LEED Certified Buildings in Massachusetts

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EECE 2300 Term Project
December 14, 2018

Introduction

Our goal is to present an in-depth analysis of the LEED certified buildings in Massachusetts and the college-student population. We hypothesized that the population trends of Massachusetts high-school grads was related to a push for more environmentally friendly buildings in the state. As students in Boston, we are interested in the environment around us, specifically the environmental initiatives in the city. The U.S. Green Building Council's (USGBC) LEED Program promotes the certification and development of safe, green, and easy to maintain buildings around the world. [1] Leadership in Energy and Environmental Design (LEED) is the most commonly used rating system for green buildings around the world, recognized as a mark of excellent energy sustainability. Certifications can be awarded to nearly any type of buildings, from school building to personal homes. LEED Certifications are categorical and ordinal, ranking buildings as Certified, Silver, Gold or Platinum. LEED prides itself on the success of their projects, saving the owner energy, resources, producing less waste, supporting human health, attracting more tenants and costing less to maintain/operate. In 2016, the state of Massachusetts was ranked #1 in the Nation for LEED Green Building with 136 LEED-certified projects . [2]

Background

Our main data set was downloaded from the USGBC website. The site allows you to create an account and download projects based on select filters like "Name", "Country", "Certification Level", etc. Our "MA LEED.xls" file contains all LEED projects in the state of Massachusetts. All projects include Certification Date, City, Rating System, and Certification Level. The next data set came from Massachusetts Department of Elementary and Secondary Education. [3] The Department reports on the state's education through topics like Elementary/Middle/High school enrollment, Achievement in English Language Arts/STEM, Graduates Attending Institutions of Higher Education, etc. We exported the data "MA HS Grads All Years.xlsx" about Massachusetts high school graduates enrolling in higher education from the 2008 to 2016 school years. We imported matplotlib to plot our figures and numpy to create arrays. We imported a linear model from the sklearn library. We used argparse to parse our data, along with os to read data and pathlib to locate files.

Experiments

The beginning phase of our project included finding the appropriate data sets and sources. We understand that much of our data will and should be from the past decade. We planned on using heat maps to plot the areas where the density of LEED Buildings is the highest, along with corresponding cluster plots showing where student population is the greatest. Jay worked hard to compose the linear regression model, and create visualizations (below), and we manually label encoded the plots. He also cleaned the data, identifying the important features, removing duplicates, and arranging the information in appropriate dataframe form. The first visualization (Figure 1), plots the number of certifications on the y axis, and the year on the x axis. The red line represents the linear regression model, predicting the trend in certifications over time. Next, Figure 2 shows the different features, Construction, Validation, and Certification over time.

Conclusion

We found this project to be a good combination of data collection, interpretation, and analysis. Our main mission was to gain predictive insight on the growth of LEED building certifications in Massachusetts and determine what factors are influencing the rise in recognition for green buildings. One of our first challenges was getting the LEED Building Data in a workable format. Jay wrote the pre-processing steps required to read our initial LEED data. Later, however, we were able to acquire a cleaner text file that required less pre-processing. Jay wrote much of the Methodology section of or first project progress report, and Annie constructed most of our slides for the first class-presentation. He composed the linear regression module and created the first visualization. Annie's role in Python was updating the GitHub documentation, docstrings, comments, and formatting figures. After our first report, Annie found the data set reporting Massachusetts high school graduates attending college. Throughout the semester, it was difficult at times to collaborate and work on the project simultaneously, however, we believe we've both learned new information regarding data analytics in Python, and our project exemplifies the intended purpose. In the future, we can expand our project and go into greater detail with regard to the state of Massachusetts. The LEED data offered more than simply a date and certification level for each building, and if given the opportunity, we could analyze other factors such as type of building. Our process can also be replicated with other states or expanded to include the whole nation or whole world.

References

[1] *USGBC Home Page*, 2018. [Online]. Available: https://new.usgbc.org/. [Accessed: 11-Oct-2018].

[2] L. McCadden, "U.S. Green Building Council Releases Annual Top 10 States for LEED Green Building," *USGBC*, 25-Jan-2017. [Online]. Available: https://www.usgbc.org/articles/us-green-building-council-releases-annual-top-10-states-for-leed-green-building. [Accessed: 11-Oct-2018].

[3] "2015-16 Graduates Attending Institutions of Higher Education (District) - All Students - All Colleges and Universities," *2017 Report Card - Clinton Elementary (00640050)*. [Online]. Available: http://profiles.doe.mass.edu/statereport/gradsattendingcollege.aspx. [Accessed: 10-Dec-2018].
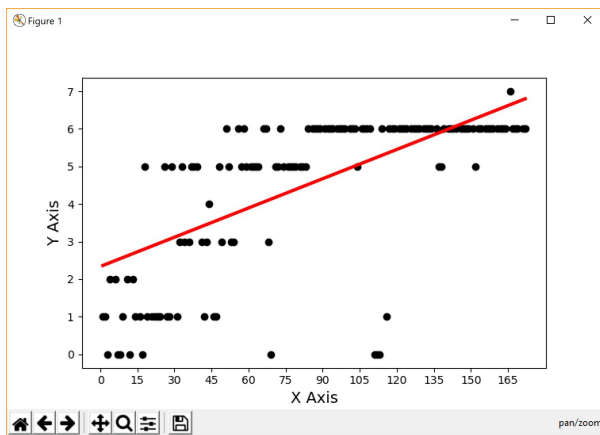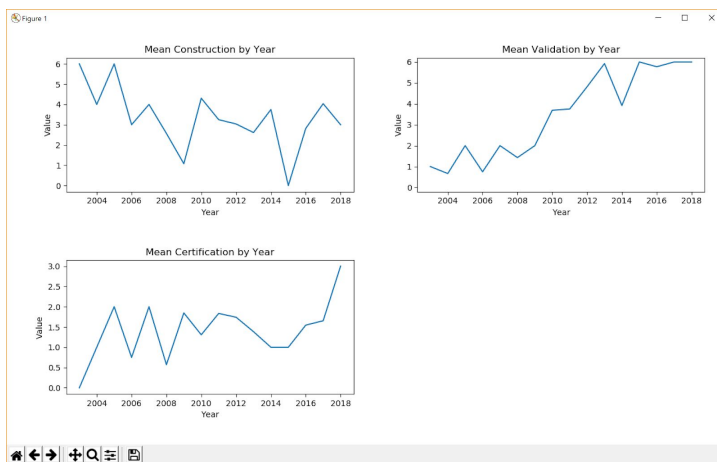
Appendix

Figure 1:

Figure 2:

GitHub Repository: https://github.com/annie-waye/2300-LEED-Project