



# AI FOR S.E.A.

We are looking for talented, innovative technologists to join our GrabFamily.



HELLO, WORLD. I'M

# Ira Oliver Fernando.

| ELECTRONICS ENGINEER | DEEP LEARNING ENTHUSIAST |

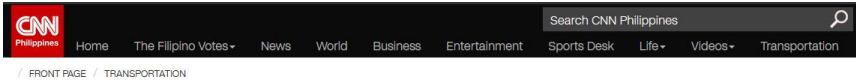
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# Manila





# Manila Traffic



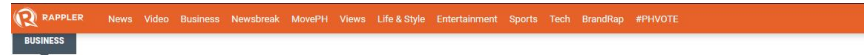
## PH loses ₱3.5B a day due to Metro Manila traffic – JICA

By CNN Philippines Staff

Updated Feb 23, 2018 12:21:00 AM



The Japan International Cooperation Agency (JICA) said the losses may go as high as ₱5.4 billion a day by 2035. (FILE PHOTO)

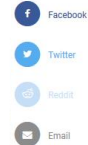


## Metro Manila has 3rd worst traffic in Southeast Asia – study

A study by the Boston Consulting Group shows Metro Manila motorists and commuters get stuck in traffic for an average of 66 minutes daily

Rappler.com

Published 8:30 PM, November 30, 2017  
Updated 8:30 PM, November 30, 2017



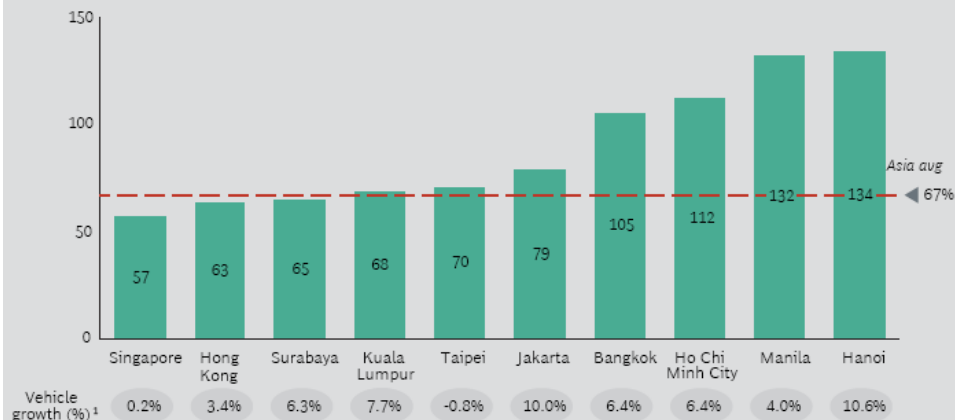
COMBINED EFFORT. Railway buildup alone may not be enough to alleviate Metro Manila's traffic congestion, according to the Boston Consulting Group. File photo by Romeo Gacad/AFP



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**EXHIBIT III: Peak hour congestion (% additional time to travel in peak hours)**



1. From 2011-2016 where data available from published government statistics 2. Peak hours defined as 7-9am, 6-8pm

Note: Asia average taken from average of East Asian cities based on TomTom traffic index

Source: TomTom traffic index; Google API; Uber; Government statistics; BCG analysis

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Providence Tower KTV Videoke, Provide

Venice Grand Canal Mall, 28 Upper Mck

Add destination

Leave now

OPTIONS

Send directions to your phone

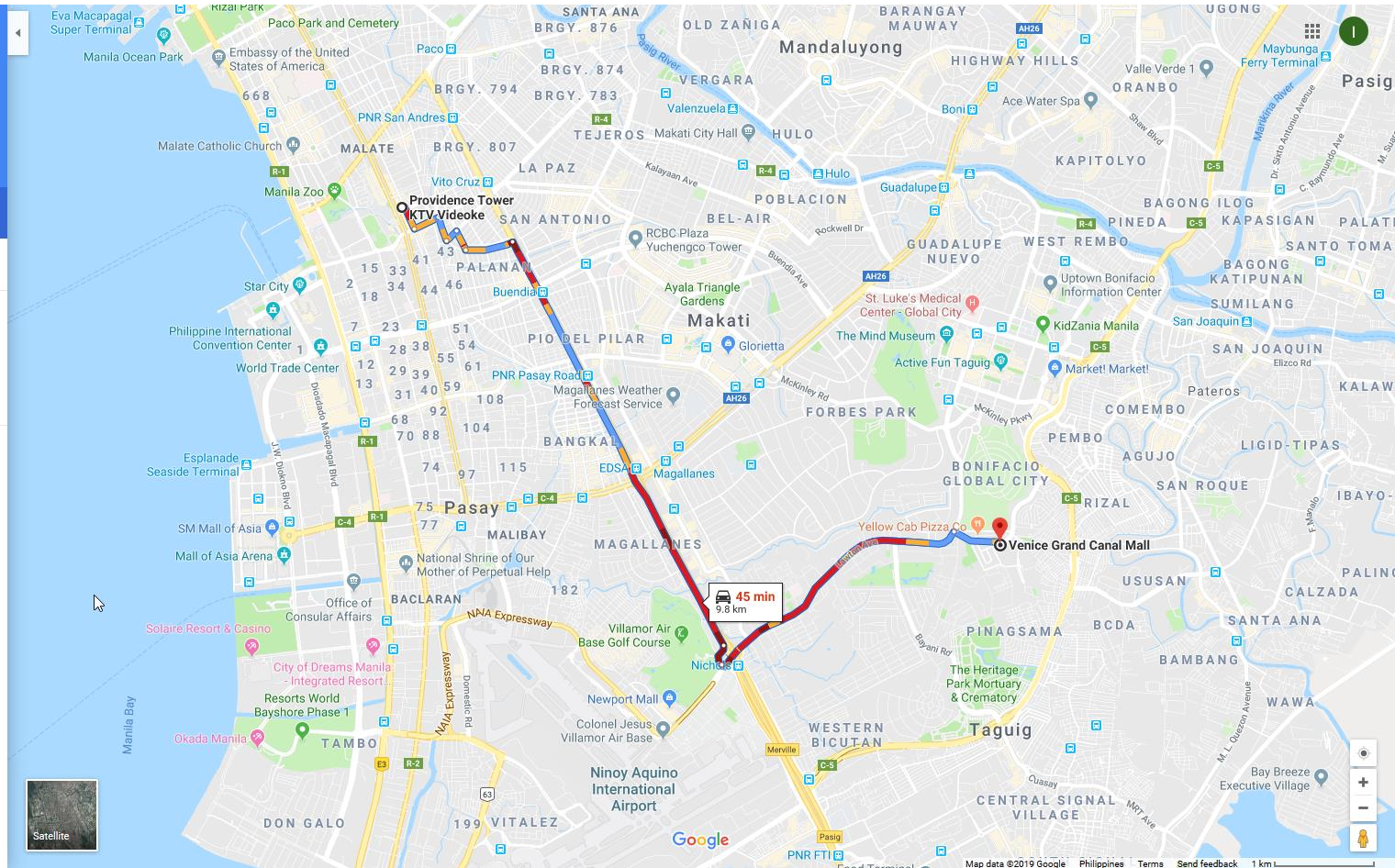
via S Luzon Expy/Osmeña Hwy/R-3 and Lawton Ave

45 min

9.8 km

Fastest route, despite much heavier traffic than usual

DETAILS



Changi Beach Park, Nicoll Dr, Singapore

Tuas Checkpoint Viaduct, Singapore

Add destination

Leave now

OPTIONS

Send directions to your phone

via PIE

Fastest route now due to traffic conditions

This route has tolls.

DETAILS

49 min

50.9 km

via AYE

Slower traffic than usual

52 min

54.1 km

via PIE and AYE

Slower traffic than usual

53 min

51.4 km

The map shows a route from Tuas Checkpoint Viaduct to Changi Beach Park. The route is highlighted in blue. Key landmarks and roads along the route include:

- Tuas Checkpoint Viaduct
- Spore Discovery Centre
- Jurong West Jurong Bird Park
- Jurong East
- Boon Lay
- Nanyang Technological University
- Chinese Garden
- Sungei Buloh Wetland Reserve
- Woodlands Waterfront Park
- Sembawang Park
- Punggol Waterway Park
- Paya Lebar Air Base
- Changi Airport Singapore
- Changi Beach Park

The map also shows the surrounding area, including the Straits of Johor, Singapore Strait, and various islands like Jurong Island, Sentosa, and Pulau Ubin. The map is powered by Google and includes a satellite view option.

Map data ©2019 Google Philippines Terms Send feedback 2 km

# Problem

- Alternate transport infrastructure still developing.
- Heavy reliance on road based transport due to lack of alternatives.
- Leads to heavy congestions on peak hours.
- Costs is not just economic but also affects quality of life.





# Solution

Use data and AI to come up with ways to improve the traffic situation.



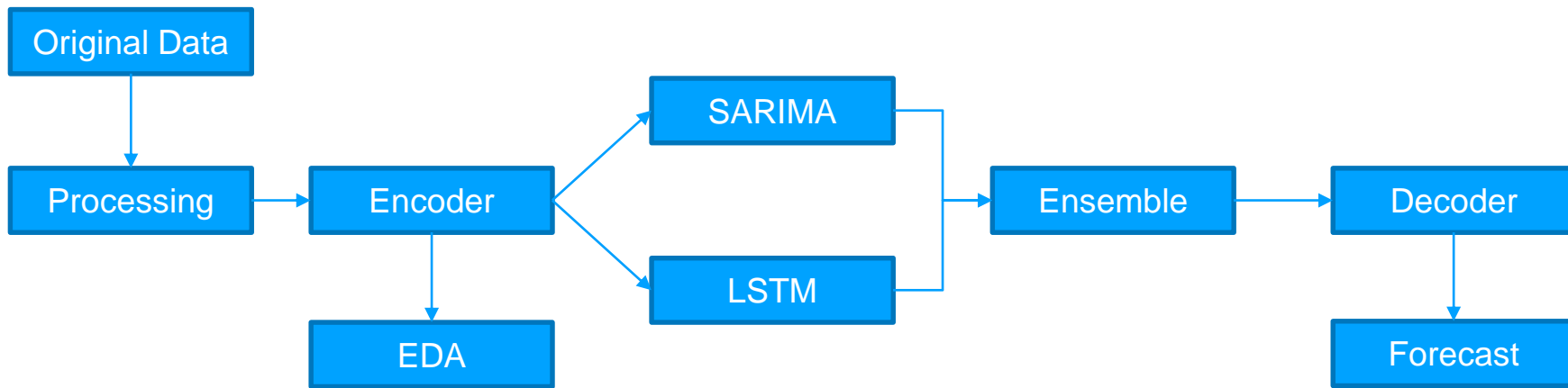
# Approach

## Split the solution into two parts:

1. Explore the data to check if there are patterns in the demand and traffic.
2. Create a model that can allow us to forecast demand and optimize operations accordingly.



# Flowchart





# Solution



# Solution

## Data Processing:

- Add time features: hour, minute, day, month, year and time stamps.
- Add location features: geohash6 encoding, latitude and longitude.
- Pivot the table (timestamp by location), preparation for time series forecasting.



# Solution

## Exploratory Data Analysis



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# EDA

## Temporal Analysis

- FB Prophet
- Seasonal Decomposition

## Spatial Analysis

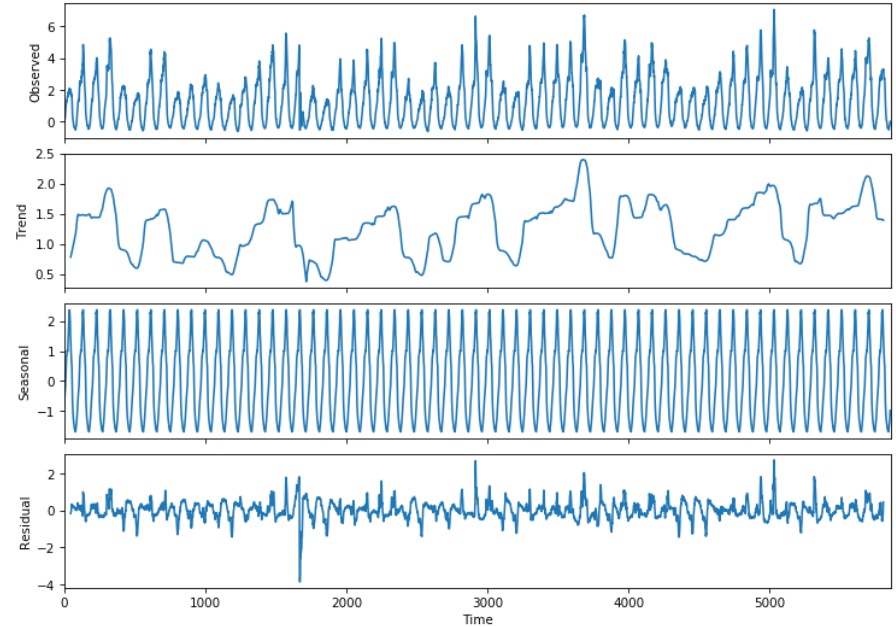
- Heatmap



# EDA (Temporal)

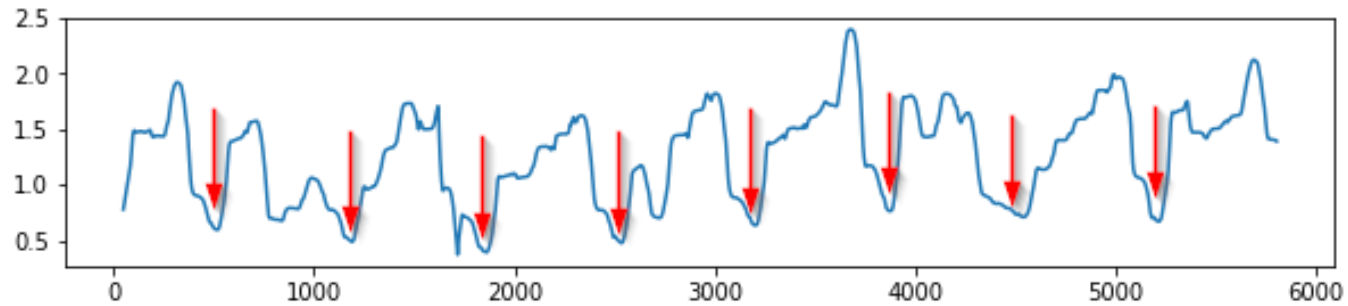
## Seasonal Decomposition

- Encoded data
- Demand level for the entire “City”.



# EDA (Temporal)

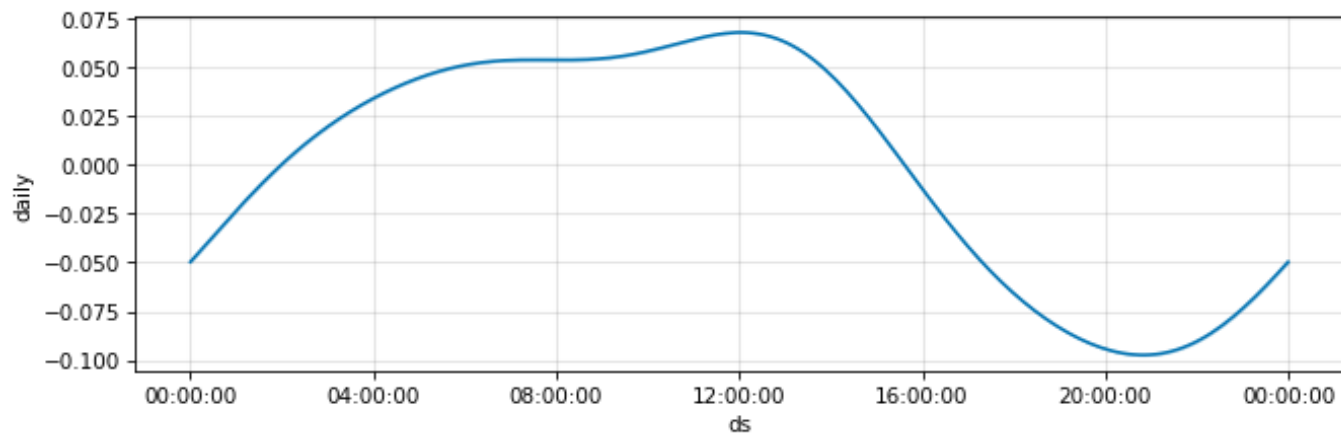
## Weekly Pattern





# EDA (Temporal)

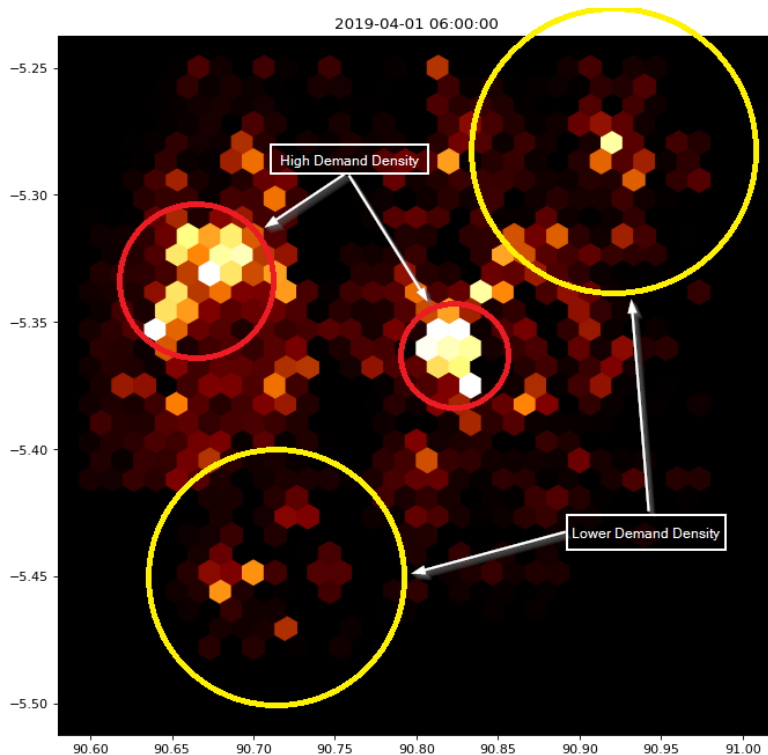
## Daily Pattern



# EDA (Spatial)

## Heatmap

- Areas of interests
- High risk areas

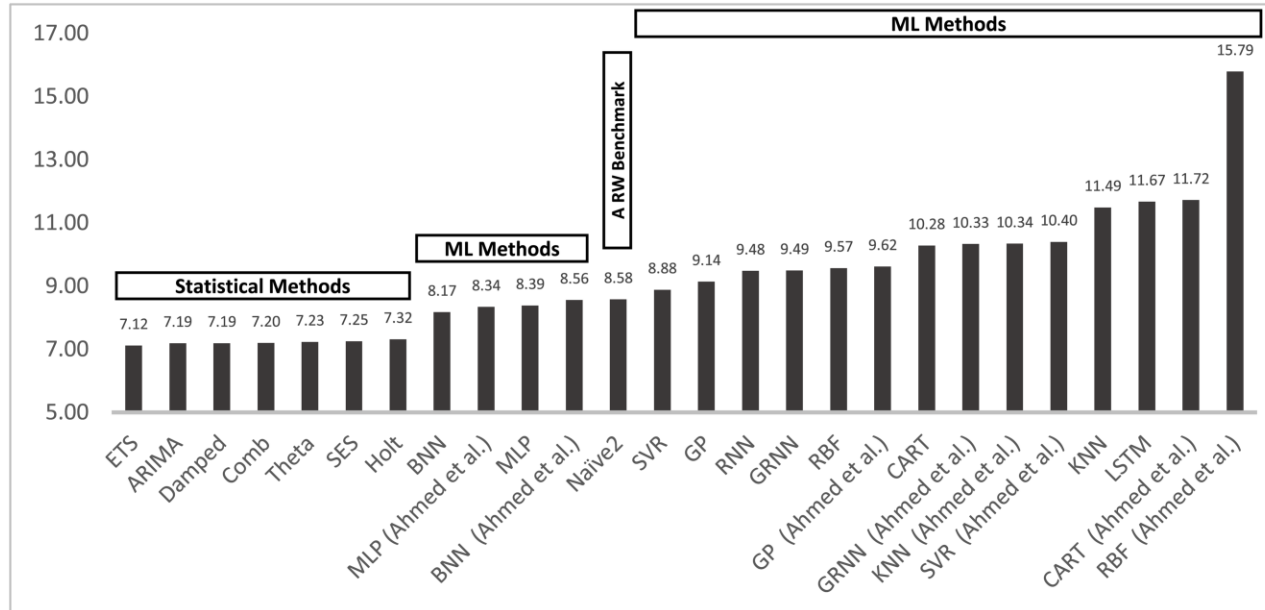


# Solution

## Forecasting Model

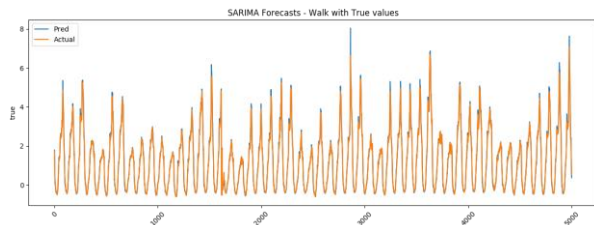


# Forecasting Model

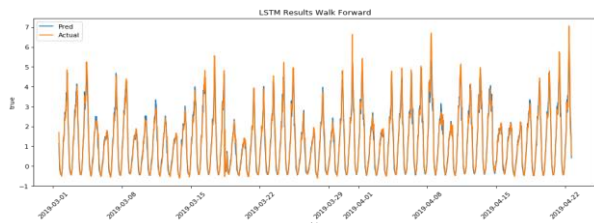


# Forecasting Model (Ensemble)

SARIMA predictions



LSTM predictions

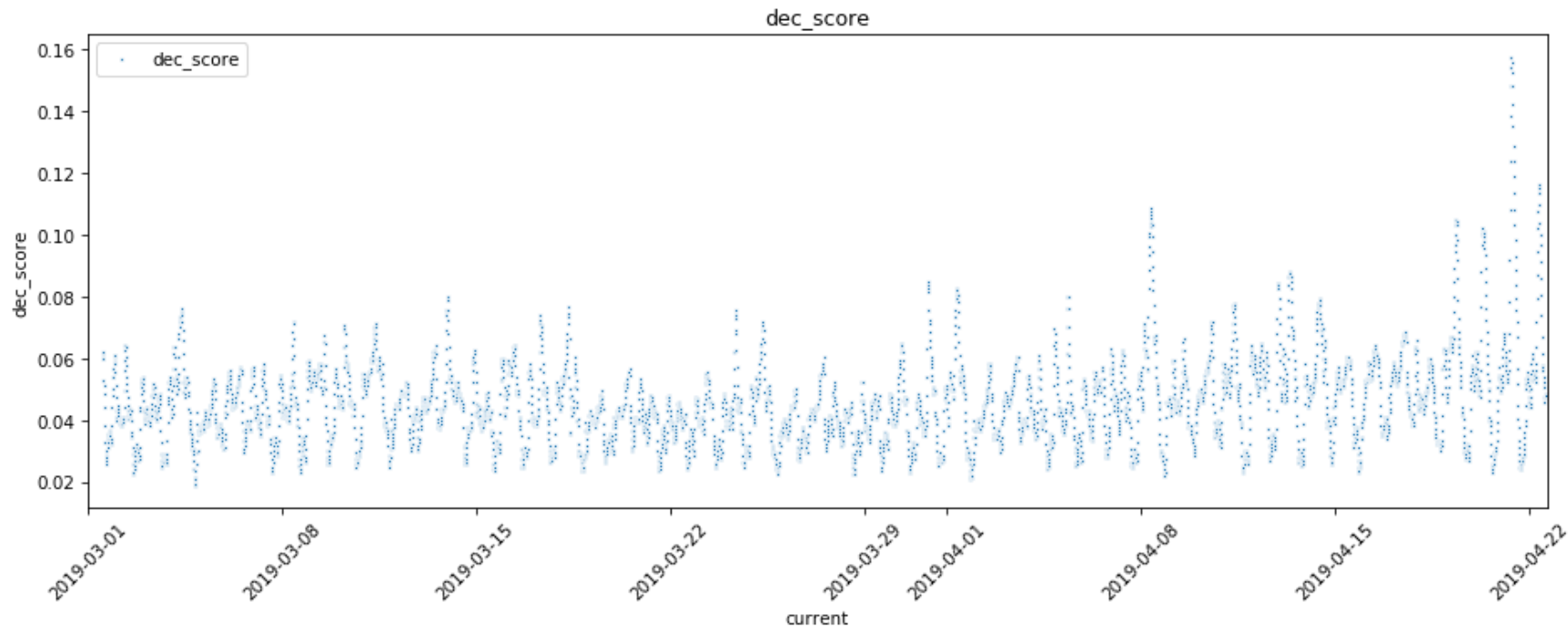


Random Forest  
Regressor

Decoder



# Final Prediction Score



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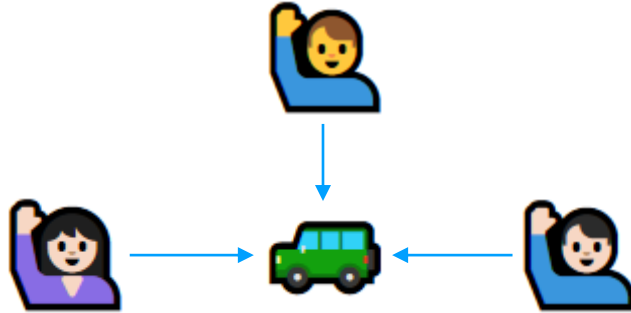
# What we learned?

- There are patterns in the Hourly and Weekly demand.
- There are High Demand Density areas.
- We can create a fairly good forecasting model.



# How can this be further implemented?

- Incentivize ride sharing services on high demand areas.



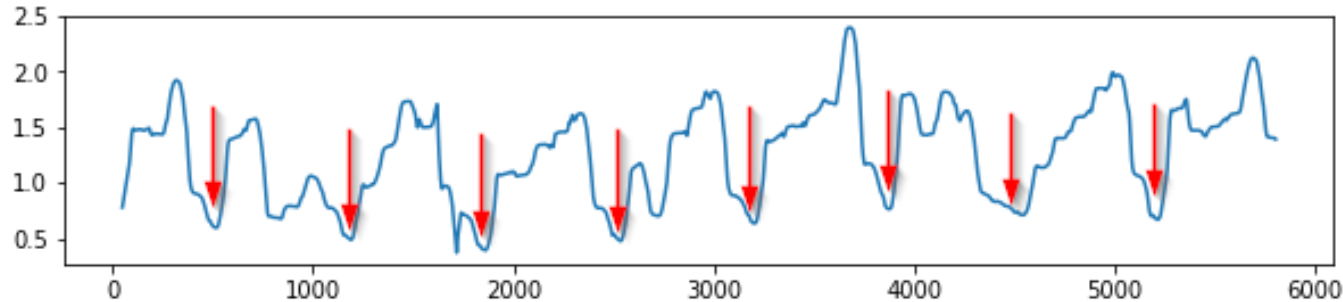
# How can this be further implemented?

- Staging resources in anticipation of forecasted demand.



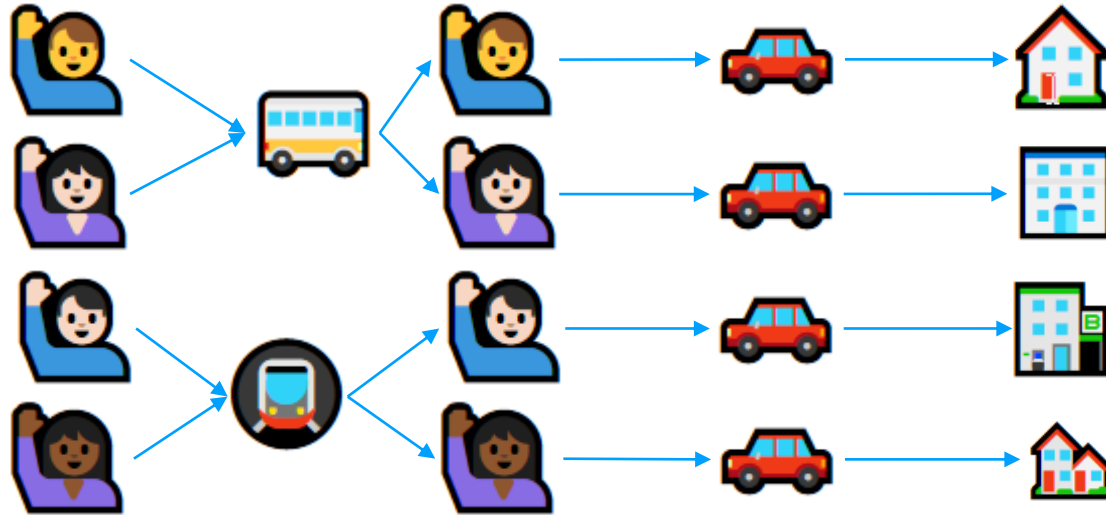
# How can this be further implemented?

- Schedule driver time-offs during low demand days.



# How can this be further implemented?

- Complimenting services between Grab and existing public transports.



# Conclusion

I am excited to have the chance of joining a team that could make positive impact not just on the lives in Manila but of SEA as a region.



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# Sources:

[Manila Skyline image - u/sunshine\_oi on reddit]([https://www.reddit.com/r/Philippines/comments/8zaihu/makati\\_city\\_at\\_night/](https://www.reddit.com/r/Philippines/comments/8zaihu/makati_city_at_night/))

[Metro Manila has 3rd worst traffic in Southeast Asia – study](<https://www.rappler.com/business/190016-metro-manila-traffic-southeast-asia-study-bcg-uber>)

[Unlocking Cities - Boston Consulting Group]([http://image-src.bcg.com/Images/BCG-unlocking-cities-2017\\_tcm93-178660.PDF](http://image-src.bcg.com/Images/BCG-unlocking-cities-2017_tcm93-178660.PDF))

[Statistical and Machine Learning forecasting methods: Concerns and ways forward](<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0194889>)

