Visualization of Prefecture-Level Japanese Population and Sex Ratio in 2021

Tomoya Miyake (244x081x)

Introduction

Japan is a country where the distribution and density of the population vary greatly by region. In recent years, from the perspectives of regional revitalization and urban planning, there has been a growing demand for a detailed understanding of population trends in each prefecture. In particular, since statistical data on areas with concentrated populations affects various socio-economic aspects, its visualization has become an important issue.

In this study, we developed an interactive information visualization system using the 2021 prefecture-level population data extracted from the "Population on October 1 of Each Year: Statistical Table Based on the 2020 Census Standards" provided by e-Stat. The system adopts an interactive approach that integrates multiple perspectives—bar chart, scatter plot, and a detailed information panel—so that users can intuitively grasp trends in the data. Furthermore, through user interactions such as sorting, brush selection, and clicking to display details, the system aims to provide an environment in which the characteristics of each prefecture can be analyzed from multiple viewpoints.

Method

The system is implemented as an interactive information visualization application that runs on a web browser, using HTML, CSS, JavaScript, and D3.js as the main technologies. It is hosted on GitHub Pages, thereby providing an easily accessible environment for anyone.

Data

The data used in this study is the 2021 prefecture-level population data extracted from the "Population on October 1 of Each Year: Statistical Table Based on the 2020 Census Standards" provided by e-Stat. This dataset records, for each prefecture, the "Japanese population (excluding overseas residents)" and the "population sex ratio (with female = 100)." These numerical values are used for visualization.

System Components

The system is broadly composed of the following three components. An overview of the system is shown in Fig. 1.

1. **Bar Chart View**
   On the first row, the Japanese population for each prefecture is displayed as a bar chart. Users can rearrange the bars in descending order by population using the "Sort by Population" button, or return to the default order using the reset button. Each bar element is linked such that when the mouse hovers over it, a highlight effect is applied, and clicking on it updates the detailed information panel.

2. **Scatter Plot View**
   On the left side of the second row, a scatter plot is presented with the horizontal axis representing the Japanese population and the vertical axis representing the population sex ratio. A vertical brushing function is added to the scatter plot so that users can select a specific range of population sex ratios. When a range is selected, the corresponding data points in both the bar chart and the scatter plot are highlighted, facilitating easier analysis.

3. **Detailed Information Panel**
   On the right side of the second row, a panel displays detailed information of the prefecture that the user has clicked on. This includes the Japanese population, male and female populations, population sex ratio, overall statistical data, and the timestamp of the data. The selected prefecture remains persistently highlighted, and is visually emphasized through its linkage with the other components.
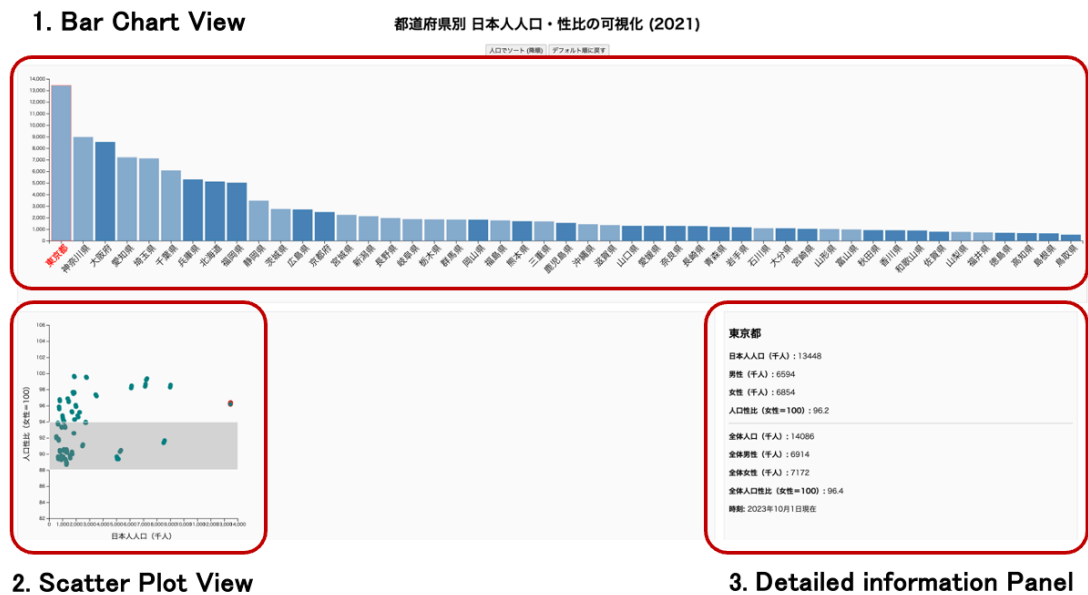
1. Bar Chart View

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2. Scatter Plot View

3. Detailed information Panel

Fig .1：System Overview

Result

First, no prefecture was found to have fewer females than males; the maximum observed was in Tochigi Prefecture, where there were 99.7 males for every 100 females. When selecting the range where the number of males per 100 females is between 98 and 100, the following prefectures were identified: Kanagawa, Aichi, Saitama, Chiba, Ibaraki, and Tochigi (Fig. 2). From this, it can be seen that prefectures with relatively high male ratios are predominantly found in the metropolitan area. In fact, Tokyo shows a notably high value with 96.2 males per 100 females.

Even when examining the range from 94 to 100 males per 100 females, excluding Okinawa (which has a ratio of 96.5), it is apparent that the prefecture farthest to the west is Shiga, and that the remaining prefectures are mostly located in the eastern part (Fig. 3).

Conversely, when looking at the lower range of 88 to 94 males per 100 females, it was found that all prefectures west of Kyoto (excluding Okinawa) fall within this range, indicating that the male ratio in western Japan is low. Additionally, in the

Tohoku region, with the exception of Miyagi and Fukushima, the other prefectures also show low male ratios (Fig. 4).

One possible explanation for the concentration of males in the metropolitan area is that job opportunities are concentrated there, which attracts male migrants. Conversely, it is thought that many women tend to remain in their hometowns—often for reasons such as marriage—and thus regions like Kansai retain a relatively higher proportion of women.
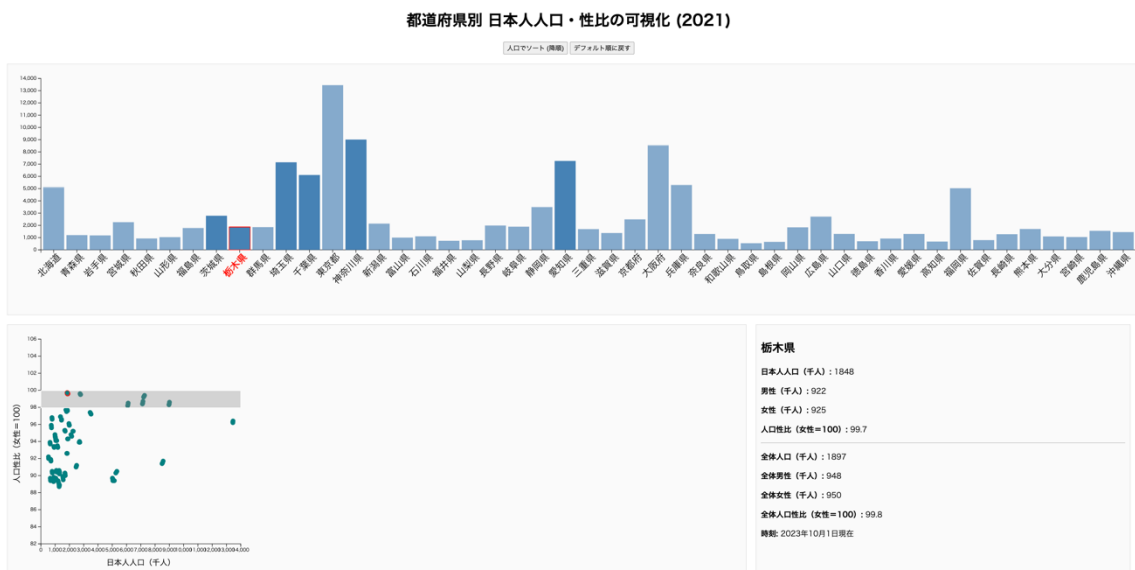

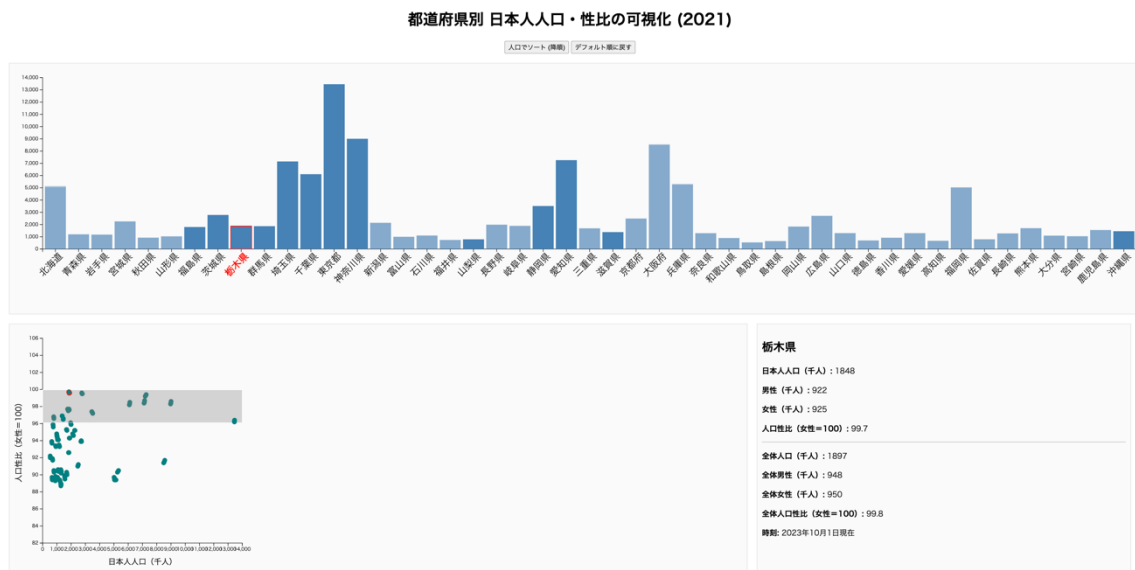Fig .2：When selecting a range of 98 to 100 males per 100 females

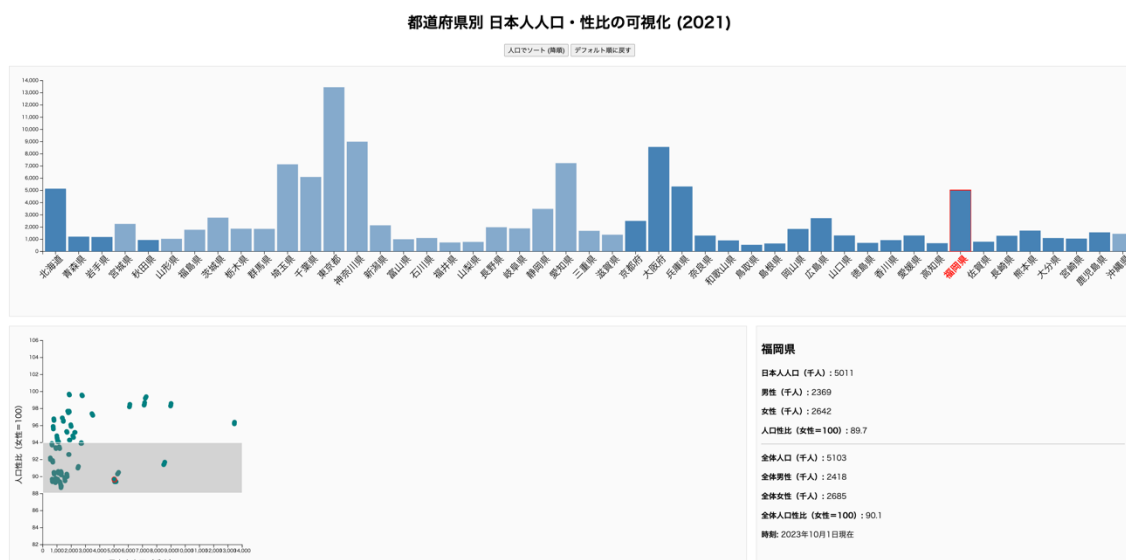Fig .3：When selecting a range of 96 to 100 males per 100 females

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Fig .4：When selecting a range of 88 to 94 males per 100 females

Discussion

From the results of this study, it was found that prefectures with high male ratios are concentrated in the metropolitan area. Contrary to expectations, even in relatively urban prefectures such as Osaka, Kyoto, Fukuoka, and Hyogo, the ratio of males does not exceed 94 per 100 females, which reflects an overall lower ratio in western Japan.

Conclusion

For future research, since this study is based on relatively old data from 2021, we plan to investigate how these trends have changed in the wake of the COVID-19 pandemic, among other factors.

Reference

e-Stat「各年 10 月 1 日現在人口 令和2年国勢調査基準 統計表」
（https://www.e-stat.go.jp/dbview?sid=0003448231）