

CHAPTER 1

INTRODUCTION

1.1 Problem Background

Urban greens, including trees, shrubs, and associated vegetation in cities, have long been recognized for their importance in the urban environment. In fact, there have been countless studies in recent years reiterating the instrumental importance of urban forests or trees in lowering urban temperatures and creating more comfortable microclimates (Pauliet, 2003; Schwaab, 2021), providing physical and mental health benefits (Lee, 2010), etc. making the urban areas more livable for its inhabitants.

Unfortunately, there are hardly any regulations guiding the management of urban greens in Malaysia. The Malaysian urban landscape planning practices are mostly based only on open space coverage (Rusli and Rudin, 2010). For instance, under the National Urbanization Policy (NUP), two hectares of open space per 1000 urban population were set as the planning standard and a minimum of 10% or 0.2 hectares of open spaces are dedicated for all development (NUP9.ii). While open spaces are an essential part of urban greens, this single variable on itself is not enough to provide comprehensive data to inform planning that can optimize the experience of the places' inhabitants.

Along with the increase in global awareness on the importance in urban green spaces, urban green space is increasingly seen as an integral part of cities planning (James, 2009), fueling the growth of research in this field. According to the systemic review based on PRISMA framework by Rajoo et. al. (2021), there is a growing trend in research articles concerning urban forests in Malaysia from 2007 onwards. Out of the 43 records reviewed, only 4 of them were focused on the spatial analysis of urban green space (Kanniah, 2017; Masum et. Al., 2017; Kasim et. Al., 2019, Nor et. Al., 2019). This shows an untapped opportunity where the spatial analysis on urban green coverage in Malaysia can be investigated.

Nevertheless, all of the spatial studies are based on macro-scale aerial views, making them not representative of the human experience on the ground level on the day-to-day micro level. While these studies are essential, they are not able to relate to the direct human user perspectives when they are in the city. In other words, satellite imagery is useful for high level planning of preservation and restoration, but not informative for the environmental design of the everyday human experience.

It is long overdue that we adopt better metrics to measure urban greeneries coverage that can allow us to integrate urban green into our daily experience in the Malaysian urban environment.

1.2 Problem Statement

In this study, we try to tackle the problem by measuring and mapping urban green in a Malaysian city to analyze its coverage from the eyes of the users. In other words, this study measures: “how much greeneries can people in a Malaysian city see?”

The quantified study of the urban users’ views is made possible by the establishment of Green View Index (GVI), which makes use of street view images and detects the proportion of greeneries in the images collected. While the study is limited to the street views, the studies and information extracted remain to be highly informative for planners as the streets are the public space with the most human activity.

Nevertheless, there are several challenges to overcome in the study, which lead to our research questions.

1.3 Research Questions

The questions that this research attempts to answer are:

1. How do we collect the large amount of street view data required as raw data and study the urban green coverage?
2. Given the large amount of street view images, what kind of learning algorithms can we use to predict GVI efficiently?
3. How do we interpret and analyze the predicted GVI and make it informative for the urban planning process?

1.4 Aim and Objectives

The aim of this project is to visualize the state of urban green coverage in Malaysian city from the users' perspective with Green View Index (GVI). Dashboard is developed as the final output that allows us to interpret the findings intuitively. Objectives of this research are as follow:

1. To collect and process street view images data to measure urban green coverage from the perspective of human users.
2. To compute GVI effectively from street view images with Pixel Segmentation and supervised machine learning models.
3. To develop a dashboard to visualize the estimated GVI of selected sites and assess the distribution of green views in Malaysian city.

1.5 Scope of Study

Due to limitations in time and resources, a smaller scope in Johor Bahru city center is chosen as a representative sample site for this study. It is chosen due to it being the central hub of Johor Bahru with a high population density. As there are no official boundaries demarcating the Johor Bahru city center area, local experience is used to help formulate the definition of city center area. In this case, the main road *Jalan Lingkar Dalam* acts as the edge of the city center.

Meanwhile, the street views images used to compute GVI are collected in December 2022 from the Street View API provided by Google Maps due to its availability and accessibility. As the site has a nearly eclipse outline, the actual boundary of the studied site is approximated by a circle to facilitate the function of Google Maps. With several experimentations, the sample site is set to be a circle with a 1000m radius from the *Komtar JBCC*.

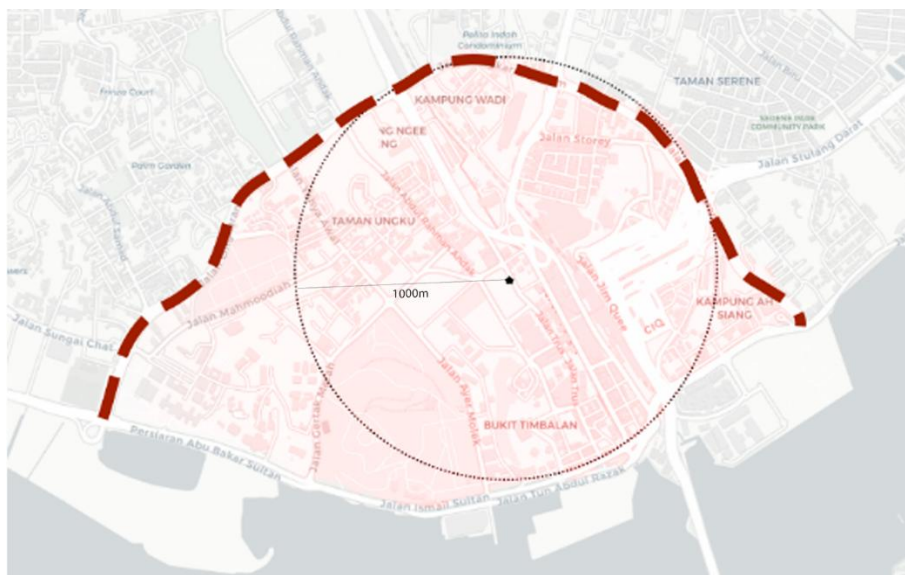


Figure 1.1 Site plan boundary.

1.6 Significance of Study

The project is expected to provide comprehensive insights on the urban green coverage from users' perspectives measured by GVI in Johor Bahru city centre. This information will be

useful to discover the state of urban green coverage in a Malaysian city and inform the process of urban planning of the said area, while also shining some light on the conditions of the other similar urban areas in Malaysia.

Besides, this study also seeks to compare various existing methods used to compute Green View Index (GVI) to find out the most accurate methods for the task.

1.7 Project Organization

The project is laid out in 5 chapters, in the first chapter we go through the introduction to the problem background and statement, research questions and objectives, along with the scope to establish the framework of study. In Chapter 2, extensive literature review is done to understand the state of urban greeneries research in Malaysia, the use of GVI and the methods used to compute GVI. Several methods are reviewed, and their respective evaluation metrics are explored. In Chapter 3, detailed methodology for the project procedure is established, from data preparation to model development and evaluation, and lastly reporting. Chapter 4 cover initial findings about GVI in the study site. Chapter 5 concludes the project with its achievements, limitations and how it can be improved.