

Using Hong Kong and Singapore as Models for Efficient Public Transportation Networks

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Our Team

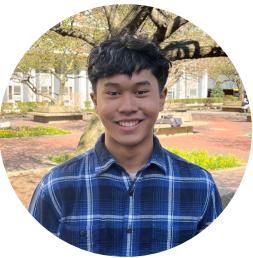


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Agenda

Executive Summary

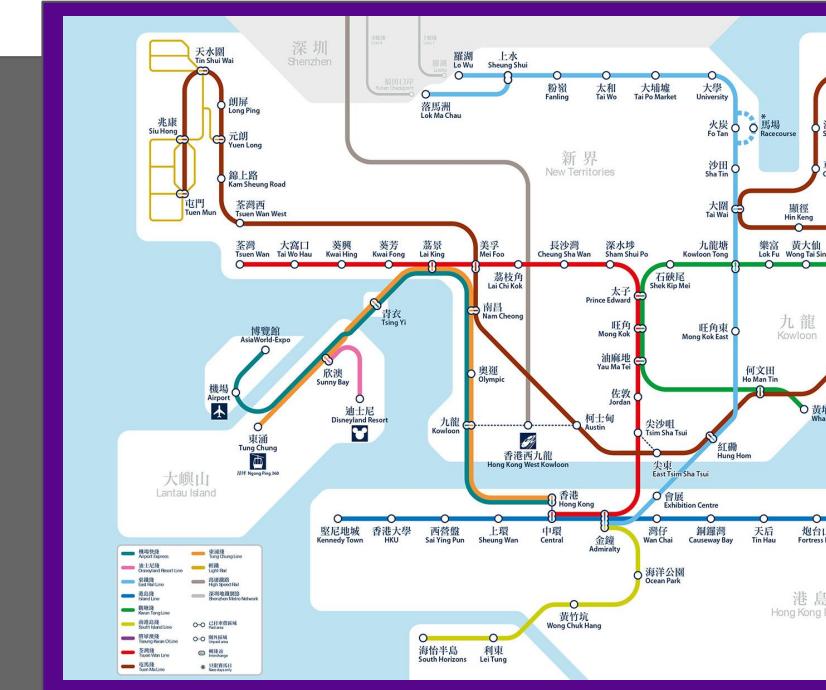
Methodology

Analysis and Conclusions

Applying Results

Concerns & Next Steps

Appendix & Sources Cited





Executive Summary

Background

Globally, only **one in two urban citizens have convenient access to public transportation**. As a result, combined with a global trend towards car-centric infrastructure, much of the world's population is either **left without a means of mobility** or **forced to use a car**, a leading contributor to carbon emissions.

The **resiliency** of our world's cities in the face of rising climate and inequality issues depends on the **proliferation of efficient, effective, and convenient public transport networks**.

Problem

How can urban planners in the world's largest cities best use **data-driven insights to direct the expansion** of their cities' public transport networks? The solution must address those **factors which largely drive utilization** of public transport in order to ensure an **efficient, effective, and convenient** network.

Our Plan

Identify cities with efficient public transportation networks



Determine factors that lead to use of public transportation / placement of points of access to network



Develop model to predict location of points of access based on determined factors



Apply model to cities with weak public transportation networks

Methodology

Why Hong Kong and Singapore?



Highly-Ranked

- HK and Singapore are ranked **1st and 4th** in the Oliver-Wyman Urban Mobility Readiness Index for Public Transport as well as **1st and 2nd** in the McKinsey Urban Transportation Systems report.



Data Availability

- Data is **readily available** for these cities and at a **large enough resolution**
- The Singapore government has a **robust statistical department**
- Both have datasets collected at a **city level rather than at a regional level** due to their status as autonomous or independent cities



High Ridership

- The HK and Singapore public transport networks are among the most used in the world
- HK: **88%** of daily trips are via public transport¹
- Singapore: **60%** of daily trips to work are via public transport²
- High ridership points to **efficiency, effectiveness, and convenience** of network

Methodology

What Explanatory Factors and Why?

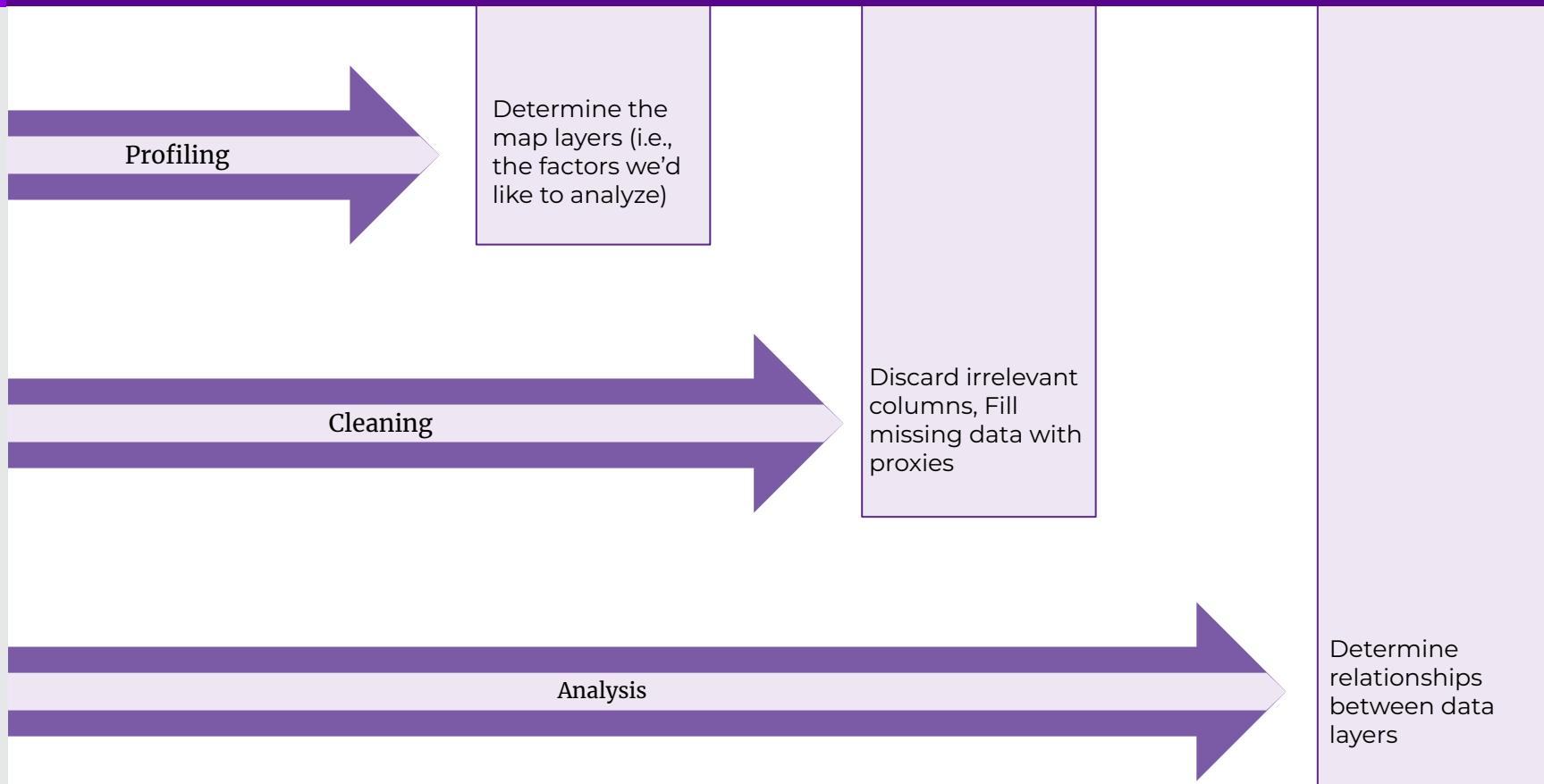
These are the factors that we believe to be correlated with locations of points of access to public transportation networks



Accessibility to Public Transportation Network

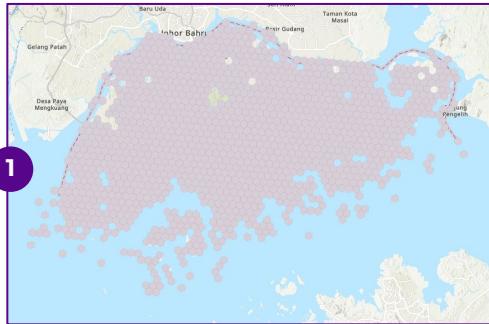
Methodology

Data Processing Framework

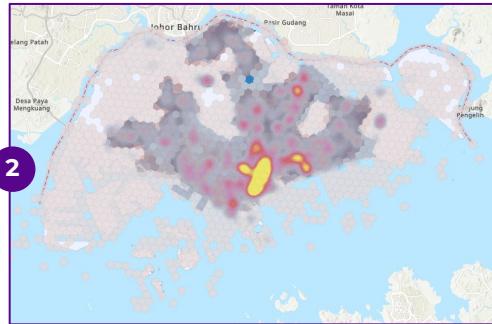


Methodology

Our Analysis

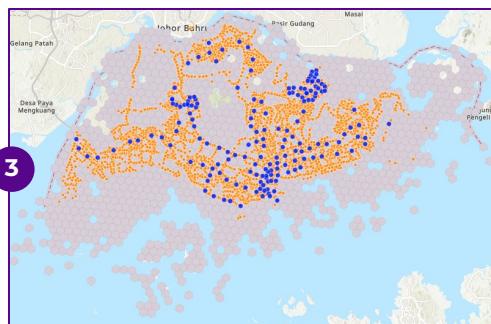


1
Subdivide Singapore into H3 Index areas of resolution 8



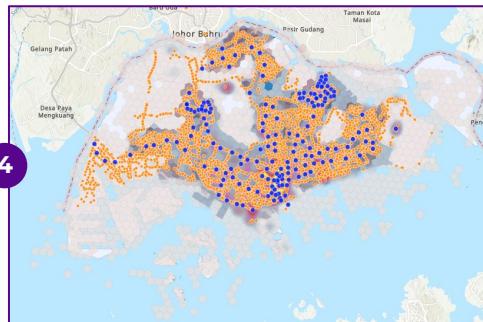
2

Assign values to index areas representing income level, population, and number of points of interest



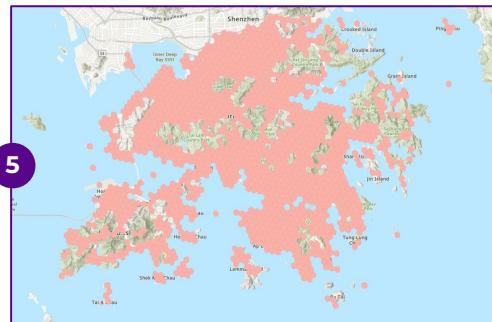
3

Assign values to index areas representing access to public transport (i.e. bus and metro stops nearby)



4

Build model to determine relationship between explanatory variables and access to public transport. Nearby Metro stations are weighted 11x higher than bus stops



5

Repeat process for Hong Kong and combine results

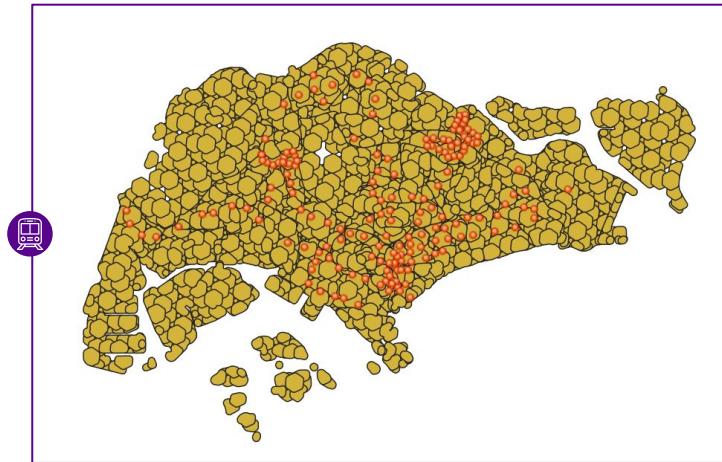


6

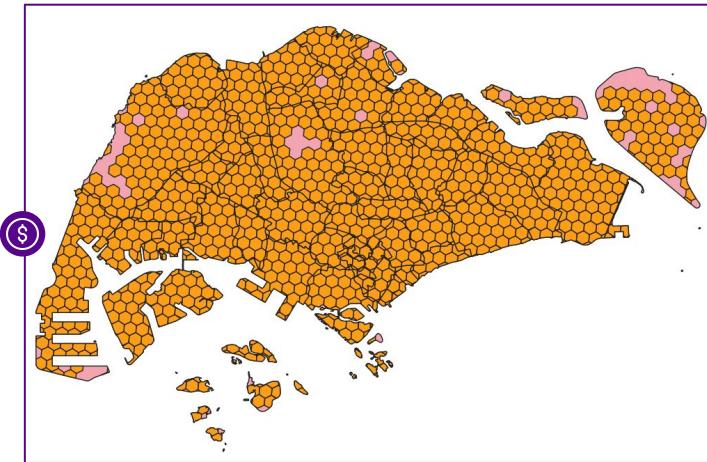
Apply model to chosen city -> Jakarta

Methodology

Specific Points of Note



Buffer layer of 300m to calculate number of **easily accessible** subway stations for each H3 index. Take largest count per H3 index as measure of accessible stations.



Calculate intersection of H3 hexes with city's subdivisions. Use area to measure **weighted average of median income** in H3 index.

Conclusions from Analysis

1

Points of interest are positively correlated with access to public transportation

2

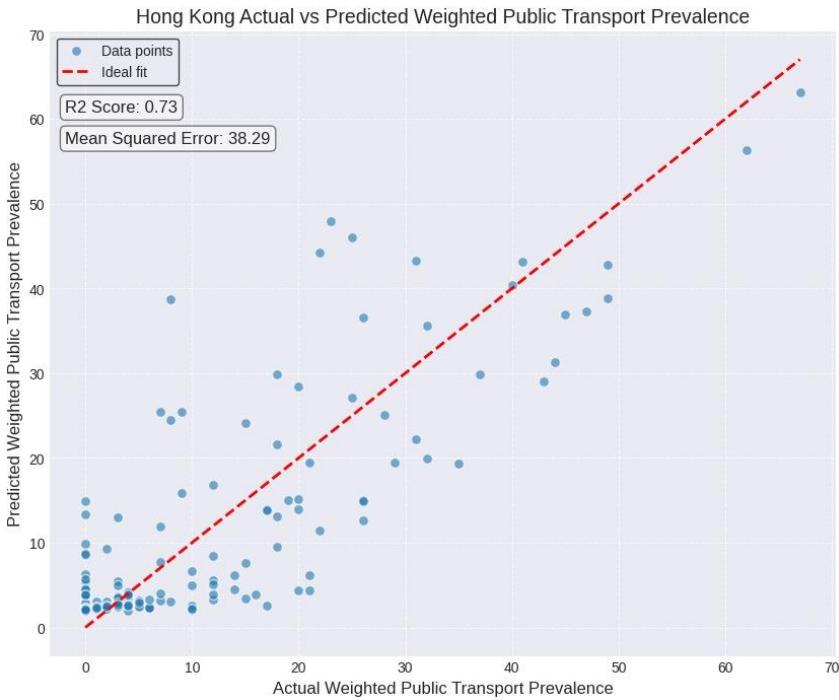
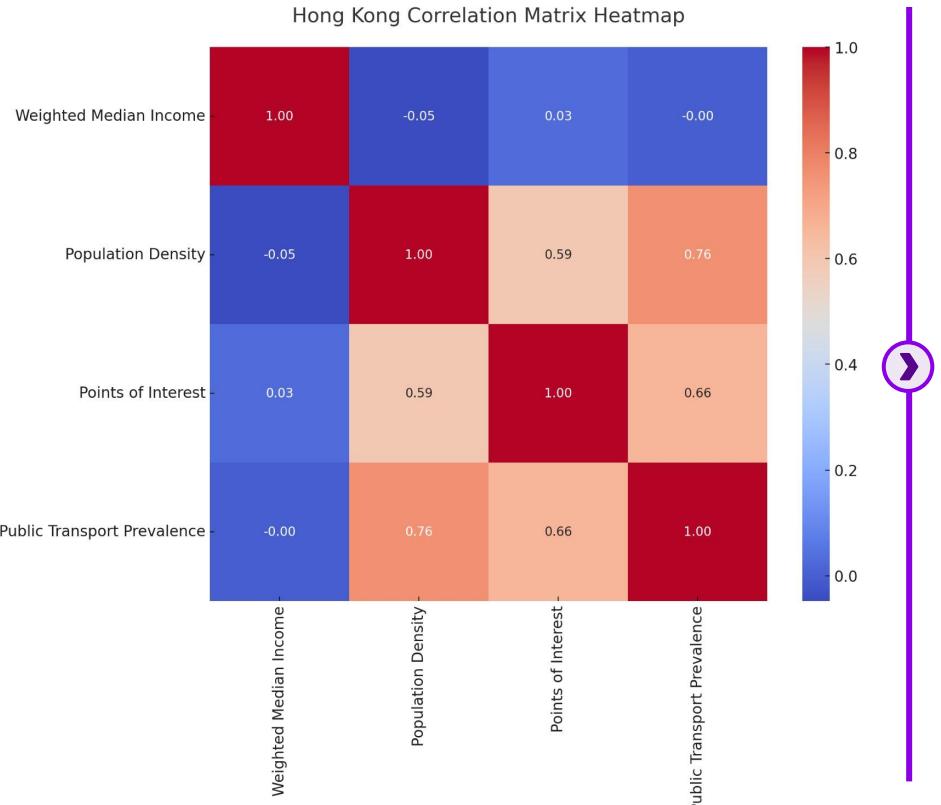
Income level of an area is not correlated with access to public transportation

3

Population density is positively correlated with access to public transportation

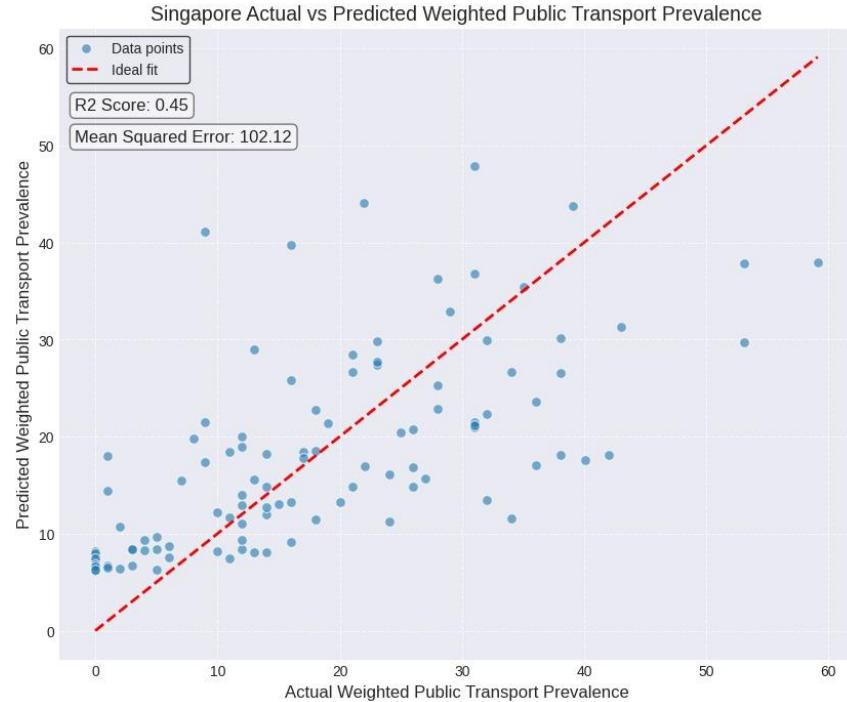
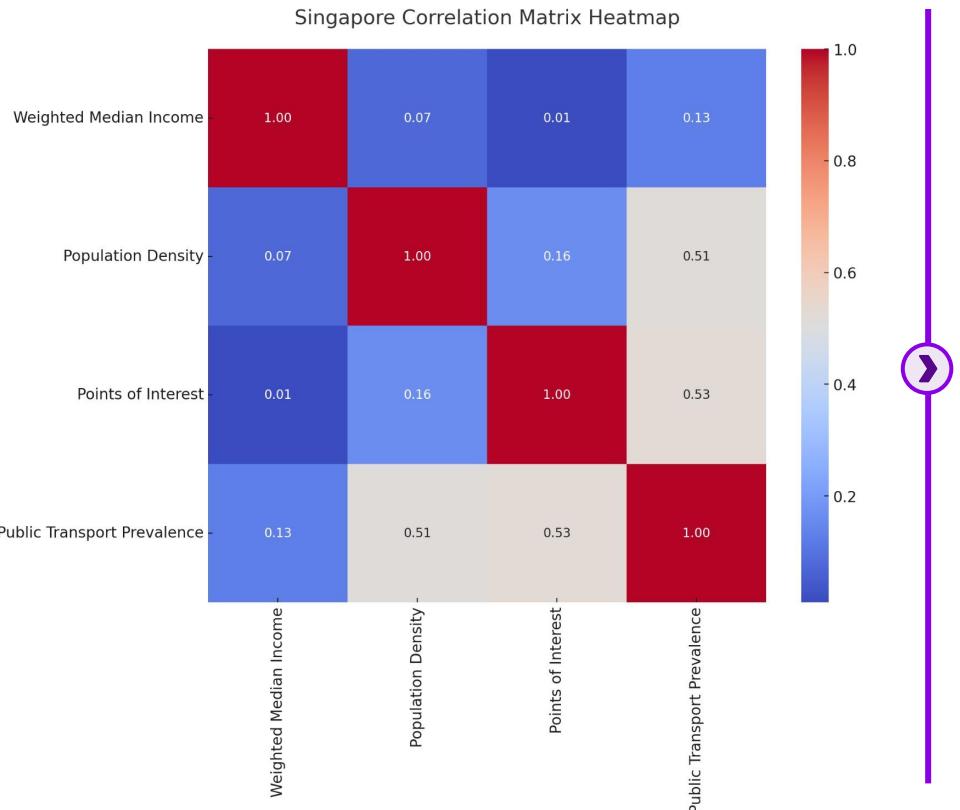
Data Visualization

Hong Kong



Data Visualization

Singapore



Application

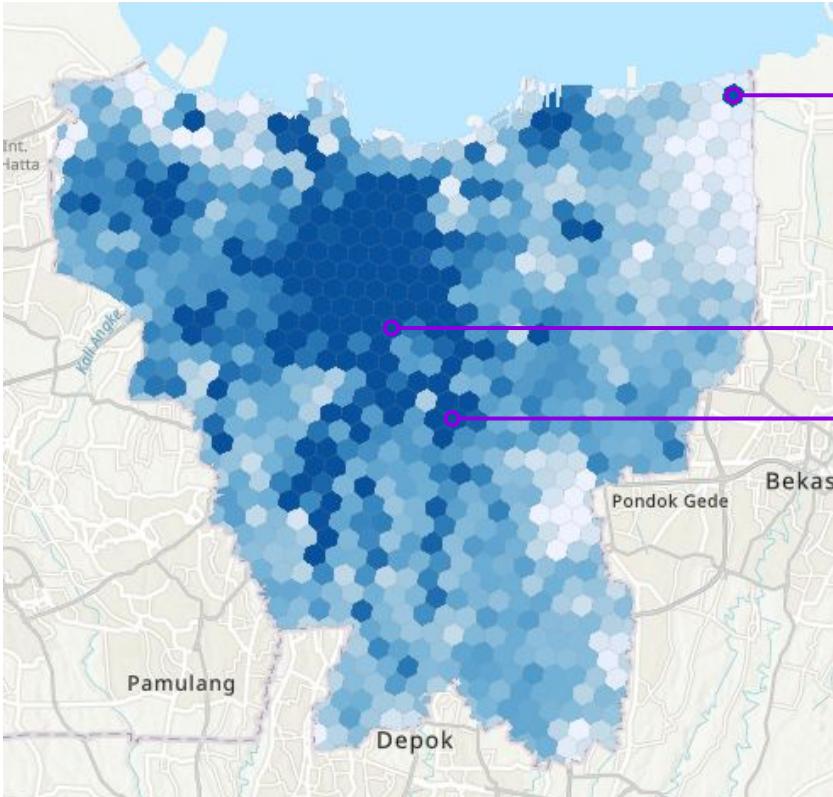
Jakarta

Ranked 38/60 in
Oliver-Wyman
Urban Mobility
Readiness Index
for Public
Transport

Currently facing
huge issues as a
result of poor
infrastructure
and climate
change

Personal
connection of
members to city

Map of Jakarta with Predicted Density of Points of Access to Public Transport Networks



- STIP: Government Maritime University Model predicted points of access: **11.60**

- Bundaran Hi: Monument located in Central Jakarta Model predicted points of access: **13.42**

- Location in Tebet: Most densely populated district in South Jakarta Model predicted points of access: **8.96**

Note: Distance from city center was used as a proxy for income level due to lack of dataset availability. Based on study: Spatial Sorting of Rich Versus Poor People in Jakarta

Concerns and Next Steps

Concern 1: Statistical Power

Using data from only two cities to build a model could lead to limited and imprecise conclusions



Next Step: More Cities

Identify more cities with efficient public transport networks to add to data for model

Concern 2: Poor Data Quality

Datasets were gathered from a variety of sources of differing qualities. In addition, Jakarta lacked a proper data set to model income distribution



Next Step: Find Better Data

Lack of restrictions on dataset choice means that we can use more complete and higher quality datasets in next steps

Concern 3: Feasibility

Model doesn't take into account geographic, social, and political factors which could impact feasibility of recommended points



Next Step: Feasibility Score

Find datasets to act as proxies for said factors to develop an aggregate feasibility score for each recommended point

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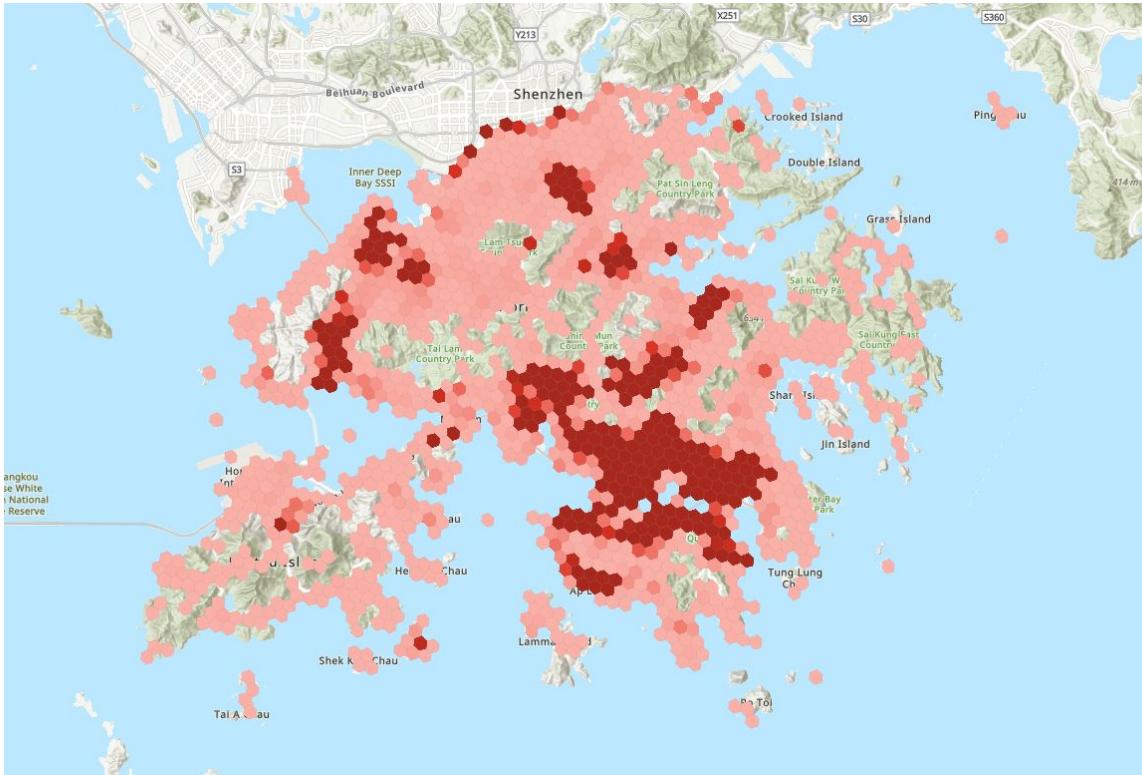
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Thank you!

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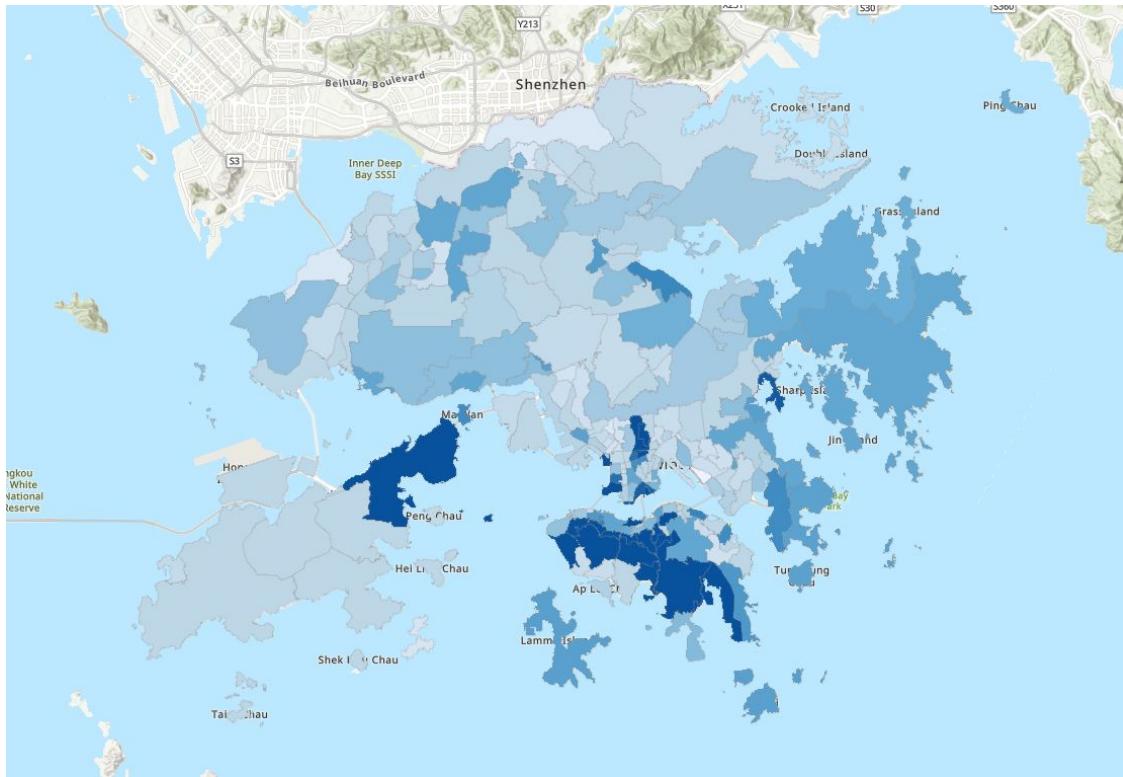
Appendix A

Population Density in HK



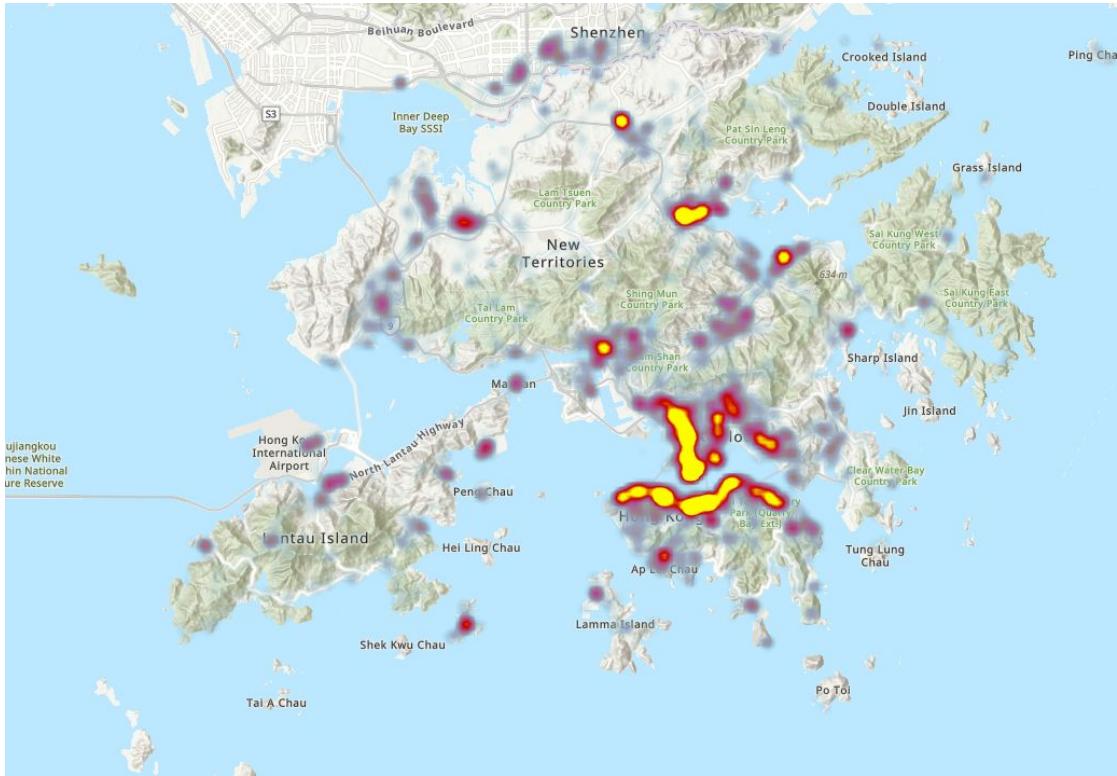
Appendix B

Income Distribution by HK TPU



Appendix C

Heatmap of POI in HK



Appendix D

MTR Stations in HK



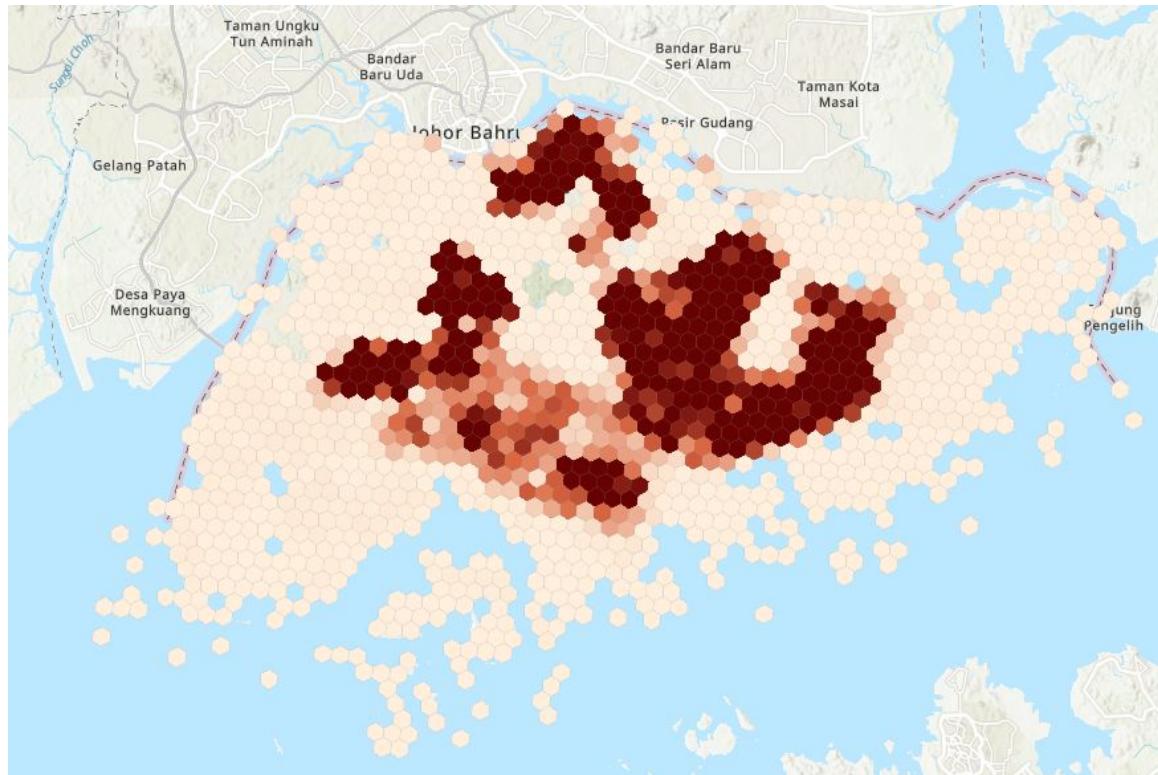
Appendix E

Bus Stops in HK



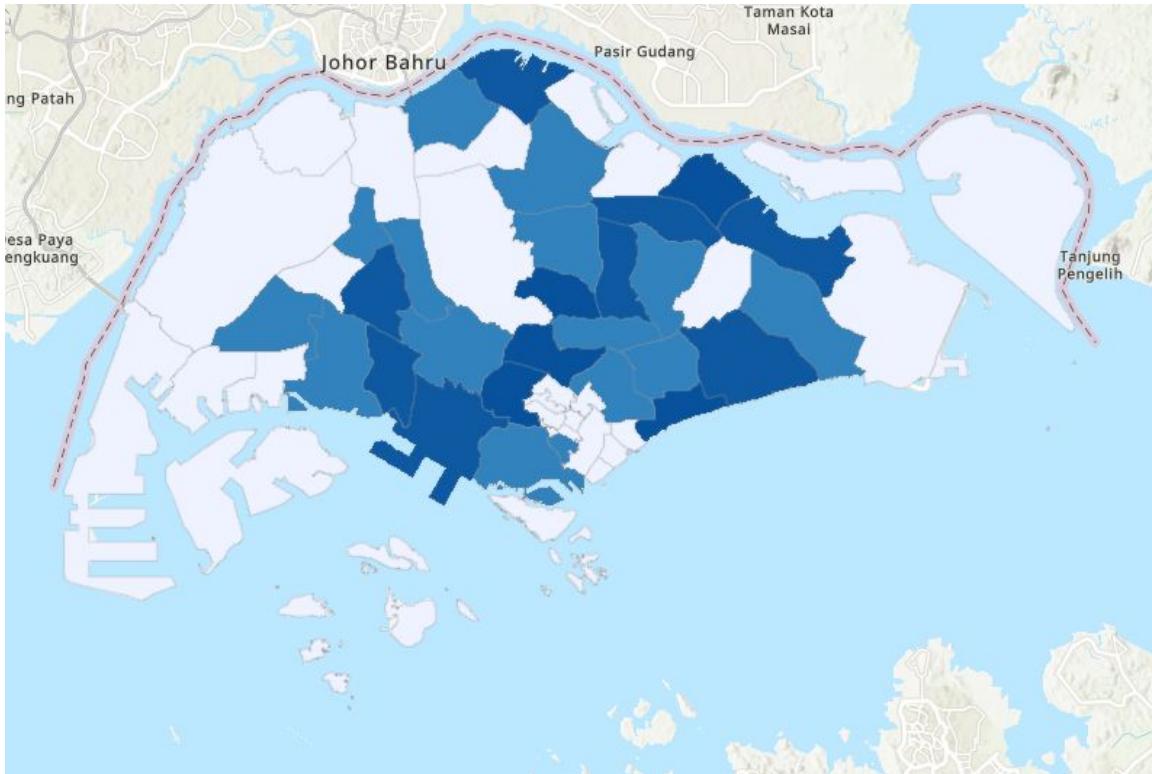
Appendix F

Population Density in Sg



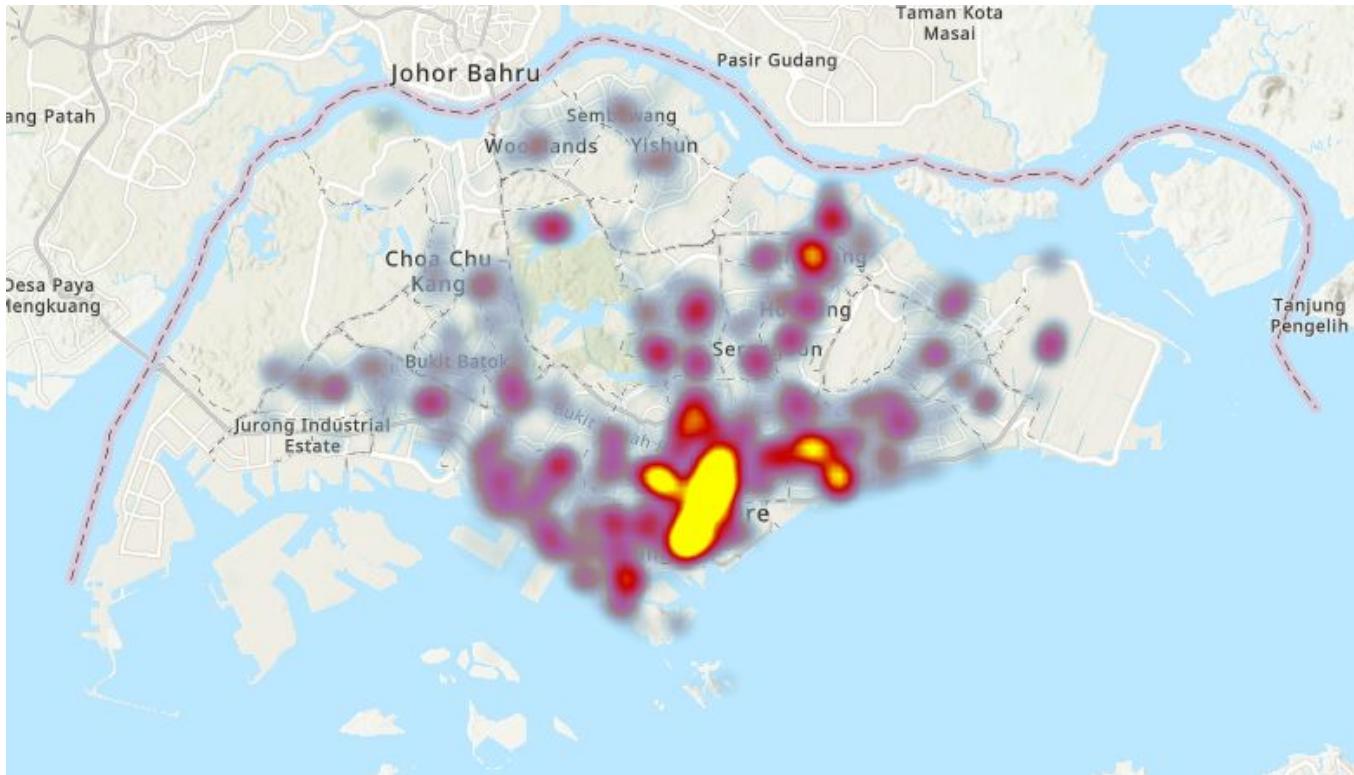
Appendix G

Income Distribution by Sg Planning District



Appendix H

Heatmap of POI in Sg



Appendix I

MRT Stations in Sg



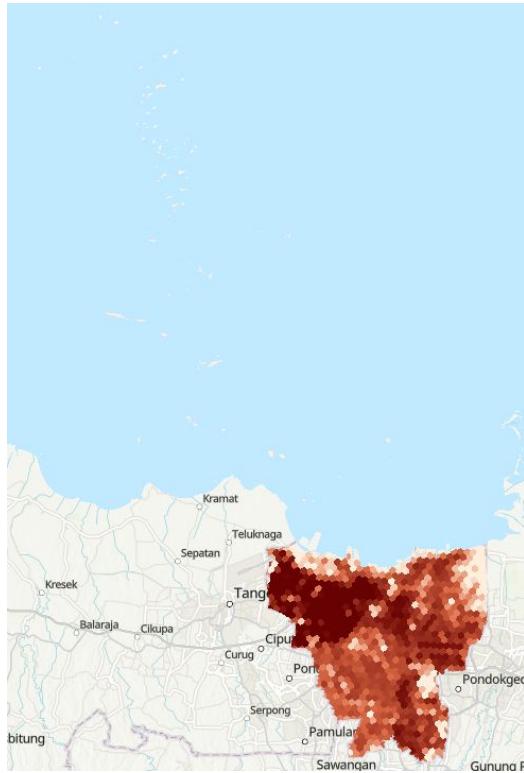
Appendix J

Bus Stops in Sg



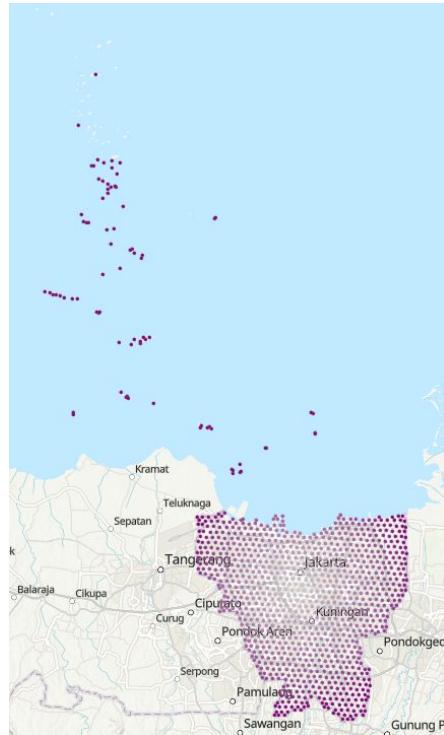
Appendix K

Population Density in Jakarta



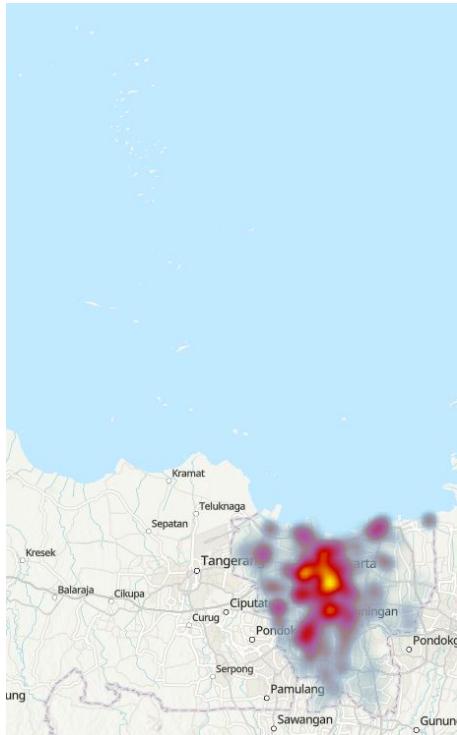
Appendix L

Income Distribution (Using distance from city center as proxy) in Jakarta



Appendix M

Heatmap of POI in Jakarta



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