Urban Connectivity Dynamics: Analyzing Free Public WiFi Distribution in Toronto*

By Building Typology, Population, and Socioeconomic Indicators

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In the era of increasing digital dependence, understanding the intricacies of urban internet connectivity is pivotal for fostering an effective and technologically equitable society. Public WiFi is a vital tool in modern society, offering internet access and supporting economic development, education, and social connections. In response to the increasing importance of internet connectivity in contemporary urban life, I investigate the distribution of free public WiFi in Toronto. This paper aims to provide key statistics on the distribution of public WiFi in Toronto and analyze the impact of building types, demographics, and economic influences on its distribution to gain as comprehensive a picture as possible of the role and impact of public WiFi in our lives.

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*Code and data are available at: https://open.toronto.ca/dataset/city-of-toronto-free-public-wifi/, and https://open.toronto.ca/dataset/ward-profiles-25-ward-model/.

1 Introduction

In an era characterized by an ever-deepening reliance on digital technologies, the intricate tapestry of urban internet connectivity is emerging as a pivotal force in the transformation of our societal fabric. Countries globally are acknowledging internet access as an indispensable tool for active participation in contemporary democratic societies. In Canada, the Canadian Radio-television and Telecommunications Commission (CRTC) has recognized that "broadband internet access services are crucial to Canada's economic, social, democratic, and cultural fabric." As a university student navigating the complexities of contemporary living, the significance of understanding these dynamics cannot be overstated. We are acutely aware of the transformative potential that connectivity holds.

Public WiFi, often taken for granted in our daily lives, emerges as a vital tool shaping the contours of a technologically inclusive society. It plays a pivotal role in modern society, offering a myriad of benefits to individuals. Beyond providing a cost-effective alternative to cellular data, it fosters internet accessibility, enabling people to stay connected without constraints. This flexibility and mobility are particularly advantageous for students, travelers, and those on a budget, allowing them to work, study, or communicate from diverse locations. Moreover, public WiFi contributes to social inclusion, bridging the digital divide and ensuring that even those without home internet access can engage in online activities. Access to information, job searching, and remote work opportunities are further facilitated, enhancing the overall quality of life. In emergencies, public WiFi serves as a crucial communication lifeline, demonstrating its indispensable role in connecting people and providing access to vital services.

Beyond the conveniences of internet access, it serves as a linchpin fostering economic development, facilitating education, and fortifying social connections. The present study, anchored in the evolving landscape of Toronto, endeavors to unravel the mysteries surrounding the distribution of public WiFi. This paper embarks on a compelling exploration of the distribution of free public WiFi in Toronto, recognizing it as not merely a technological amenity but a cornerstone of our modern existence. By examining the impact of various factors, such as building types, demographic patterns, and economic influences, this research seeks to paint a comprehensive portrait of the role and impact of public WiFi in our lives, providing readers with a lens to comprehend the symbiotic relationship between technology and urban living.

This research is divided into three main parts: Introduction@sec-intro, Data@sec-data, and Conclusion@sec-conclusion. Commencing with the Data section, a meticulous exposition ensues, delineating the origin of datasets garnered from the OpenDataToronto Library and expounding upon the procedural rigors applied for data refinement and analysis. The conclusion part shows what I found during the analysis, while goes deeper into those findings, and finally wraps up the main discoveries from this paper about public free WiFi in Toronto.

2 Data

In this section I will be diving deeper into the various modes of `R`-based (R Core Team 2022) data collection and generation within `RStudio` (RStudio Team 2021). The data used in this paper is retrieved from the `opendatatoronto` R package (Gelfand 2022), namely, the Toronto fire incidents dataset. Other R packages including functionalities from `tidyverse` (Wickham et al. 2019), `here` (Müller 2020), `readr` (Wickham, Hester, and Bryan 2024), `ggplot2` (Wickham 2016), `knitr` (Xie 2023), and `dplyr` (Wickham et al. 2023). Greater detail concerning the utilization of the mentioned packages will be further explained in the following subsections.

2.1 Location and description data of Toronto free public WiFi

The data I mainly used to generate the visualizations in this paper is City of Toronto Free Public WiFi from Open Data Toronto (Gelfand 2022) that is an open source tool designed to be publicly available and encourage the development of valuable insights. The dataset, released by Toronto's Department of Information & Technology, captures information on location and description data free public WiFi locations in the City of Toronto and is updated monthly.

The data used for analysis in this article is as of January 3, 2024. According to the data characteristics described on the portal, this data should include information such as address, building type, building name, postal code, whether there is public wifi, etc. Through systematic analysis, it is found that only building type is the main subject variable that can be used to study the influencing factors of distribution. In order to quickly extract available data, only columns with reasonable data are retained during the data cleaning process (see Table 1). Basic data cleaning of column values to shorten the description of different types of clinics and improve readability. I create a statistic on the basis of monthly groups, using kable() from knitr to create Table 1.

Table 1: Sample of cleaned Free Public WiFi data

Building type	Ward	Ward Number
Arena	Etobicoke North	1
Arena	Don Valley East	16
Arena	Willowdale	18
Arena	Humber River-Black Creek	7
Arena	Humber River-Black Creek	7
Arena	Humber River-Black Creek	7
Arena	Parkdale-High Park	4
Arena	Etobicoke-Lakeshore	3

2.2 2021 Ward Profiles based on the 25-Ward model

In order to deeply understand the factors affecting the distribution of public wifi in Toronto, I will study the population and income of each ward in Toronto on this basis. Therefore, the regional profile dataset (Data 2021), based on the 2021 Census data, was also included in the analysis. The dataset, published by City Planning, was last updated on January 3, 2024. The dataset contains demographic, social and economic information such as income and population for each ward.

Ward profile data is stored in an Excel file with multiple tabs. The relevant data used for this analysis is included as a variable in the first TAB, the 2021 Census. Therefore, only the data from this TAB is downloaded for analysis. Further data cleansing was done to transform the data, retaining only information related to income and population levels in each ward (see Table 2). Based on the Toronto Open Data Portal, the package has a CSV file, 25 ward names and numbers, which contains the mapping between ward codes and ward names. I create statistic to visualize these data, using kable() from knitr to create Table 2.

Table 2: Sample of cleaned Ward of Toronto data

Population	Income	Ward Number
115120	38135	1
117200	45345	2
139920	65575	3
104715	49440	4
115675	45055	5
107355	41265	6
111200	37675	7
114820	45915	8

And also planes (Figure 1).

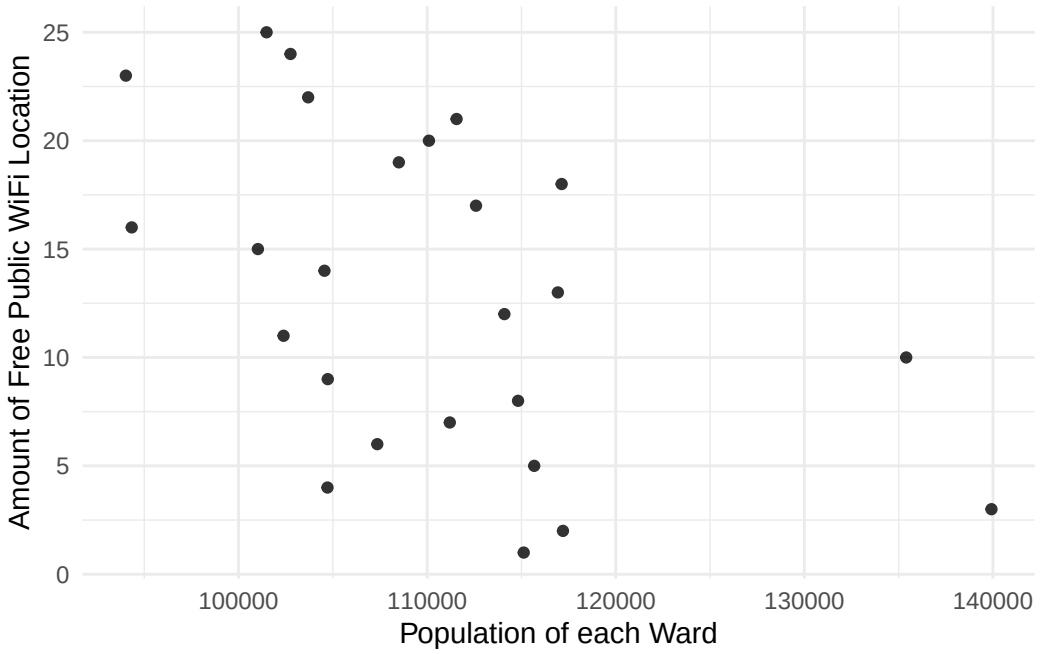

Figure 1: Relationship between Population of each Ward and Amount of Free Public WiFi Location

Talk way more about it.

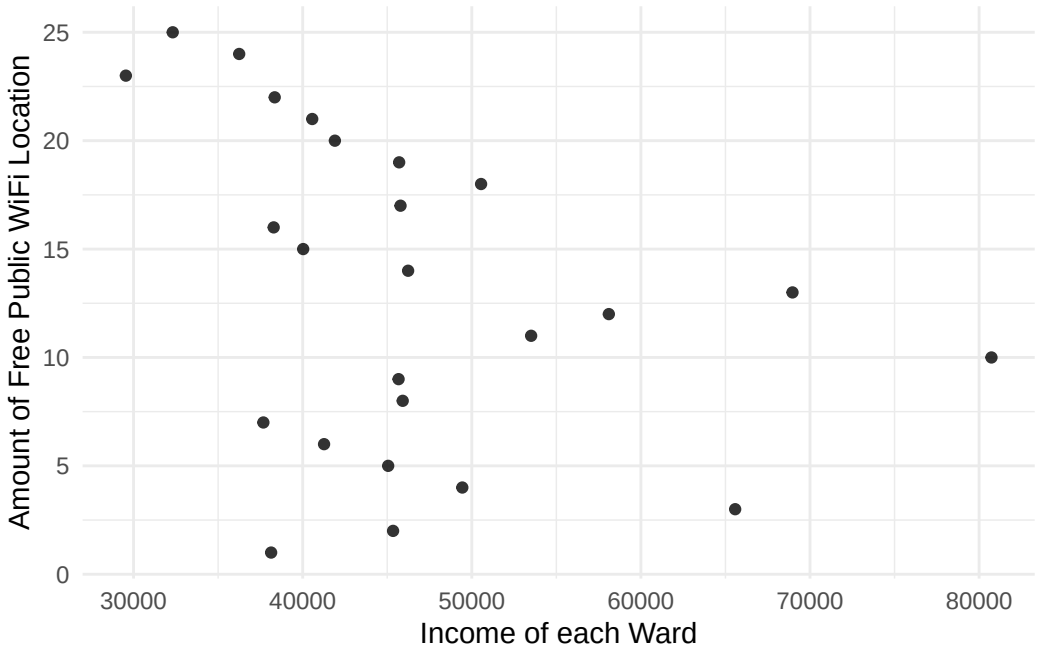

Figure 2: Relationship between Income of each Ward and Amount of Free Public WiFi Location

Here we briefly describe the Bayesian analysis model used to investigate… Background details and diagnostics are included in **?@sec-model-details**.

We run the model in R (R Core Team 2022) using the `rstanarm` package of (**rstanarm?**). We use the default priors from `rstanarm`.

3 Conclusion

3.1 Demand: Societal need for public Wi-Fi differs according to building types

Our results are summarized in **?@tbl-modelresults**.

3.2 Population: Higher population density correlates with increased distribution of free public WiFi

3.3 Economy: Income levels have limited influence on availability of free public Wi-Fi

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