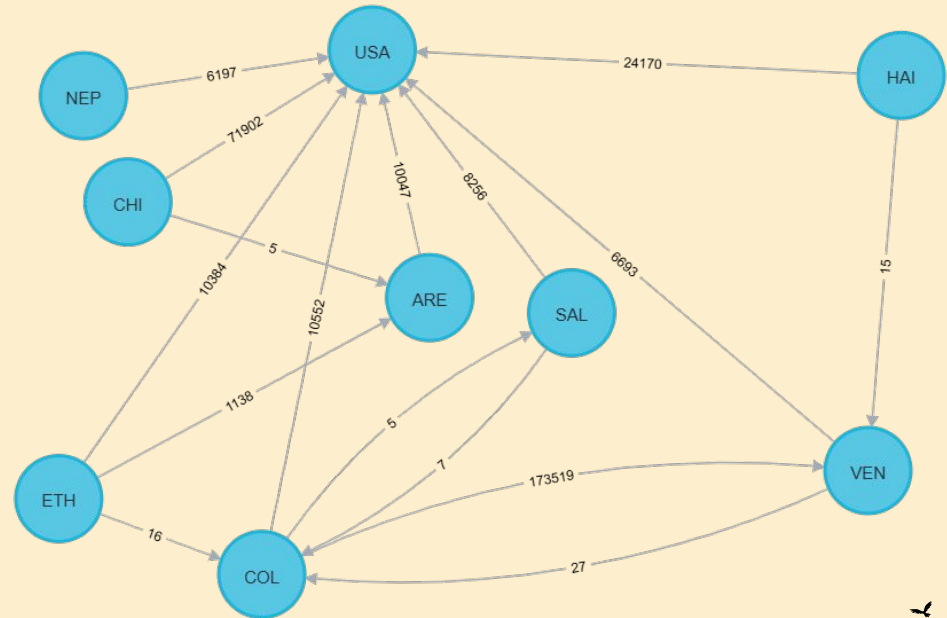
Top Countries (2018)	Betweenness
MLI (Mali)	111.90
ETH (Ethiopia)	104.21
SYR (Syrian Arab Rep.)	41.03
SUD (Sudan)	38.82
YEM (Yemen)	38.53
ARE (Egypt)	32.23
RUS (Russian Federation)	31.35
TUR (Türkiye)	30.34

Top Countries (2022)	Betweenness
RUS (Russia)	145.42
USA (United States of America)	96.93
CUB (Cuba)	82.98
GUI (Guinea)	82.23
ETH (Ethiopia)	70.39
SYR (Syrian Arab Rep.)	67.26
GFR (Germany)	64.02
PAK (Pakistan)	59.88



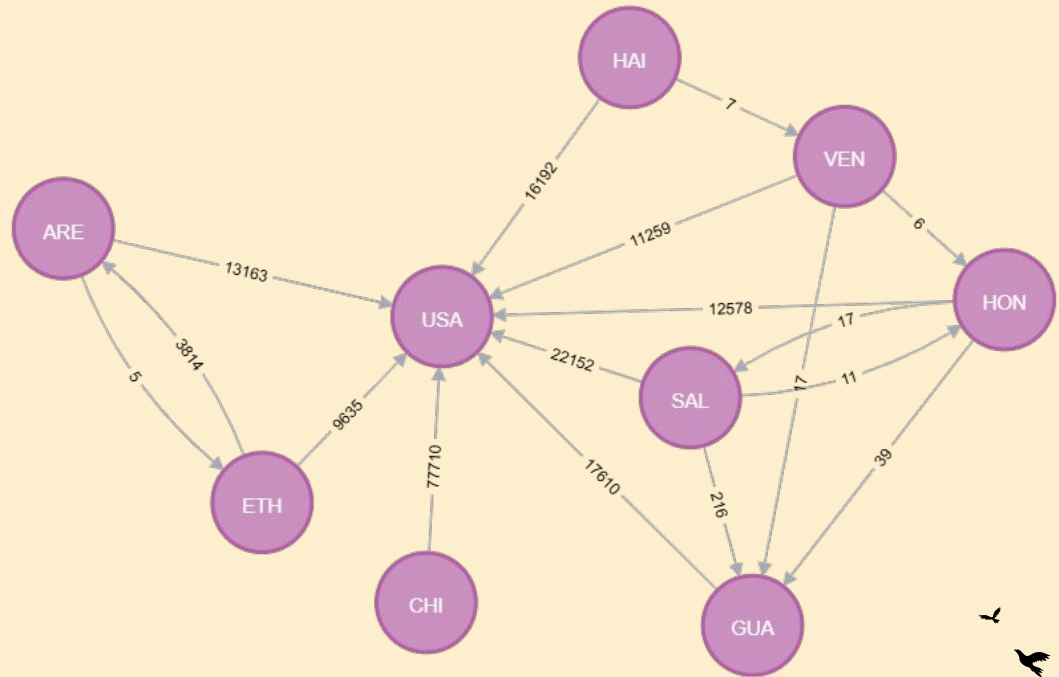
2014: What were the top countries sending refugees to the US each year?

Top 8 Countries Sending	# of Refugees
China (CHI)	71,902
Haiti (HAI)	24,170
Colombia (COL)	10,552
Ethiopia (ETH)	10,384
United Arab Emirates (ARE)	10,047
El Salvador (SAL)	8,256
Venezuela (VEN)	6,693
Nepal (NEP)	6,197



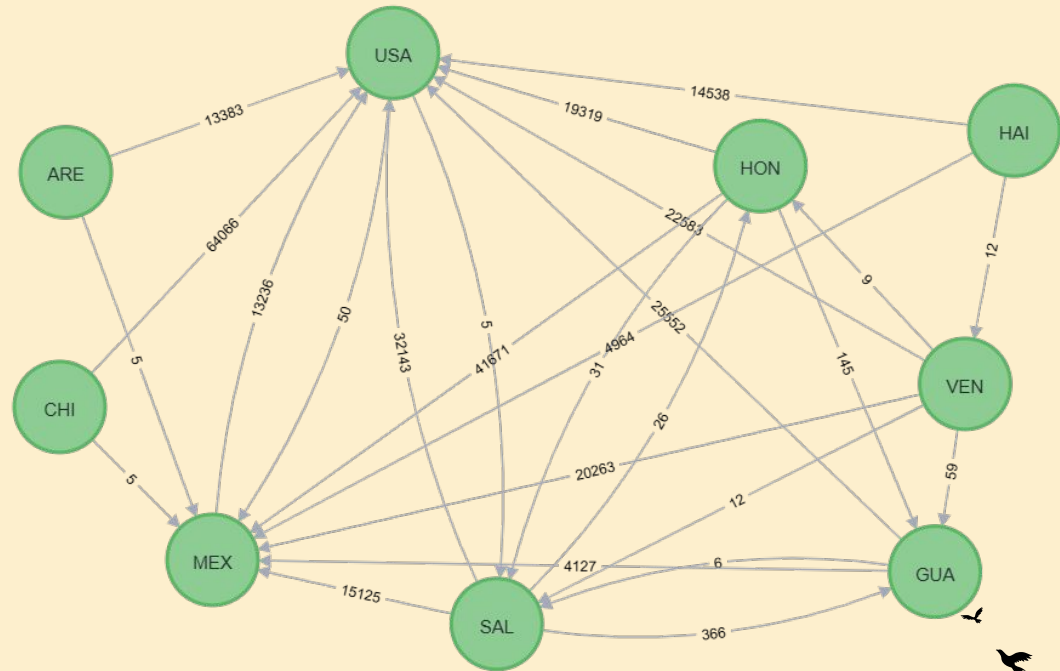
2018: What were the top countries sending refugees to the US each year?

Top 8 Countries Sending	# of Refugees
China (CHI)	77,710
El Salvador (SAL)	22,152
Guatemala (GUA)	17,610
Haiti (HAI)	16,192
United Arab Emirates (ARE)	13,163
Honduras (HON)	12,578
Venezuela (VEN)	11,259
Ethiopia (ETH)	9,635



2022: What were the top countries sending refugees to the US each year?

Top 8 Countries Sending	# of Refugees
China (CHI)	64,066
El Salvador (SAL)	32,143
Guatemala (GUA)	25,552
Venezuela (VEN)	22,583
Honduras (HON)	19,319
Haiti (HAI)	14,538
United Arab Emirates (ARE)	13,383
Mexico (MEX)	13,236



The background is a stylized landscape with silhouettes of people and birds. In the foreground, three people are silhouetted against a light yellow background. One person on the left carries a bag, a child stands in the middle, and a person on the right carries a large pot on their head and a bag. The landscape features rolling hills in shades of brown and orange, with some pinkish-red bushes at the bottom. White clouds and black birds are scattered across the sky.

03

MongoDB

NoSQL Document Database



MongoDB

What is it?

- Document-based NoSQL database with flexible schema.
- Stores hierarchical data as JSON-like documents.

How could it be used by UNHCR:

- Store multiple POVs for analytics
 - Sending country POV
 - Receiving country POV
 - Year POV
- Allow us to easily incorporate hierarchal (rather than tabular) secondary data by country
 - Region/year next tier below country
 - Metrics such as GDP, population, literacy rates, etc. by region
 - Could also store detailed refugee data (demographics, family relationships, medical data, migration history)

Why relational database is a bad fit:

- In tabular format, hierarchical data structure less clean
- May need to pull data from multiple tables rather than one document



The background of the slide features a stylized landscape illustration. In the foreground, three silhouetted figures stand on a blue horizontal line representing water. From left to right: a woman carrying a bag, a small child, and a man carrying a large barrel on his head and a bag. The background consists of rolling hills in shades of brown and orange, with a few white clouds and black birds scattered across the light orange sky.

04

Redis

NoSQL Key-Value Database



Redis

What is it?

- In-memory key-value store for real-time data.
- Optimized for low-latency operations and alerts.

How could it be used by UNHCR:

- If we had live movement data, good for dynamically displaying movement between countries/refugee counts/sending counts - can help UNHCR optimize resources

Why relational database is a bad fit:

- Queueing real-time refugee movement data through a relational database would be too slow compared to Redis database.



A stylized landscape illustration with a warm, orange-toned sky and rolling hills in shades of brown and red. In the foreground, three silhouetted figures—a man, a child, and a woman carrying a large bundle on her head—stand on a blue path. The sky is decorated with white clouds and black birds. A blue square containing the number '05' is positioned to the left of the title.

05

Conclusions

Conclusions



- **Top countries receiving refugees:** US, Canada, Germany, Great Britain, Australia
- **Top countries sending refugees (in general):** Syria, Iraq, Somalia, DR of the Congo, Sudan
- **Top countries sending refugees (to US):** China, Central America, South America
- **Top temporary refuge countries:** US, Russia, Mali, Ethiopia, Syria (variation across years, high betweenness)
- Results consistent throughout years, with seemingly little change between US presidential administrations
- MongoDB use case: Organizing POVs by sending country, receiving country, year, etc. in hierarchical format
- Redis use case: Real-time refugee movement data

