

Boston Student Housing Analysis

Project Report

DS 5110: Introduction to Data Management and Processing

Section 4

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1 ABSTRACT

Housing for students is one of the big challenges in Boston, being among the cities with prestigious universities and a great academic atmosphere. With a growing student population that flocks to high institutions such as Harvard, MIT, Boston University, and Northeastern University, the demand for student housing surpasses supply. This competitive market forces students to navigate high rental costs, limited availability, and a need for convenient locations close to their universities.

The project seeks to address these challenges by analyzing the critical factors that influence student housing decisions: rental costs, proximity to universities and number of bedrooms. The project provides actionable insights and recommendations through data analytics and visualization using Python, geospatial analysis with Folium, and the XGBoost machine learning model. Students benefit from crystal clear information about the trade-offs between affordability and proximity, enabling them to make informed choices based on their priorities.

The project also serves the university housing offices, property developers, and policymakers by giving them a clear indication of gaps and opportunities in the student housing market. Universities can improve on-campus and off-campus housing support, developers can target areas of high demand, while policymakers can enact strategies that will encourage affordable housing around academic institutions. The following project addresses short-term needs while informing longer-term solutions to improve the student housing situation in Boston and provide a roadmap for replication in other municipalities.

2 INTRODUCTION

Boston is often hailed as the "academic capital of the world" with the inclusion of prestigious institutions like Harvard University, the Massachusetts Institute of Technology (MIT), Boston University, and Northeastern University. Thousands of students worldwide flock to Boston each year because of its academic excellence. But this translates to a high demand for housing, which becomes ever so difficult to locate if it is to be both affordable and decent. For students, finding the right housing goes far beyond having a roof over their heads. It means it will directly affect their academic performance, mental health, and general well-being. The proximity of housing to their university, affordability of rent, safety in the neighborhood, and accessibility of basic amenities-all play a crucial role in their decision-making process. Unfortunately, the Boston housing market, which is highly competitive, has very limited availability and high rents. Students, particularly those on shoestring budgets, have often been forced to compromise on many of their major needs amidst these challenges. The project attempts to take a closer look at the state of affairs relating to student housing in Boston based on critical parameters: rent prices, distance from universities, and diversity of housing. Beyond helping students, the project aims to help universities, property developers, and policymakers understand how to better support the student population in their housing needs.

3 OBJECTIVES

The overall objective of the study is to deeply analyze the student housing market in Boston, considering the special problems that students face. Specifically, this project will seek to:

1. Understand the Diverse Housing: Research one, two, and three-bedroom apartments etc for students. In this case, the diversity of the type of housing is an understanding of what options may exist for students.
2. Affordability Analysis: This visualizes the rent price in different neighborhoods around Boston to locate an area which will be within the student budget. It also depicts the housing and location costs so as to aid the student in decision-making.
3. Assess proximity to universities: The accessibility of the housing with regards to distance from major universities should be assessed. This study also enumerates the importance of location for students who require housing proximity to their campuses for ease of academic and social activities.
4. Address Existing Challenges and Recommend Solutions: Provide actionable recommendations based on the findings to help improve the student housing experience in Boston. These insights seek to guide not only students but also stakeholders such as universities, developers, and policymakers.

By achieving these objectives, the project aspires to provide a holistic understanding of the student housing landscape in Boston, addressing both current challenges and future opportunities.

4 METHODOLOGY

This project will address the various challenges of analyzing the student housing market in Boston through a comprehensive, data-driven methodology to provide detailed insights and actionable recommendations for stakeholders. The process begins with data collection, a critical step to ensure that the analysis is grounded in reliable and representative data. Data is scraped from Zillow, one of the most widely used platforms for rental listings. The data in this file include rental prices, location of houses, and numbers of bedrooms-a comprehensive insight into all the housing opportunities for students around Boston.

After scraping is complete, extensive preprocessing goes into making this data analytic-ready. It involves addressing inconsistencies such as duplicate entries, format inconsistency, or loss of some values in raw data, ensuring a dataset that is accurate and available for use. The preprocessing step also covers the transformation of data into standardized formats suitable for various advanced analytical techniques. For example, numerical fields like rental costs and geospatial coordinates are preprocessed to attain precision; categorical data is cleaned in order to reduce ambiguity.

The analytical phase is powered by Python. Key libraries like Pandas are employed for data manipulation, which efficiently explores and transforms the dataset. This dual approach ensures both depth and flexibility in the analysis. Another key part of the methodology is geospatial analysis, focusing on the spatial relationships between housing locations and major universities in Boston. With high accuracy, distances are calculated by utilizing the Google Maps API and Geopy library to allow the analysis to include proximity as a critical factor in housing decisions. The results from this analysis are visualized using Folium, which develops interactive maps that intuitively provide a sense of the geographic distribution of housing options and their ease of access to academic institutions.

To make the findings accessible and practical, an interactive dashboard using Streamlit has been developed. The main user interface, this application provides key insights such as rental cost trends, proximity analyses, and housing availability. The users can filter by budget, distance from universities, and even the number of bedrooms to come up with results that would suit their needs. This interactive visualization enables students and other stakeholders in making well-informed decisions quickly and efficiently.

Then Predictive analytics with machine learning models would form part of the work: predict future trends in the housing demands using the XGBoost model. This model studies all interactions between historical data and vital variables to make foresights from the analysis, which involves predicting the fluctuation of rentals or high-demand zones that may occur. Because a predictive ability like this applies really well to long-term views, universities, policy members, and property developers come forward with strategic decisions while seeking to meet the upsurging needs.

This multifaceted approach means that the project covers current challenges and future opportunities within the Boston student housing market. Combining robust data collection, sophisticated preprocessing, advanced analytical tools, and interactive visualization with machine learning provides a scalable and comprehensive framework that will be useful for not only supporting students in Boston but also serving as a model for other cities to analyze their respective housing markets. The project, through this, tries to bridge the missing link between insights from the data and actionable insights that are to be given, impacting the students' experience of accommodation and resource utilization by stakeholders positively.

5 RESULTS AND DISCUSSIONS

This report sheds light on the various major trends and patterns emerging in Boston's student housing market and, thus, sets an all-inclusive view regarding the challenges and opportunities available in this competitive sector. Each discovery contributes to a better picture of the factors driving choices about where to live in the Boston area.

1. Rental costs and proximity:

Accordingly, it emerges from the analyses that rental prices are directly related to proximity to Boston's major universities. Properties closer to campuses are way more expensive, reflecting the premium placed on convenience and accessibility. This trend is particularly evident in areas near institutions like Harvard, MIT, Boston University, and Northeastern University, where demand for housing is exceptionally high. Conversely, properties located farther away from campuses offer more affordable rent, making them attractive to students on tighter budgets. However, these reduced costs are at the cost of longer travel times, which have a great impact on the daily routine, academic schedules, and quality of life that students can experience.

2. Housing Preferences:

Single-bedroom apartments are the most preferred among students, especially among those with limited financial resources. These units strike a balance between affordability and privacy, making them an ideal choice for many students. Furthermore, shared accommodations proved to be a very popular alternative, reflecting students' efforts to share costs and access better living conditions. This trend indicates that affordability and shared expenses are the major drivers in the student housing market, especially in a city like Boston, which has some of the highest rental costs in the country.

3. Interactive Exploration:

To empower students and other stakeholders in making informed housing decisions, an interactive dashboard was developed using Streamlit. This tool allows users to dynamically explore housing options by applying filters such as proximity to a specific university, budget range, and the number of bedrooms. This interactive functionality allows users to tailor their search to best suit their preferences and constraints, easing the process of finding suitable housing options in a multidimensional market. The dashboard not only simplifies their decision-making process but presents them with insights which otherwise would involve a lot of time-consuming manual operations.

4. Geospatial Insights:

Its major strength includes the provision for geospatial insight via maps generated through Folium. These maps show the spatial distribution of housing options relative to universities, hence giving a clear view of how location affects accessibility and cost. This is invaluable geospatial analysis for students, as it allows them to weigh housing options against their academic, social, and commuting priorities. Such information will also be useful for stakeholders like universities and housing developers to determine areas with high demand and potential opportunities for development or improvement.

5. Predictive Modeling:

Integration of the XGBoost machine learning model adds a predictive dimension to the analysis, hence making it possible to forecast future trends in housing demand. This feature is particularly valuable for stakeholders such as universities, property developers, and policymakers, as it enables them to anticipate market fluctuations and plan accordingly. For example, the model can identify potential areas of increased demand, predict rental price trends, and suggest optimal locations for new housing developments. With these forward-looking insights, the project goes beyond descriptive analysis to offer tools that can inform long-term strategies for addressing housing challenges.

In all, the results from this project give a balanced insight into Boston's student housing market by highlighting major trends, preferences, and challenges. Integration of interaction tools, geospatial analysis, and predictive modeling lays a very strong foundation for further development; thus, the project is a valuable contribution to students and stakeholders alike. By addressing the identified limitations and expanding the scope of analysis, this project will, in future iterations, go even further in providing insights and solutions to navigate the complexities associated with student housing in Boston.

6 CONCLUSION

This project provides a comprehensive overview of Boston's student housing market, covering critical aspects such as affordability, proximity, and housing preferences. By leveraging data scraped from Zillow, advanced geospatial analysis, and a user-friendly Streamlit dashboard, the project offers insightful analysis of factors affecting the choice of student housing. Integrating a machine learning model, XGBoost, makes the model predictive in nature, which would further enable stakeholders to anticipate future trends and demands in the housing market.

While areas like real-time data updates and model refinement remain opportunities for improvement, the project lays a strong foundation for addressing student housing challenges. The insights generated from this study not only help students make informed housing choices but also provide universities, developers, and policymakers with the data needed to enhance the student housing experience. This project framework can also be applied in other cities facing similar challenges, hence scalable and effective.

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Appendix

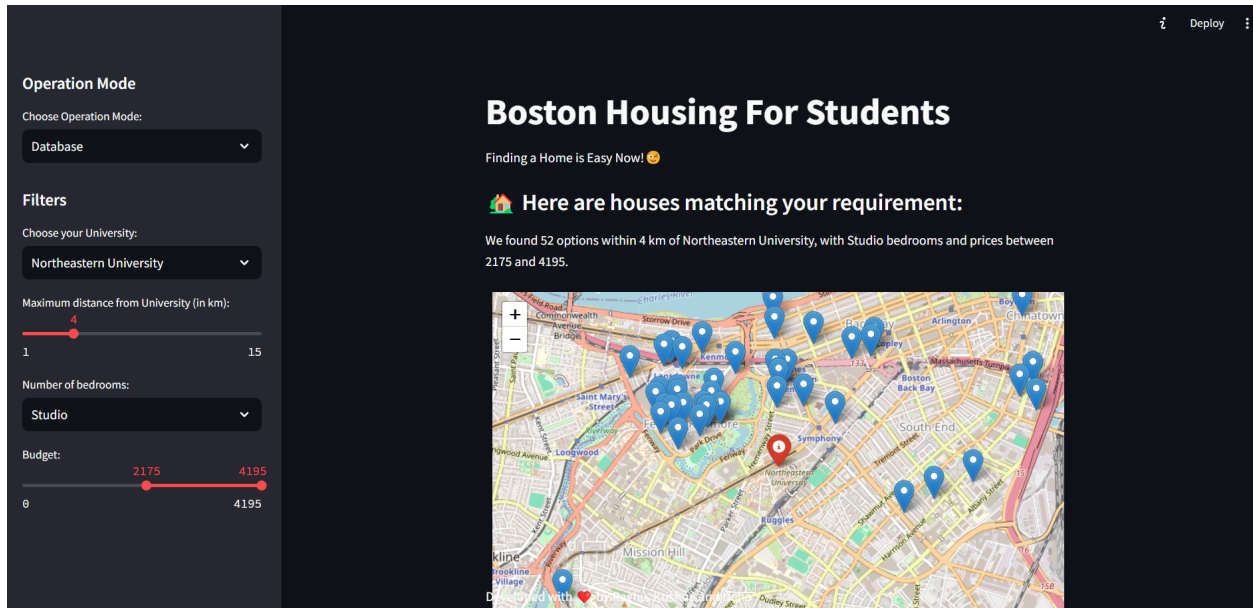


Figure 1: Database mode

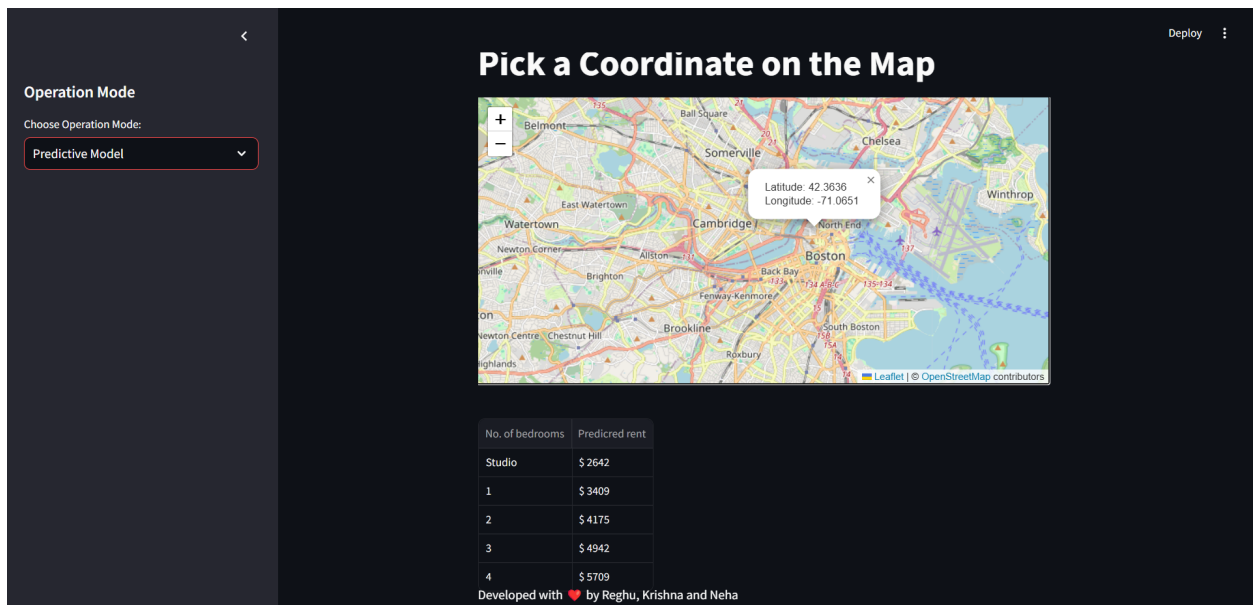


Figure 2: Predictive model mode

Link to deployed app: <https://bostonstudentnest.streamlit.app/>