Machine Learning Application on Urban Planning: A Case Study of Chicago's Downtown Parking Structures

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Project Context and Purpose:

Parking space planning is part of urban planning, a process of land usage design and regulation in the urban areas (Urban Planning, 2016). Urban planning concerns itself with both the development of open land and the revitalization of existing parts of the city, thereby involving both location selection of new parking structures and relocation of existing parking structures (Fainstein, n.d.).

Chicago is one of the biggest cities in the United State since it was founded in 1830. Prosperity often means crowded and expensive. In the past years, Chicago's parking rates have increased about 12 percent per year, compared with 4.4 percent for the country as a whole (Diesenhouse, 2007). Old buildings in downtown Chicago restrict the city's parking capacity, but the increasing number of vehicles requires more parking spaces. Therefore, this leads to an urgency in making effective and efficient urban planning for Chicago downtown's parking structures.

In my Capstone Project, I want to investigate solutions to the shortage of parking spaces in Chicago downtown. I am going use the area aside Michigan Avenue as a case study because the Michigan Avenue is the busiest street in Chicago's downtown and faces the most severe crisis in parking space shortage. I will use machine learning to analyze the parking shortage issue. Machine learning is a methodology that applies computing algorithms to analyze sample data to achieve certain goals. I will use two methods, hot spot analysis and linear regression (Matijosaitiene, McDowald, Juneja, 2019) to predict and visualize outcomes from machine learning. Hot spot analysis is a method that treats each parking structure as a hot spot and analyzes its coverage and

capacity. Linear regression is a math model that can predict location selection of future parking facilities.

I am going to load the traffic data near Michigan Avenue based on time for the traffic pattern. I am also going to load the parking data, including the location and capacity of parking facilities and road parking spaces, so that I could have a geographic dataset that indicates coverage of each parking spot. To model parking in the Michigan Avenue area, I am going to apply machine learning techniques to simulate the parking flow based on the traffic data and geographic parking data. Results of the modeling would show the insufficiency of parking spaces in both time-based and space-based.

From the space-based simulation, I would like to discuss where potential choices of building new parking facilities are and how big the parking facilities are. I would also discuss the potential relocation or expansion of current parking facilities based on this simulation. From the time-based simulation, I would like to discuss the effectiveness of parking facilities. Take the case study of the Michigan Avenue as an example, I may want to consider enable some of the parking permit zone nearby during that time because some of the parking facilities is overloaded for some period of time.

I would bring my background in computer science and past experiences in data analysis into the construction business with this research on urban parking planning. I believe the usage of technology like machine learning will increase both the accuracy and efficiency of parking facilities' planning and construction.

For the traffic data, I will get it from the Chicago government's dataset (Chicago Metropolitan Agency for Planning). For the data of parking permit zones along the road, I will get it from the Chicago government's data portal (Chicago Data Portal). I will also

use records from some of the parking facilities' websites. In addition, I would also need to find out vacant buildings or spaces by looking through the city's records.

This study will show the significance of machine learning and data analysis techniques in urban planning. Results of the study may potentially support Chicago government's future decision-making and facilitate sustainable parking planning (Matijosaitiene, McDowald, Juneja, 2019). I am also a driver in Chicago and suffer from the poor parking situation in downtown Chicago; thus, I want to contribute to changing this situation.

Proposed Table of Contents:

Proposed Timeline:

July 11 – Write first two chapters of Capstone Report

July 25 – Send first two chapters of the Capstone Report to my writing mentor

August 1 – Meet with writing mentor about chapters one and two

Make changes to chapters one and two

August 8 – Start writing chapters three and four

August 22 – Send chapters three and four to my writing mentor

September 8 – Meet with writing mentor about chapters three and four

Make changes to chapters three and four

September 15 – Start writing chapter five

September 29 – Send chapter five to writing mentor

October 12 – Meet with writing mentor about chapter five

Make changes to chapter five

October 26 – Send complete draft of Capstone Report to writing mentor

November 3 – Meet with writing mentor and make changes to final draft

November 8 – Submit final draft of Capstone Report

November 14 – Give Final Presentation

November 18 – Incorporate final suggestions and submit final bound copy

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Fainstein, S. (n.d.). *Urban planning | Definition, History, Examples, Importance, & Facts*. Encyclopedia Britannica. Retrieved October 26, 2021, from https://www.britannica.com/topic/urban-planning

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