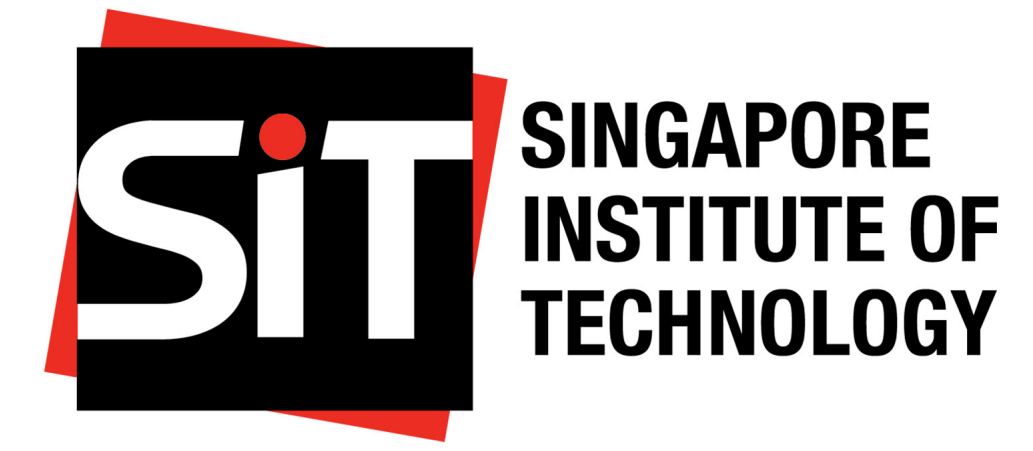


## The Rise of Virtual Kitchens (2020–2023)

Zhang XiangHui, Lin WeiChen, Priscilla Thung, Tang Guan You, Arshad Bin Mazlan, Wong Jing  
Yong Shawn (Information and Communication Technologies)



# INTRODUCTION

The COVID-19 pandemic has profoundly transformed numerous industries, and the food and beverage sector is no exception. One of the most notable developments during this period has been the rapid growth of virtual kitchens, also known as ghost kitchens or cloud kitchens.

Virtual restaurants in this context means that the restaurant is only available for pickup/delivery and there's no dine in option. They are "ghost restaurants", there is no place to walk up to, no signage, no seating. These restaurants operate out of commercial warehouses or trailers. And people usually patronize these virtual restaurants through delivery apps due to the restaurant names, and attractive images.<sup>1</sup>

Virtual kitchens represent a significant shift in food production, marketing, and consumption by offering increased flexibility and efficiency. This transformation encourages both consumers and restaurateurs to embrace innovative approaches, fostering a dynamic and resilient food service landscape. This project aims to enhance previous visualizations and provide a comprehensive overview of the expansion of virtual kitchens across various states.

## PREVIOUS VISUALIZATION

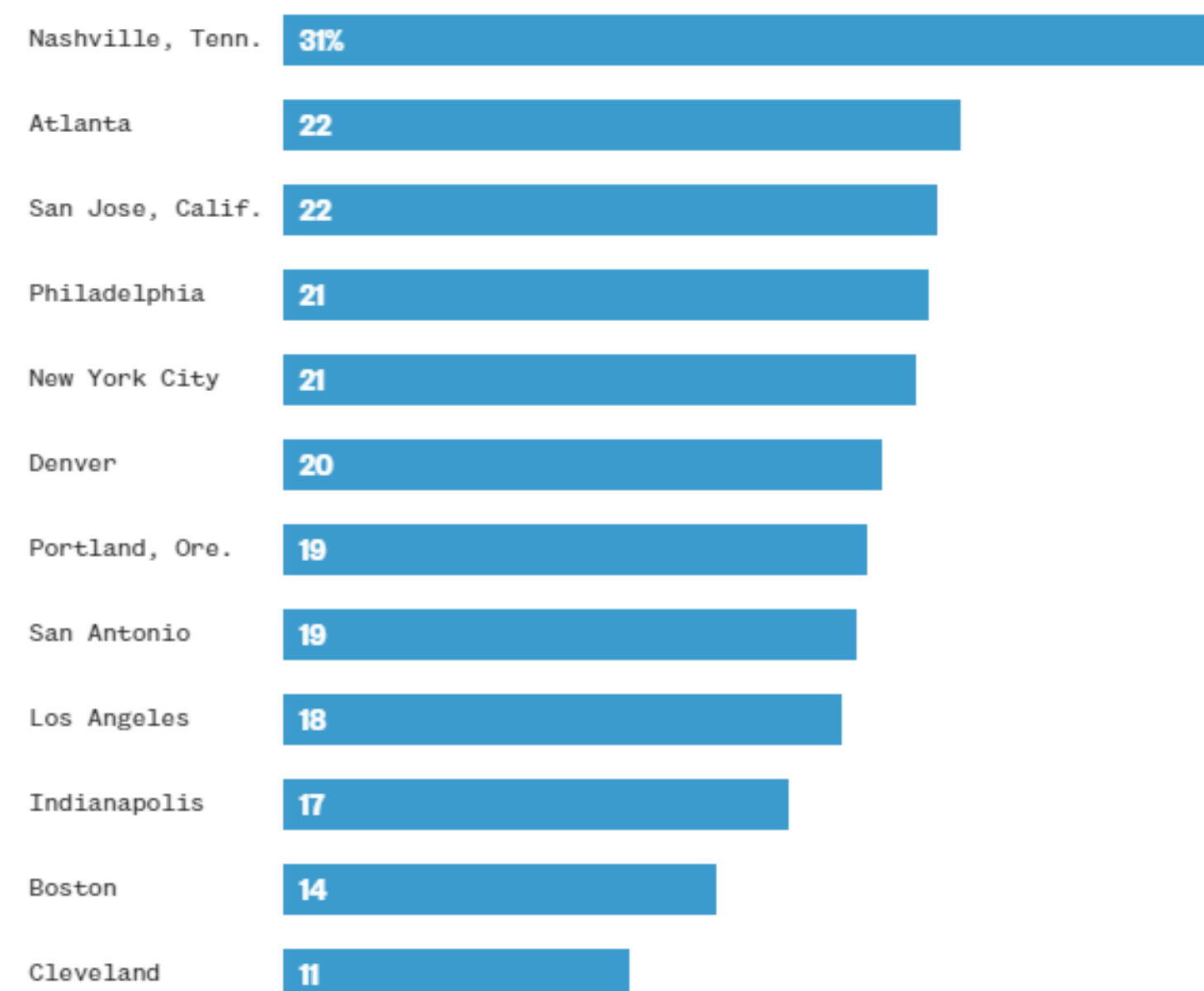


Figure 1: Percentage of restaurant listings in a city.

## STRENGTHS

- The visualization is simple and straightforward to understand.
- It shows the top 12 cities with the highest percentage increase of virtual restaurants, which allows the reader to understand the cities that are in popularity for these virtual restaurants.
- Based on the data, you can really see the huge boom in popularity of virtual restaurants over the years.

<sup>1</sup><https://academy.getbackbar.com/understanding-the-concept-of-virtual-restaurants>

## SUGGESTED IMPROVEMENTS

1. **Add a plot title and a source note:** Ease the reader's understanding of the visualization.
2. **Identify missing data:** If there are missing data, it should be clearly indicated.
3. **Ensure consistency in labels:** Consistency in data annotation (the percentage) can help readers understand the visualization easily.
4. **Add a legend:** A legend can help readers understand the visualization easily while reducing misinterpretation of the visualization.
5. **Include statistics for every state:** Statistics will help readers get an overview of the virtual restaurants across the country.
6. **Use a choropleth map:** A choropleth map can help readers visualize the distribution of restaurants in different states more effectively.
7. **Use a sequential color palette:** A sequential color palette helps convey a natural and intuitive sense of increasing or decreasing magnitude.
8. **Bin the data:** Binning the data allows a range of values to be grouped together to simplify and clarify the visualization.
9. **Add labels for each state:** To avoid overplotting, use two-letter abbreviations instead of full state names.

## IMPLEMENTATION

## Data

- The data used in this visualisation was obtained from Kaggle<sup>2</sup> and GitHub<sup>3</sup>, that was scraped from Uber Eats<sup>4</sup>.
- The datasets contains information on the number of restaurants and important data such as name, full address, lat, long.
- The data was cleaned and transformed to extract the state abbreviation and the year partnered.

## Software

We used the Quarto publication framework and the R programming language, along with the following third-party packages:

- *dplyr* for data manipulation
- *tidyverse* for data transformation
- *ggplot2* for visualization based on the grammar of graphics
- *usmap* for plotting the US map
- *scales* for formatting the scales of the plot
- *sf* for spatial data manipulation
- *ggtext* for formatting text in the plot
- *stringr* for string manipulation
- *knitr* for dynamic document generation

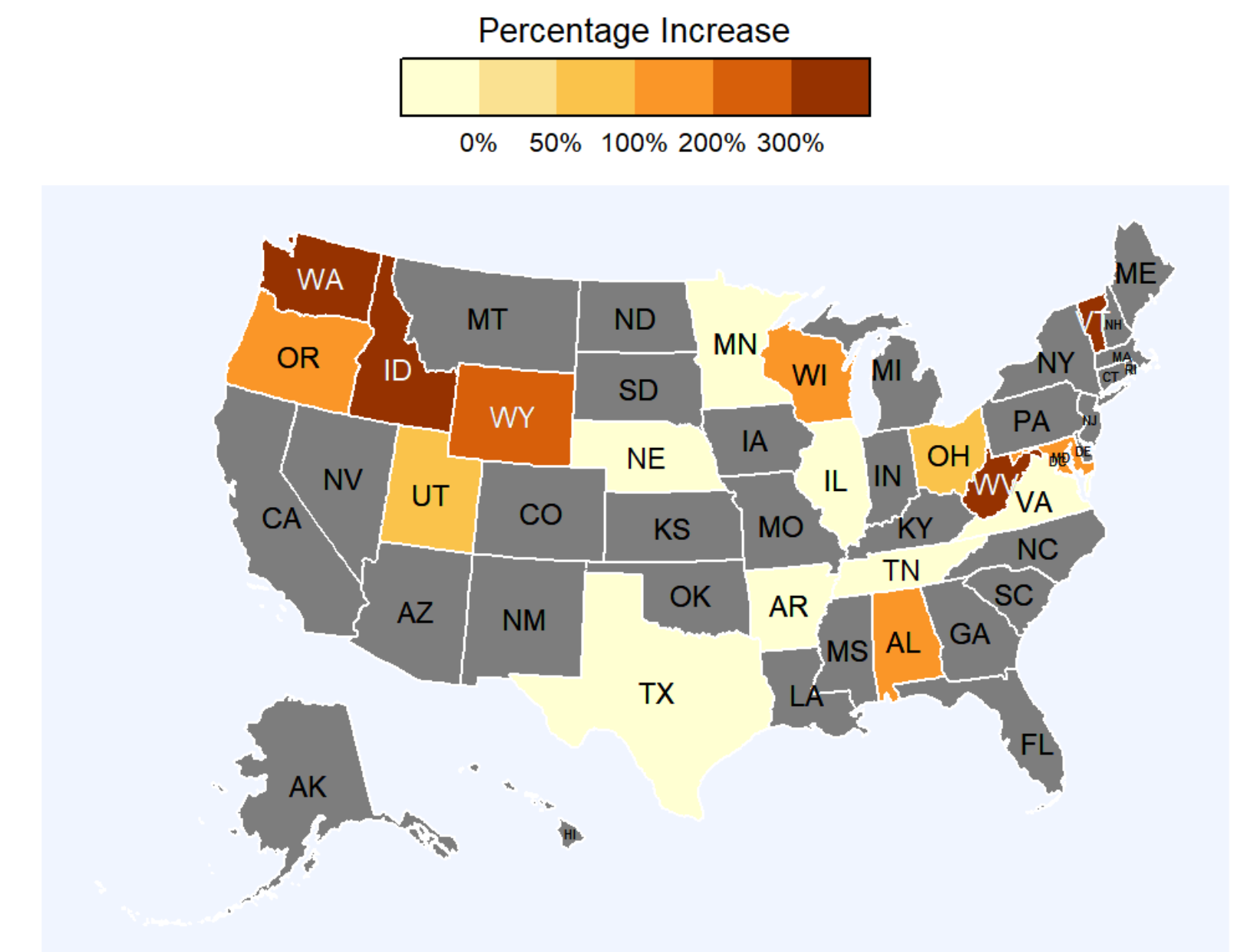
<sup>2</sup><https://www.kaggle.com/datasets/ahmedshahriarsakib/uber-eats-usa-restaurants-menus?resource=download&select=restaurants.csv>

<sup>3</sup><https://github.com/gunit/Extreme-Uber-Eats-Scraping/blob/master/1.5M-Uber-Eats-Restaurants.zip>

<sup>4</sup><https://www.ubereats.com>

## IMPROVED VISUALIZATION

### Increase in virtual restaurants by State between 2020 and 2023



Grey areas represent states that do not have data

**Source:** Kaggle Dataset of Uber Eats USA Restaurants and Github "gsunit" Uber Eats Scraping

Figure 2: Percentage increase of virtual kitchens in the United States.

## FURTHER SUGGESTIONS FOR INTERACTIVITY

Due to the intention of the visualization to be used in a poster, there are no interactive elements. However, if the visualization were to be used in a digital format, the following interactive elements could be added:

1. *Hover-over information:* When hovering over a state, the user can see the number of virtual kitchens in that state.
2. *Filtering:* Users can filter the data by year to see how the number of virtual kitchens has changed over time.
3. *Zooming:* Users can zoom in on a specific region to see the number of virtual kitchens in more detail.
4. *Search:* Users can search for a specific state to see the number of virtual kitchens in that state.

## CONCLUSION

We have implemented the suggested improvements to the visualization. By using a choropleth map, it ensures that the data is much more easily understood as readers can identify areas with a higher percentage of virtual kitchens and get an overview of the distribution of virtual kitchens.