CHAPTER 5

CONCLUSION

5.1 Contribution

In evaluating multiple models for Green View Index (GVI) prediction, i.e. pixel segmentation, DCNN model, and DeepLabV3+ model, this study provides valuable insights into the accuracy, inference time, and potential biases associated with each approach. With information on the performance of these methods, urban planners can select the most appropriate model for GVI prediction based on specific requirements and constraints.

The predicted GVI in selected site, Johor Bahru city center is clustered and analysed to reveal distinct patterns and trends within the GVI data. These clusters represent categories based on predicted GVI ranges, generating invaluable insights of green views across the city center, thereby contributing to inform appropriate solutions to optimize it. The interactive dashboard developed as part of this project allows stakeholders and urban planners to visualize and explore these clusters, gaining a deeper understanding of the spatial distribution of green spaces.

In short, this project offers a comprehensive understanding of the current state of green views in the Johor Bahru city center. The findings provide valuable guidance for urban planners in optimizing green space allocation, identifying areas in need of improvement, and promoting sustainable and user-friendly urban environments. The experience and insights generated from this project can be generalized to understand the state of urban green coverage in other cities in Malaysia.

5.2 Limitations of Project

In this project, we have visualized the GVI values in Johor Bahru city center that enables future research. Nonetheless, it also comes with several limitations.

Firstly, the scope of the project is too small. As the current project only covers a radius of 1000m, it only includes a very small part in Johor Bahru. The small scope does not allow us to uncover more patterns that can further inform urban planning. Besides, due to the limitations of Google API, the range of the study site is set to be a circle with constant radius. This arbitrary site boundary does not allow for more nuanced analysis on factors that can result in differences of GVI, e.g., local governance, zoning, socioeconomic level of the site, etc. A larger study site in GIS can be used to conduct more comprehensive study on a larger scale. Complementary information such as zoning and socioeconomic levels can be juxtaposed to the GVI of site to extract insights for urban planning.

Regarding the sampling process, there is an important limitation too. As the GSV images are retrieved by random coordinates within the set site boundary, the sampling does not consider the distance between sampling points. This method is suboptimal as it can either (1) not cover the study site adequately for comprehensive analysis or (2) taking too many samples at similar points which results in bias. This can be optimized by integrating GIS information consisting of street information and setting constraints such as distances between sampling points on the same street to be within a particular range.

For the calculation of GVI, the limitation lies in the variation of target data as they are created by manually tracing vegetation in Photoshop. This can introduce a lot of noise and bias for the model developed for GVI computation, which is especially so when we try to scale up and include more data. This can be improved by establishing a rigorous selection method to follow when manually selecting vegetation. As GVI is point data, they can be aggregated to produce a weighted mean GVI of an area to make them more interpretable for the stakeholders.

As for explorative analysis on each cluster, they are mostly qualitative instead of quantitative due to the complexity of retrieving relevant layers of data such as zoning of site, road width and length in digital format. Due to the lack of extra layers of data, it is difficult to

carry out quantitative study on how GVI distribution relates to other features. This has significantly limited the comprehensiveness of the quantitative elements in this study.

In conclusion, there are multiple limitations in terms of the scope of study, sampling methods, model development for GVI calculation and clustering analysis that can be improved in further studies.

5.3 Future Improvements

Based on the limitations established, several improvements can be made in the further development of the project. Firstly, a larger site can be used to uncover more patterns and contexts behind distribution of GVI. Second, a GIS model including street information can be used to optimize the sampling method by setting the minimum and maximum distance between sampling locations, thereby reducing bias introduced. Thirdly, a more rigorous and formal process for ground truth generation when masking greeneries manually will be established to reduce the man-made variation. Finally, more features should be included in the study to increase the comprehensiveness of the study of GVI, e.g. road width, estate price, zoning, etc.