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| **Team name:** | Viz Visionaries |
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| **Tutorial day and time:** |  |
| **Year and Semester:** | July 2023, Semester 7 |
| **Word count:** |  |

<https://cos30045-group8.netlify.app/>

**Project Process Book**

MIGRATION OF INDIA DATA VISUALISATION

**Title Page**

Includes:

• descriptive title (e.g., ‘Data Visualisation Project’ is not acceptable)

• link to Mercury hosted website (must be on title page)

• team name and student names and IDs

• tutorial day and time

• year and semester

• word count

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# **Introduction**

## **Background and Motivation**

Who will use, or be interested in, this visualisation (i.e., users)? What kind of tasks will they want to do? Why is it important?

The intended audience for our six data visualisations encompasses a diverse group, including individuals, policymakers, researchers, and organizations with a keen interest in comprehending the intricacies and ramifications of migration in India. This user base holds various roles and exhibits different interests, ranging from government officials and policymakers, researchers and analysts, and organisations to the general public.

For government officials and policymakers, our choropleth map and heatmap data visualisations, which delve into the unemployment rates of 2023 in different states of India and the wages disparities between India and other countries, hold immense significance. These visualisations are crucial for making well-informed decisions and addressing socio-economic challenges. They provide a valuable tool for formulating and evaluating policies related to immigration and economic development.

Similarly, researchers and analysts, tasked with studying migration trends and their impact on socio-economic factors, find our sunburst chart data visualisation particularly useful. This visualisation, which represents the population of India each year, contributes to academic research, informs studies on population dynamics, and supports social analysis.

Furthermore, organizations such as Non-Governmental Organizations (NGOs) can harness the insights from our cluster-stacked bar chart, which focuses on the relationship between diseases and migration. This data visualisation helps organizations understand migration patterns, enabling targeted interventions and assistance programs and contribute to designing initiatives that address the specific needs of migrant populations and contribute to the promotion of social welfare.

For the general public, our Pie Chart data visualisation provides accessible insights into the causes, consequences, and trends of migration in India. It serves as an informative tool for understanding the reasons behind Indian migration.

The importance of our data visualisations spans various critical aspects of socio-economic dynamics in India. Firstly, the unemployment rate visualisation, empowers policymakers to make informed decisions about employment strategies and interventions, crucial for addressing socioeconomic disparities. Also, by addressing unemployment through targeted strategies informed by the unemployment rate visualisation, individuals are more likely to find stable employment opportunities within their home country. Secondly, the reason for migration visualisation, encompassing gender-specific data, aids in crafting policies tailored to the diverse needs of migrant populations, fostering social inclusion and integration. Additionally, understanding the specific reasons for migration enables policymakers to implement measures that directly address the root causes, creating a more conducive environment for people to stay. Thirdly, wages disparities across countries, presented in our visualisations, offer insights into global economic trends, enabling policymakers to make informed decisions on labour-related policies for sustainable development. Also, the economic planning facilitated by wages disparities and demographic insights further aids in creating opportunities, improving living standards, and reducing the allure of seeking employment abroad. Moreover, our visualisations on international migration from India and the impact on metropolitan areas provide essential data for understanding the scale and implications of global diaspora, guiding diplomatic and urban planning decisions. Additionally, the age-group analysis from the population visualisation aids in demographic planning, influencing policies related to education, healthcare, and workforce development. The visualisation of disease prevalence affecting migration provides invaluable information for public health planning, allowing targeted healthcare strategies to address the unique health needs of migrants, thus enhancing overall well-being. In summary, our data visualisations play a pivotal role in fostering informed decision-making, socio-economic inclusivity, and sustainable development in India thereby reducing the chances of people emigrating.

## **Visualisation Purpose**

What questions will the user be able to answer with your visualisation? List the possible benefits of the completed visualisation.

The completed visualisations empower users to explore and comprehend various facets of migration in India, offering valuable insights and answers to a multitude of questions.

Through the Unemployment Rate of 2023 in India visualisation, users can discern the state-wise distribution of unemployment in 2023, identifying regions with higher or lower rates and understanding the national landscape. This realization underscores the impact of high unemployment as a motivating factor for Indian people to immigrate.

By exploring the Indian Migration Reason visualisation, users can acquire insights into the primary reasons for migration concerning a specific gender. This analysis enables the identification of differences in migration patterns between genders and highlights factors that exert a significant impact on migration decisions.

Wages of Various Countries visualisation assists users in grasping the average salary comparison across different countries. It facilitates an understanding of how India's monthly and hourly wage structures compare with those of other nations. Additionally, it helps identify specific countries with higher or lower monthly and hourly wage levels. This visualisation facilitates a comparative analysis of global wage structures, aiding in understanding India's economic competitiveness.

The Disease Leads to Migration visualisation allows users to comprehend the prevalence of diseases among immigrants in India. Additionally, it provides insights into which specific diseases contribute to the highest number of immigrants.

Migration from India to Other Countries visualisation offers users insights into the specific metro area of the country to which most Indians immigrate and the total number of Indian immigrants in the specific metro area of the country. Additionally, users can determine the percentage of Indian migration relative to the population of each country's metro area.

Furthermore, Population of India visualisation enables users to observe the distribution of India's population across different age groups and track how the population has evolved over time.

The benefits of the completed visualizations are multifold, providing users with a comprehensive understanding of various aspects of migration in India. These insights empower users to make informed decisions, implement targeted interventions, contribute to academic research, and raise public awareness.

For instance, policymakers can leverage the Unemployment Rate of 2023 in India visualization to make informed decisions about regional employment strategies, addressing socio-economic disparities effectively. This data-driven approach aids in tailoring interventions based on state-wise unemployment patterns. Next, Non-Governmental Organizations (NGOs) and other organizations can use visualizations like Disease Leads to Migration to design targeted health interventions and assistance programs. Understanding prevalent diseases among migrants is crucial for enhancing overall well-being and planning effective healthcare strategies. Furthermore, researchers can utilize visualizations across the Population of India charts for academic research on population dynamics, socio-economic factors, and migration trends. The detailed data provided by the visualizations contributes valuable insights for in-depth analysis and scholarly exploration. Lastly, the visualizations raise public awareness about the complex interplay between unemployment, migration, and health. By presenting data in a visually accessible format, these visualizations foster a more informed and engaged society, encouraging dialogue and understanding of critical issues.

In summary, the completed visualizations serve as powerful tools for decision-makers, researchers, organizations, and the public, offering diverse benefits that extend to policy formulation, targeted interventions, academic exploration, and societal awareness.

## **Project Schedule**

Make sure that you plan your work so that you can avoid a big rush right before the final project deadline. Write this in terms of weekly deadlines.

**Week 3**

**Activity**

1. Conducted research on migration information.
2. Filtered out several suitable countries for our project and discussed with team members to decide which one was more suitable.
3. Read the Project Process Book instructions.

**Deadline for this week: 9 September 2023**

**Week 4**

**Activity:**

1. Discuss and finalize the project title.
2. Identify and retrieve datasets from online sources.
3. Determining the titles for the charts.
4. Search for suitable charts corresponding to each dataset.
5. Participated in and contributed to Stand-Up 1 meeting in class.

**Deadline for this week: 16 September 2023**

**Week 5**

**Activity:**

1. Research on Indian migration details to gain further insights and a deeper understanding of the various aspects of migration in India.
2. Research datasets that related to India.
3. Trying different research methods and sources to uncover diverse and valuable information that could contribute to the project's dataset collection.

**Deadline for this week: 23 September 2023**

**Week 6**

**Activity:**

1. Presented the datasets collected by each team member and discuss the which datasets are suitable for the project.
2. Identify the 6 datasets required for the project.
3. Renamed the dataset titles to enhance clarity and compatibility with the charts.

**Deadline for this week: 30 September 2023**

**Week 7**

**Activity:**

1. Determine and assign the types of charts for each dataset.
2. Generate 6 CSV files by extracting the essential data from the datasets we found.
3. Assign development responsibilities for each chart to every team member.

**Deadline for this week: 7 October 2023**

**Week 8**

**Activity:**

1. Research on the chart templates as references for development.
2. Create a new project in Figma to sketch the chart prototype: <https://www.figma.com/file/UWxd1ZE9F5eeS1g9glI1cY/Untitled?type=design&node-id=0%3A1&mode=design&t=lHaHPkCtoIW3EPjC-1>
3. Conduct research and commence the development of the charts.

**Deadline for this week: 14 October 2023**

**Week 9**

**Activity:**

1. Should filter out all necessary data and organize it into relevant CSV files.
2. Completed the development of at least one chart.
3. Should finish sketching the chart prototype in Figma.

**Deadline for this week: 21 October 2023**

**Week 10**

**Activity:**

1. Completed the development of at least one chart.
2. Identified and selected the cover page for the Project Process Book.
3. Participated in and contributed to Stand-Up 2 meeting in class.
4. Compiled a comprehensive list of all required features for each chart in point form within the Project Process Book.

**Deadline for this week: 28 October 2023**

**Week 11**

**Activity:**

1. Continued development on the remaining charts.
2. Completed the development of the landing page for the charts.
3. Progressed on the Project Process Book of the data source.

**Deadline for this week: 4 November 2023**

**Week 12**

**Activity:**

1. Completed the development of at least two charts.
2. Accomplished the task of finishing the design sketches through hand drawings.
3. Participated in and contributed to Stand-Up 3 meeting in class.

**Deadline for this week: 11 November 2023**

**Week 13**

**Activity:**

1. Should complete the development of the last two charts.
2. Should complete the addition of explanatory paragraphs to at least three charts, enhancing the understanding and context of the visualized data.
3. Complete the Project Process Book.

**Deadline for this week: 18 November 2023**

**Week 14**

**Activity:**

1. Check the Project Process Book to ensure accuracy and completeness.
2. Sumit the Project Process Book including all the necessary files.
3. Participated in and contributed to Stand-Up 4 meeting in class.

**Deadline for this week: 20 November 2023**

# **Data**

## **Data Source**

From where and how are you collecting your data? Provide a link to your data sources. What type of data set is it (e.g., table, network, field)? What are the attributes in your data set and what type of data are the values (i.e., categorial, ordinal, interval, ratio/quantitative)? Is there any data in the set that will not be included in your visualisation? Why?

NOTE: Make sure that the data can be used to answer the questions outlined in Section 1.2.

* + - 1. **Unemployment Rate of 2023 in India:**

We obtained the unemployment rate in India dataset from an article, and the data source is from [1]. The dataset is presented in tabular form within the article. So, we can input all the data into our CSV file by following the tabular form.

There are 2 attributes in the original dataset, and they are "State" and "% of Unemployment Rate in India". Both attributes are being utilized in our data visualisation. Also, to enhance clarity, we have renamed "% of Unemployment Rate in India" to "Unemployment\_Percentage\_in\_2023" and the “State” remains the same.

Our “State” cannot be measured in numerical terms, and it can be divided into categories, so it is qualitative data. Also, it is categorical data because it belongs to a specific category, and there is no inherent order or numeric significance to the states. Then, "Unemployment\_Percentage\_in\_2023" is quantitative because it involves numerical values that can be measured and compared. Moreover, it specifically ratio data, because it represents a percentage, and ratios in this context, have a clear definition of zero. For instance, a value of 0% indicates the complete absence of unemployment, making it a quantitative indicator with meaningful ratios for analysis and comparison.

<https://www.studyiq.com/articles/unemployment-rate-in-india/>

* + - 1. **Indian Migration Reason:**

We obtained the Indian migration reason dataset from an article, and the data source is from [2]. The dataset is presented in tabular form within the article. So, we can input all the data into our CSV file by following the tabular form.

There are 4 attributes in the original dataset, and they are "reason of migration", "female", "male" and "person". The selected attributes are “reason of migration", "female" and "male". The decision to exclude "person" is based on its lack of meaningful explanation in the articles under consideration.

“reason\_for\_migration” does not involve numerical measurements so it is qualitative data. Then, “reason\_for\_migration” is categorical data also because it represents different categories or reasons for migration. Moreover, both "male" and "female" are quantitative and ratio data due to their incorporation of numerical measurements expressed in percentages and the presence of a meaningful zero point further emphasizes their quantitative nature.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1833854>

* + - 1. **Wages of Various Countries:**

We obtained the wages of various countries' dataset from a working paper website, and the data source is from [3]. The dataset is presented in a CSV file within the working paper website. So, we can download the CSV file then collect and filter the required data.

The original dataset comprises 63 attributes, and for data visualization, the selected attributes include "year," "country\_code," "country\_name," "hw3wl\_us," and "mw3wl\_us." For improved clarity, we have renamed "hw3wl\_us" to "hour\_wages" and "mw3wl\_us" to "monthly\_wages." The rationale for not selecting the other attributes is that they exhibit similarity and adhere to a different standard. For instance, attributes like "hw1wl\_current" represent the mean wages of hourly workers in standard data without calibration, specifically denoted in Lex, LCU (reported), while "hw2wl\_current" represents the mean hourly wages with country-specific calibration, also in Lex, LCU (reported).

The “year” is ordinal data because it indicates a chronological order. Next, "country\_code" and "country\_name" are categorical data because they are used to represent categories and labels without inherent numerical significance. Moreover, "monthly\_wages" and "hourly\_wages" are quantitative data and under the category of ratio data because they are numerical and can be measured.

<https://www.nber.org/research/data/occupational-wages-around-world-oww-database>

* + - 1. **Disease leads to migration dataset:**

We obtained the disease leads to migration dataset from an article, and the data source is from [4]. The dataset is presented in an image-tabulated form within the article. So, we can input all the data into our CSV file by following the image-tabulated form.

The original dataset comprises 16 attributes, and for data visualisation, the selected attributes from the original dataset include "Disease Category", "male", "<40 years", ">=40 years" and "Prevalence among migrants". Also, we combine those attributes to become 3 attributes which are “disease\_category”, “male\_less\_than\_40\_years” and “male\_more\_than\_39\_years”. The rationale for not selecting the “Prevalence among non-migrants” attributes is it is not related to our title. Furthermore, the reason for excluding the "female" attribute is the prevalence of numerous instances where the values are consistently 0. To avoid confusion, we have opted to utilize only the data pertaining to males. Also, given that the attribute values are for males and females combined, therefore excluded the “overall prevalence” attribute to simplify and focus our data visualisation.

"disease\_category" is categorical data because it represents different categories of diseases, making it a categorical data type. Then, "male\_less\_than\_40\_years" and "male\_more\_than\_39\_years" are ratio data because they involve numerical values that can be measured and compared.

<https://www.researchgate.net/publication/319659904_Determinants_of_internal_migrant_health_and_the_healthy_migrant_effect_in_South_India_A_mixed_methods_study>

* + - 1. **Immigration From India to Other Countries**

We obtained the immigration from India to other countries dataset from an article, and the data source is from [5]. The dataset is presented in an image-tabulated form within the article. So, we can input all the data into our CSV file by following the image-tabulated form.

There are 3 attributes in the original dataset, and they are "Metropolitan Area", "Immigrant Population from India" and "% of Metro Area Population". Three of the attributes are being utilized in our data visualisation. Also, to enhance clarity, renamed "% of Metro Area Population" to "percentage\_of\_metro\_area\_population" and the replaced spaces with underscores and converted to lowercase such as "metropolitan\_area" and "immigrant\_population\_from\_india".

"metropolitan\_area" is categorical data because it presents different metropolitan areas. Next, for the "immigrant\_population\_from\_india" and "percentage\_of\_metro\_area\_population" are ratio data because they involve numerical values and they can be measured and compared.

<https://www.migrationpolicy.org/article/indian-immigrants-united-states>

* + - 1. **Population of India:**

We obtained the population of India dataset from the United Nations data bank, and the data source is from [6]. The dataset is presented in CSV files within the United Nations data bank. So, we can download the CSV file then collect and filter the required data.

The original dataset includes 12 attributes along with an age range from 0 to 100 attributes. Due to the multitude of attributes, we have consolidated the age range variables into a unified attribute named "age group" for simplification. So, the finalized set of attributes for data visualization comprises 3 attributes which are "Year", "Age\_Group" and "Value". The rationale for not selecting the other attributes is they are not related to our title.

"Year" is ordinal data because it represents different years and has a meaningful order but no consistent interval between them. "Age\_Group" is categorical data because it represents distinct groups into which classified based on age. "Value" is ratio data because it represents a numerical measure that has a true zero point and allows for meaningful ratios.

<https://population.un.org/wpp/Download/Standard/Population/>

## **Data Processing**

Do you expect to do substantial data cleanup? What quantities do you plan to derive from your data? How will data processing be implemented? Will you be deriving any variables?

Describe clean up process that was implemented. Explanation and calculation of derived variables (if used).

Extensive data cleaning was conducted on the wages of various countries and the population of India due to the substantial volume of data that required clarification.

For instance, focusing on the population of India, we filtered out non-Indian entries, selected data from the past 5 years, and aggregated 100 single-age population attributes into distinct age ranges, including Age 0-18, Age 19-30, Age 31-40, Age 41-50, Age 51-60, Age 60-70, Age 71-80, Age 81-90, Age 91-99 and Age 100+. Subsequently, we summed up the values within each age range. Additionally, unrelated attributes underwent cleanup for improved dataset clarity. Following these adjustments, the dataset now comprises a total of three attributes and 150 values is a derived result from the data processing steps.

Subsequently, dealing with the wages of various countries, which presented extensive data, even after filtering for the required years, the dataset still comprised 36013 entries and 63 attributes. Furthermore, the dataset contains numerous similar attributes that can be cleaned. For instance, "mw1wl\_current" signifies monthly standard data without calibration in Lex, LCU (reported), while "mw3wl\_current" represents monthly country-specific calibration with imputation in Lex, LCU (reported), and so forth. To clean up the dataset for relevance to the project, a multi-step process was employed. Initially, numerous unrelated attributes were removed. Then, the dataset was filtered for attribute "y3," denoting industry code, selecting only JC. Subsequently, entries with the number 74 in attribute "y4," signifying occupation code, were filtered out. Lastly, the dataset was refined to include data from seven specific countries, including India. Following these filtering and cleaning steps, the dataset was ultimately condensed to retain only 5 attributes and 245 values.

There is no extensive data cleaning conducted on the datasets of Unemployment Rate of 2023 in India and Immigration from India to Other Countries. There are some name replacements for those datasets. For the Unemployment Rate of 2023 in India dataset has 2 attributes and 54 values and for Immigration from India to Other Countries dataset have 3 attributes and 30 values.

In the Indian Migration Reason dataset, we eliminated one attribute which is “person” that lacked a meaningful explanation in the articles. To summarize, there are 42 values and 3 attributes.

In the Disease Leads to Migration dataset, we excluded the "female" attribute along with the prevalence among migrants in" <40 years" and ">=40 years" attributes due to the prevalence of numerous zero values, which could render the data incomplete. Additionally, we eliminated one attribute that lacked a meaningful explanation in the articles. Next, we selected 5 specific disease categories for our data visualisation. To summarize, our dataset comprises 3 attributes and a total of 15 values.

# **Requirements**

## **Must-Have Features**

These are features without which you would consider your project to be a failure. Were you able to deliver all the promised features? If not, explain why.

In our endeavour to develop a comprehensive suite of data visualizations, we prioritized user experience by incorporating various essential features across multiple charts. Fundamental to our approach was the integration of mouse-over tooltips, ensuring that users could effortlessly access detailed information by simply hovering over specific data points in all charts. This deliberate inclusion aimed to amplify data visibility and foster user interaction, contributing to an enriched analytical experience. These features will be included in all data visualizations.

Moreover, recognizing the significance of interpretability, we incorporated a color legend in 5 data visualisation which are the Unemployment Rate of 2023 in India, Indian Migration Reason, Wages of Various Countries, Disease leads to migration and Population of India, strategically designed to illustrate the data ranges. The color-coded representations not only added a visually appealing element to the data but also facilitated a more accessible interpretation for users, promoting a user-friendly environment.

Moreover, our commitment to interactivity led us to introduce filter buttons across the Unemployment Rate of 2023 in India, Wages of Various Countries, and Indian Migration Reason charts. These buttons empower users to selectively focus on specific data subsets of interest. For instance, in the Heatmap Chart for depicting wages of various countries, the integration of filter buttons enables users to dynamically emphasize a chosen country while rendering others transparent. This interactive feature aims to provide users with a more tailored and focused view of the data, aligning with our dedication to user-centric design. Furthermore, the integration of on-click functions, particularly in the Unemployment Rate of 2023 in India chart, adds an extra layer of user engagement and exploration.

The absence of these crucial features in the charts would be considered a failure in meeting our project objectives. Thus, our commitment remains steadfast in delivering these promised functionalities, ensuring a robust and user-friendly data visualization experience for our audience.

## **Optional Features**

Those features which you consider would be nice to have, but not critical. Were you able to deliver any of these extra features?

We considered the implementation of three additional features that we believe would be beneficial, they are table form features for displaying more details, a search bar feature, and a zoom-in and zoom-out feature for the choropleth map.

In data visualisations, we have successfully implemented those additional features that, while not deemed critical, significantly enhance the overall functionality and user experience. Specifically, we introduced search bars in charts like unemployment and immigration, facilitating efficient searching for specific data points. Additionally, we implemented a table for details feature, where clicking the filter button not only affects the chart but also dynamically displays the selected data in table form. This feature will be displayed in the charts for the Unemployment Rate of 2023 in India, Wages of Various Countries, and Population of India. This enhancement offers users a comprehensive view of specific details and facilitates a more in-depth analysis.

# **Visualisation Design**

How will you display your data? Provide some general ideas that you have for the visualisation design. Include sketches of your design. Include at lease 2-3 alternative ideas for your visualisation. Describe and justify your choice of visual encoding and idioms. Show the evolution of your design. How has it progressed? Justify the visualisation idioms you have chosen to represent your data.

Description (including screen shots) and explanation of final design.

[NOTE 1: You are encouraged to provide your own structure to this section (i.e., section headings etc).

NOTE 2: You MUST show evidence of iterative design (i.e., sketches of alternative and preliminary designs). ]

Include screenshots of final design.

**Figma link:** <https://www.figma.com/file/UWxd1ZE9F5eeS1g9glI1cY/Untitled?type=design&node-id=0%3A1&mode=design&t=S168Q81o0eQTJVIU-1>

**Draft of preliminary designs**

**Heatmap Chart: Monthly wages between few countries**

A paper with a chart and a graph

Description automatically generated with medium confidence

**Choropleth map: Unemployment Rate of India for the year 2023**

A white board with a black and white drawing

Description automatically generated with medium confidence

**Sunburst chart: Population of India**

A diagram of a sunburst chart

Description automatically generated

**Pie Chart: Reason of India people migrate**

A graph on a piece of paper

Description automatically generated

**Clustered stacked bar chart**

A graph of bar graph and bar graph

Description automatically generated

**Bubble chart:**

A drawing of circles and lines

Description automatically generated

# **Validation [optional - Bonus Points]**

Test your visualisation with users and report the results.

# **Conclusion**

Provide a summary of the project and what you learnt from doing it.

# **References**

# References

|  |  |
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