INF2178 Assignment 1

Write-up

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1. Introduction

One of the most important aspects of the homeless situation in Toronto is the shelter system, a lifesaver for the city's homeless population. Just like the seasonal changes occur, the demand for shelter services also changes, and with it, the occupancy rates vary according to the weather patterns. This study hereby offers a hypothesis aimed at shedding light on the effect of seasonal fluctuations on the seasonal shelter occupation rate, whereby this study claims that the heavy winter season is characterized by a high influx compared to the softer summer season. It is of utmost importance to understand the patterns to facilitate efficient allocation of resources and effective shelter management in that they are adequately prepared to meet the increased demand during the chilly months.

2. Methodology

To start with the hypothesis:

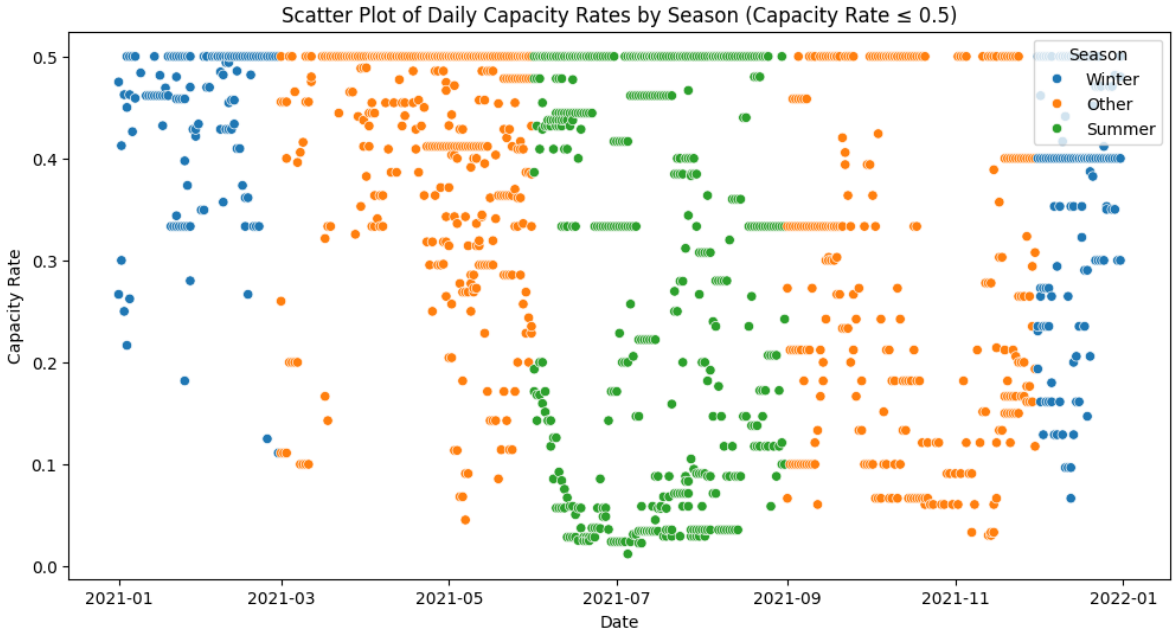
1. **Null Hypothesis (H0):** There is no significant difference in Toronto's shelter occupancy rates between winter and summer months.
2. **Alternative Hypothesis (H1):** Shelter occupancy rates are significantly higher in winter than in summer months in Toronto.

To this end, the study utilizes a hybrid approach in that it is a blend of data visualization and t-test analyses that delves into the rhythms across the seasons regarding the rates of occupancy of shelters. To justify the observed seasonal differences, the t-test component rests upon the t-test comparison of occupancy rates during the winter and summer months. This method requires an initial preparation of an algorithm for calculating the occupancy rate, which is the occupied capacity divided by the actual occupancy. Then, the research will determine a definition of winter and summer within the dataset, which is the most important yet significant differentiated season for shelter communities. In the end, set up a T-test to statistically evaluate the difference in shelter occupancy rates between winter and summer to support or refute the hypothesis that occupancy rates are higher in winter.

At the same time, the second approach employs visual data representations, such as scatter plots and line graphs, to examine the temporal and long-lasting dynamics of the occupancy rates over the course of the year. This two-way approach provides a balanced approach to understanding the impacts of seasons on the daily shelter using the statistical significance rationale and visual evidence.

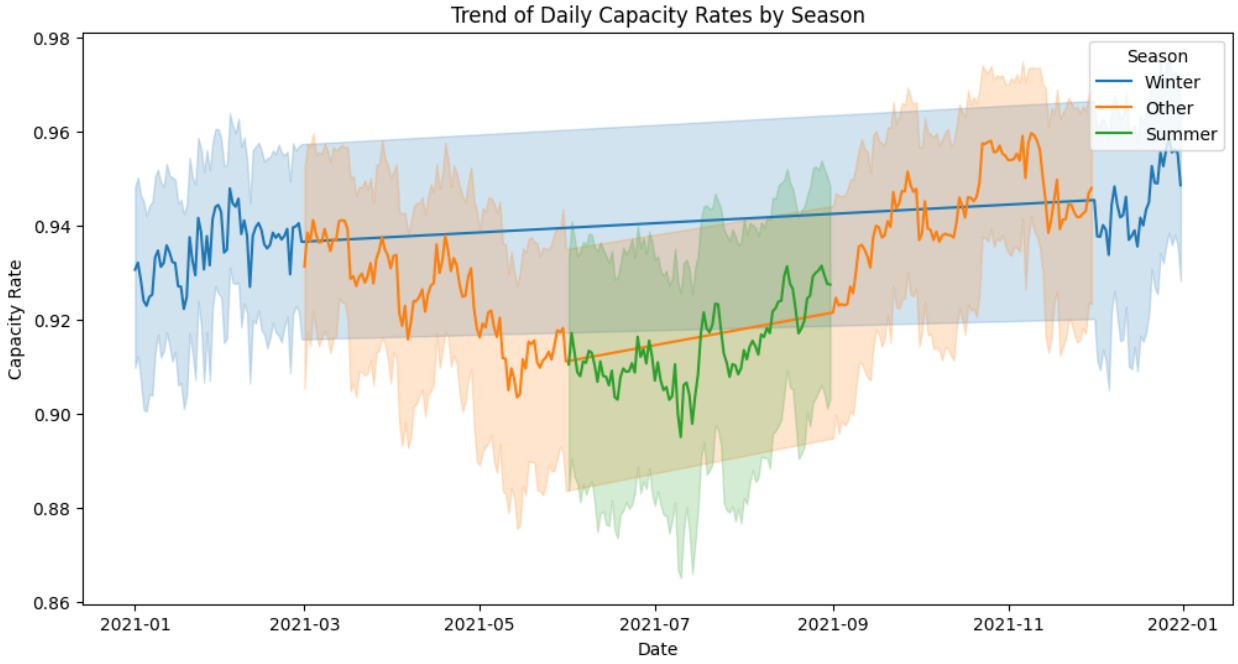
3. Result

1. T-Test: T-statistic: 13.732150632203751, P-value: 9.256519912333895e-43
    - With a T-statistic of 13.732 and a P-value of approximately very close to zero, the analysis strongly supports the hypothesis that shelter occupancy rates are significantly higher in winter than summer. The high T-statistic indicates a substantial difference between the winter and summer occupancy rates, while the extremely low P-value suggests this difference is highly unlikely to have occurred by chance, leading to the rejection of the null hypothesis in favor of the alternative hypothesis.
2. Visualizations

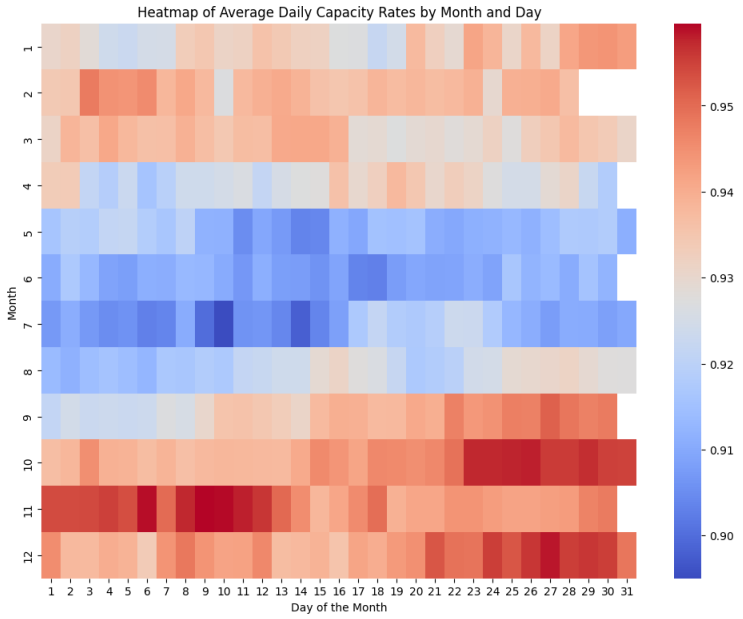


- With this scatter plot demonstrates the visualization of data distribution for all valid occupancy rates with a rate lower than 0.5. The green dots, being the summer rate, have a

much dense population around the lower side of the y-axis. This indicates that in summer, more programs and shelter tends to be not full or not fully utilized, suggesting a lower need for shelter for the shelter community.



- As this trend line plot further shows, with the capacity rate's trend displayed on the graph, we can see the rise of daily capacity rates increase during the winter seasons (December, January, February) and a significant drop during the summer months (June, July, August).



- The heatmap further demonstrates the drop in the occupancy rate drop during the summer months as well. With a more blue-colored middle indicating the differences in occupancy rate. Also supporting the alternative hypothesis.

4. Discussion

The seasonality of the findings concerning the increased shelter occupancy rates certainly confirms the necessity of early strategy planning in Toronto's shelter system. Such a seasonal surge in demand clearly reveals the vulnerability of people living in the streets to adverse weather conditions, emphasizing its necessity to maintain appropriate shelter capacity and availability of resources during such a period. These results promote a proactive paradigm in shelter operations, emphasizing the employment of innovative resource redistribution that is explicitly responsive to the seasonal changes in demand. Furthermore, the research implies an opportunity for focused interventions around winter, such as better outreach programs and more warming shelters to benefit those in need.

5. Conclusion

The research into the seasonal patterns in residents of the shelter population can hereby serve as empirical analysis that supports the argument that homelessness and the shelter communities is more

prevalent during the winter period in Toronto. The results point out that there is a need to include seasonality aspects in managing and planning for the shelter to ensure that the shelter system is adequate to respond to the surge in demand during the cold season. Through planning for seasonal fluctuations in resource use, Toronto's shelter system can strengthen its ability to offer refuge and assistance to the city's homeless community, building a system for a more resilient and responsive support structure. This study sheds light on the mechanisms that govern the nature of shelter use, serving as a point of reference for further research and action that would advance the quality of life for those within the shelter system.