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# Singapore Dengue Prediction



Group 1: Natasha. Steven. Joel.

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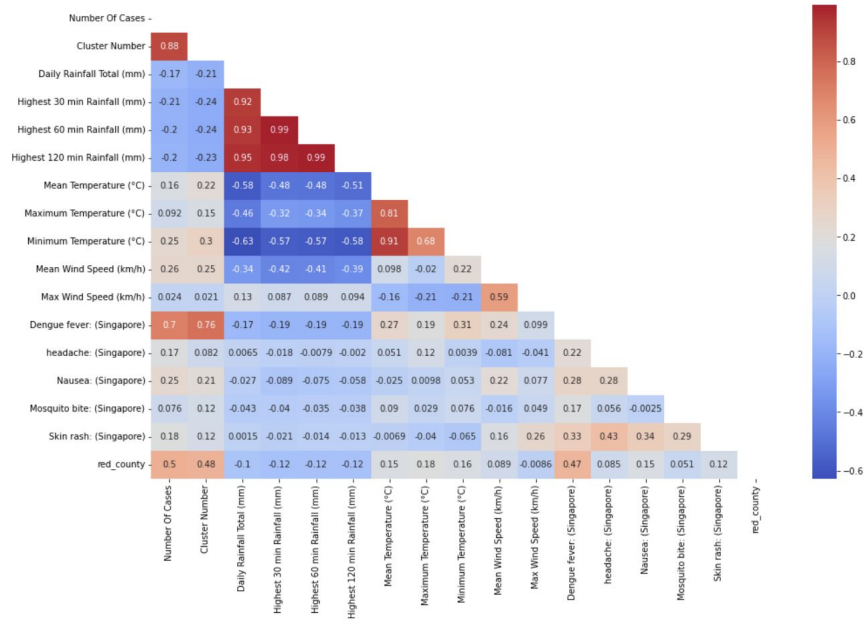
# Background

- Dengue is a disease transmitted to humans through the bite of infected *Aedes aegypti* mosquitoes. There are 4 different types based on the virus (DENV1-4)
- Infected individuals may develop symptoms in 2 weeks as the incubation period is about 1 week
- There are several symptoms of dengue fever such as fever, persistent headache, nausea, and skin rash where in severe case it can lead to bleeding and persistent vomiting which can eventually lead to death
- Individual effort to reduce potential mosquito breeding locations is highly encouraged, however, NEA takes prevention seriously through scheduled fogging and Project Wolbachia (releasing male Wolbachia-*Aedes* mosquitoes to breed with female mosquitoes and their egg won't hatch)
- Problem statement:

**As part of NEA planning team, we are going to try to forecast Dengue case in Singapore to ensure our fogging schedule**

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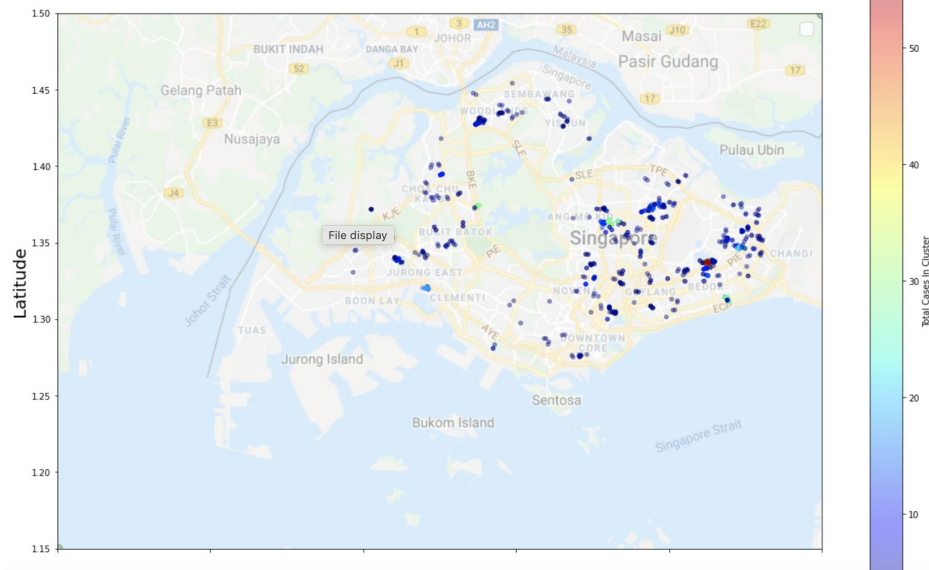
# EDA Binary Classification- Dataset Check



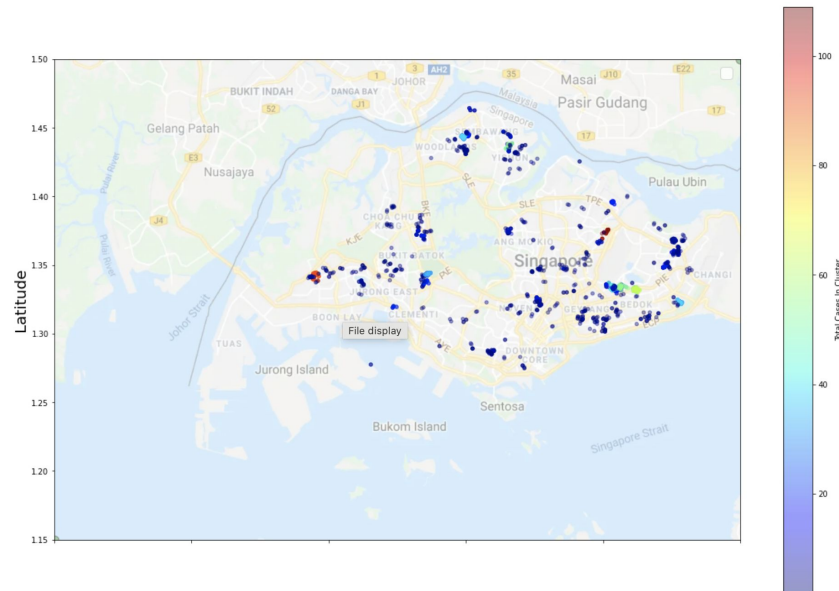
- High collinearity
- A lot of missing data in weather data based on Station
- Preprocessing: rainfall imputed with 0 and temperature with average temperature. Limitation: might skew our data
- Data used: based on county (weather, trend, cases)
- However if we see based on the data

# Dengue Spread by Year

2015

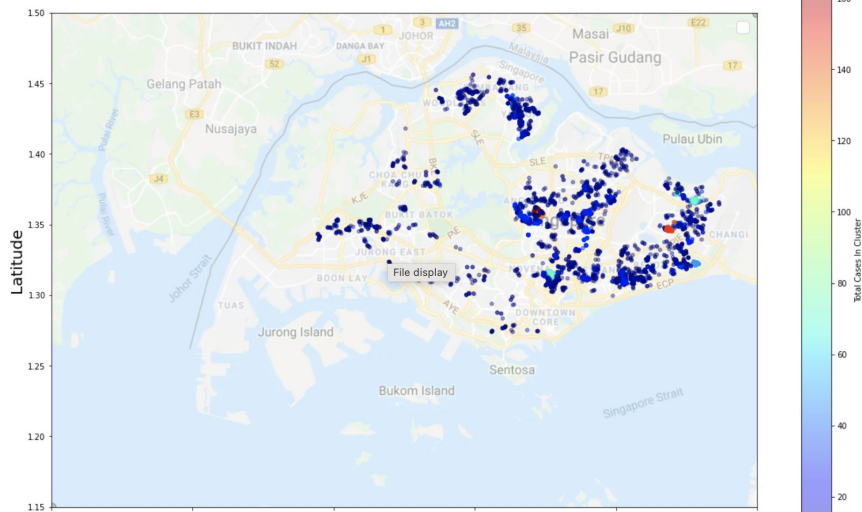


2016

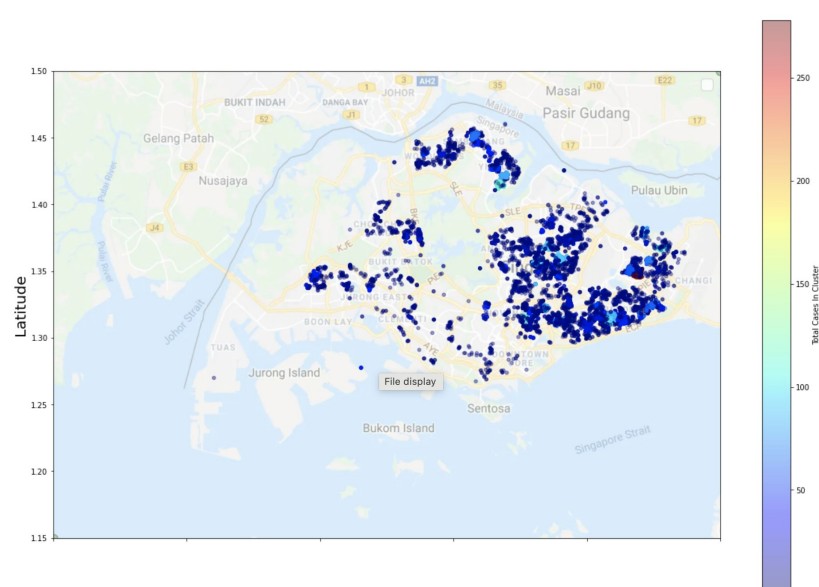


# Dengue Spread by Year

2017

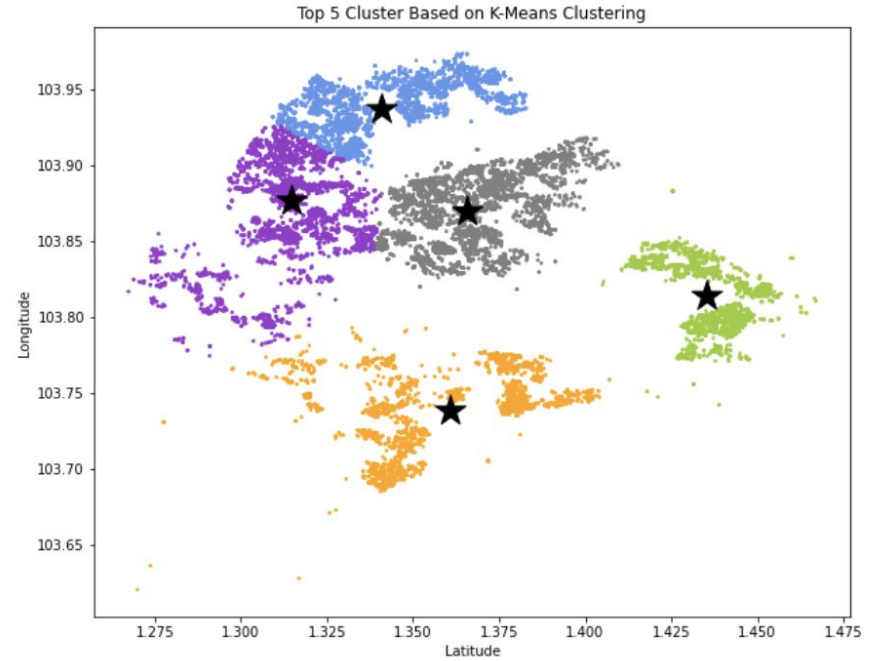
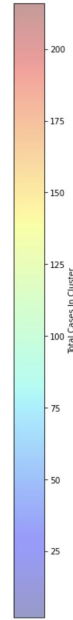
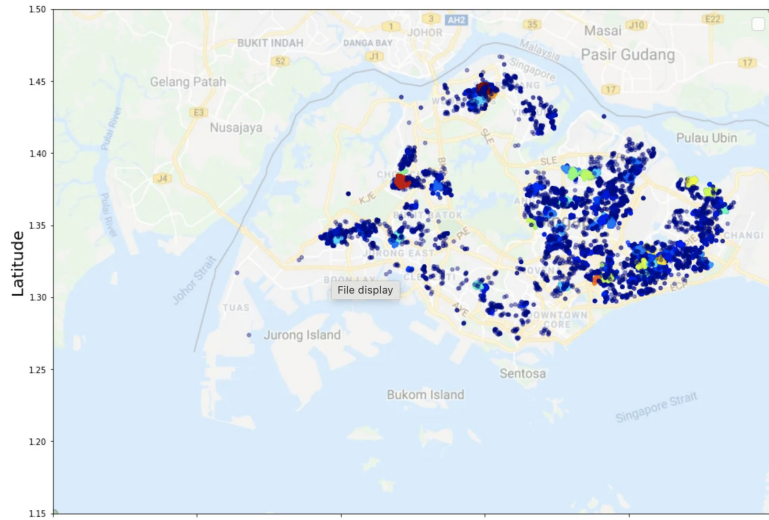


2018



# Dengue Spread by Year

2019



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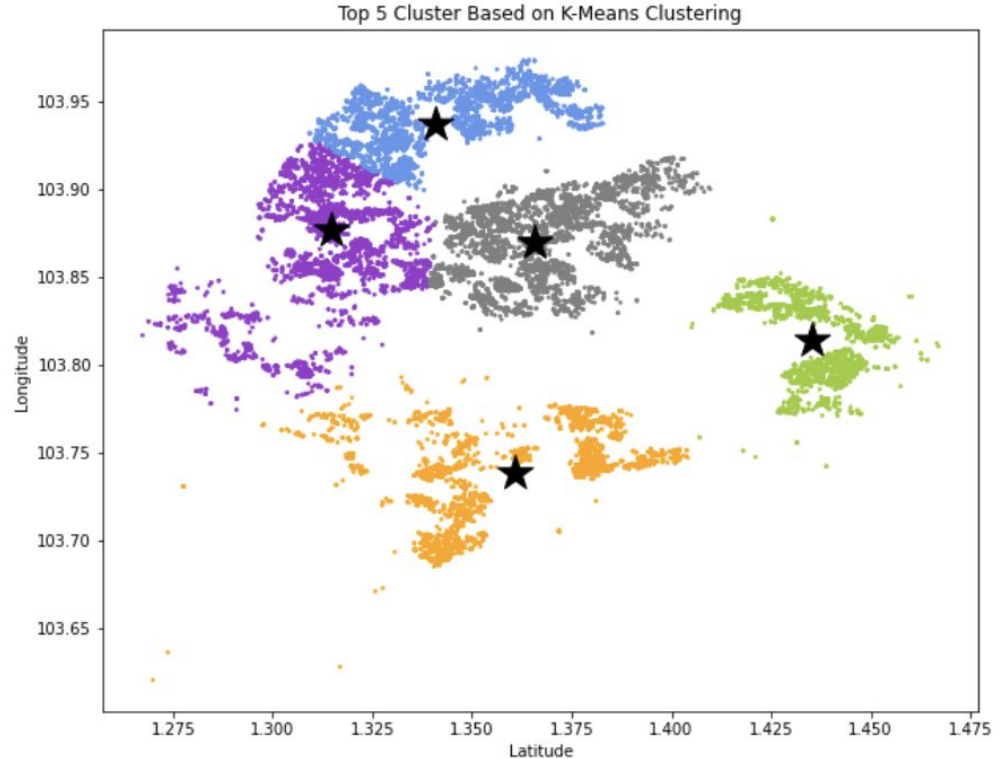
# Spatial Analysis (2015-2019)

1. There is a clear increase in cases from 2015 to 2019 with a concentration of cases in the East Side of Singapore.
  2. Heatmap shows higher incidences when the colour is red.
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# Recommendations

Intervention from the K-Means centroid of each major cluster and work inside-out for efficient resource allocation





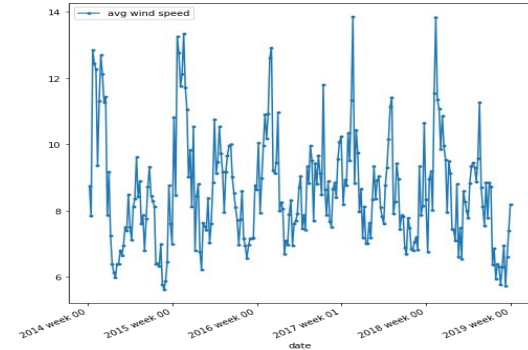
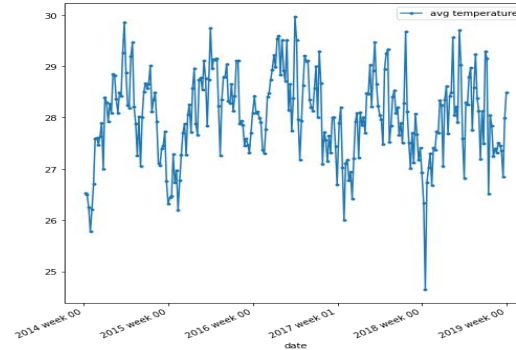
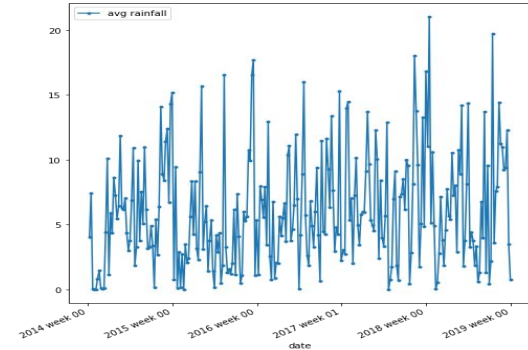
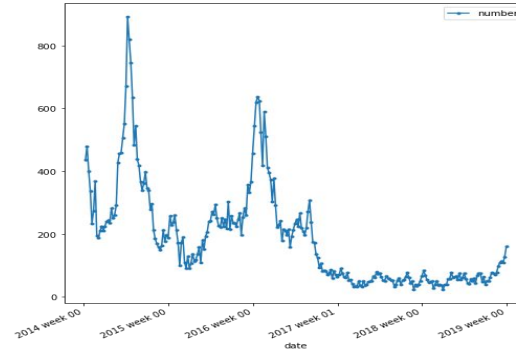
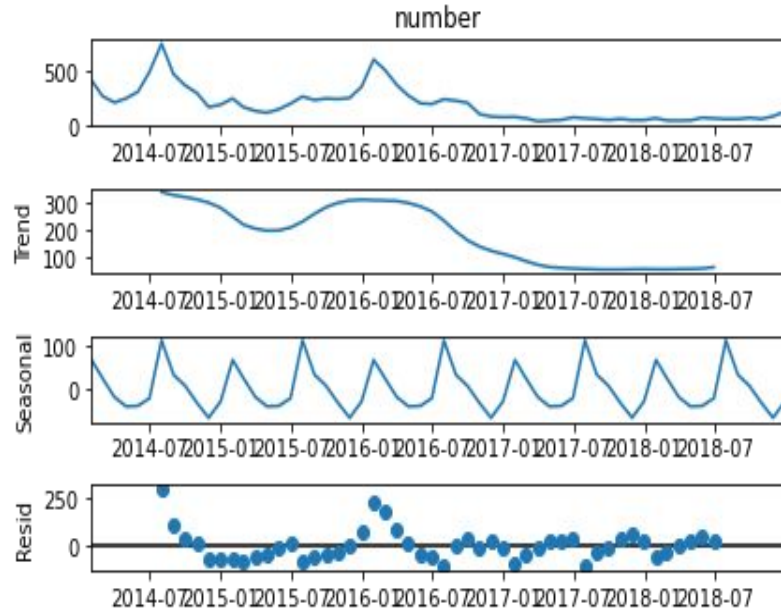
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## Top 5 Clusters

1. Serangoon
  2. Woodlands
  3. Tampines
  4. Geylang
  5. Tengah
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# Time Series Model

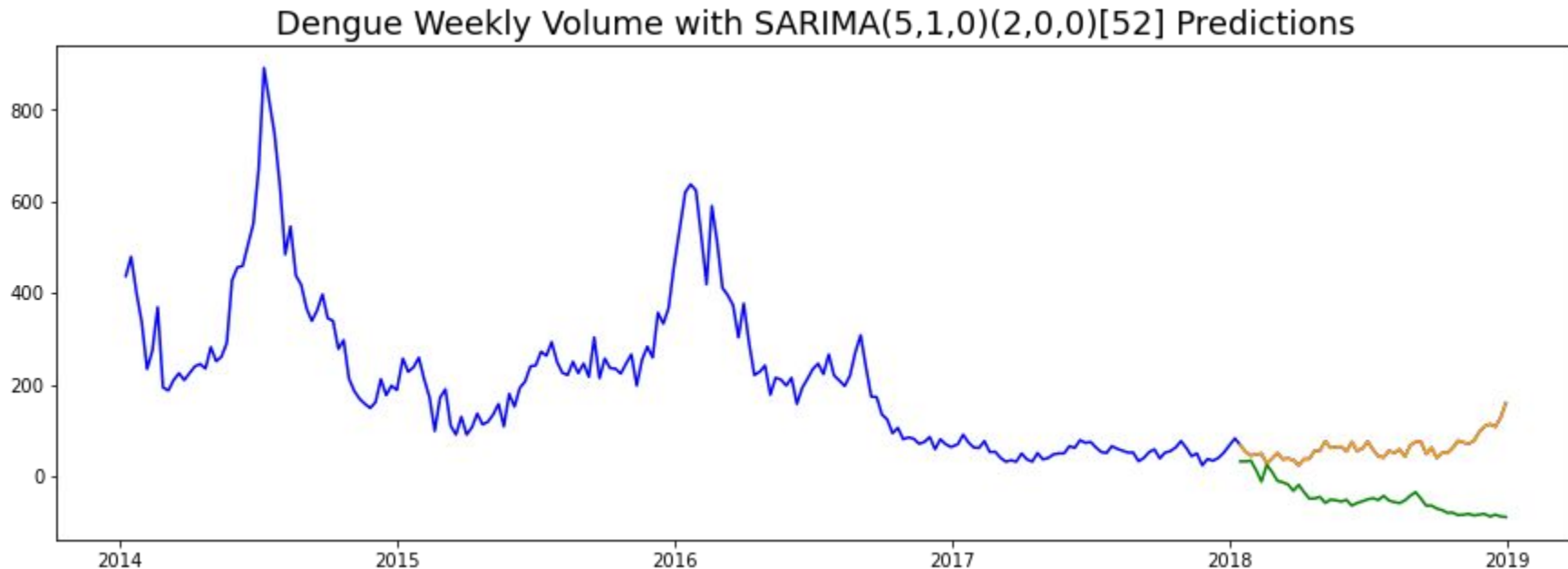
## Data Preprocessing



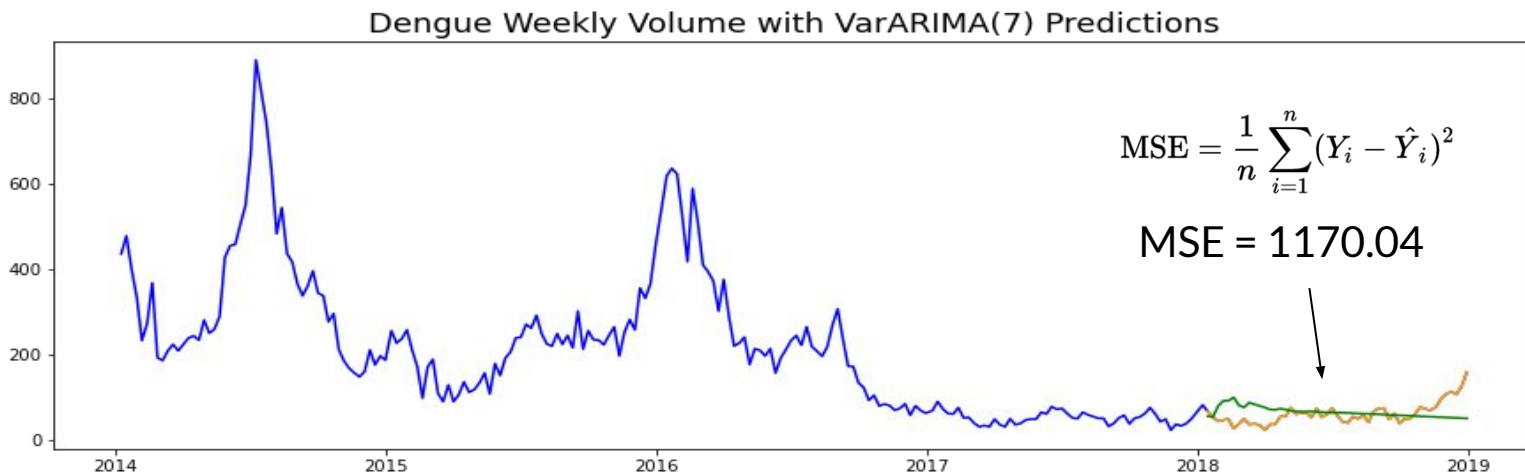
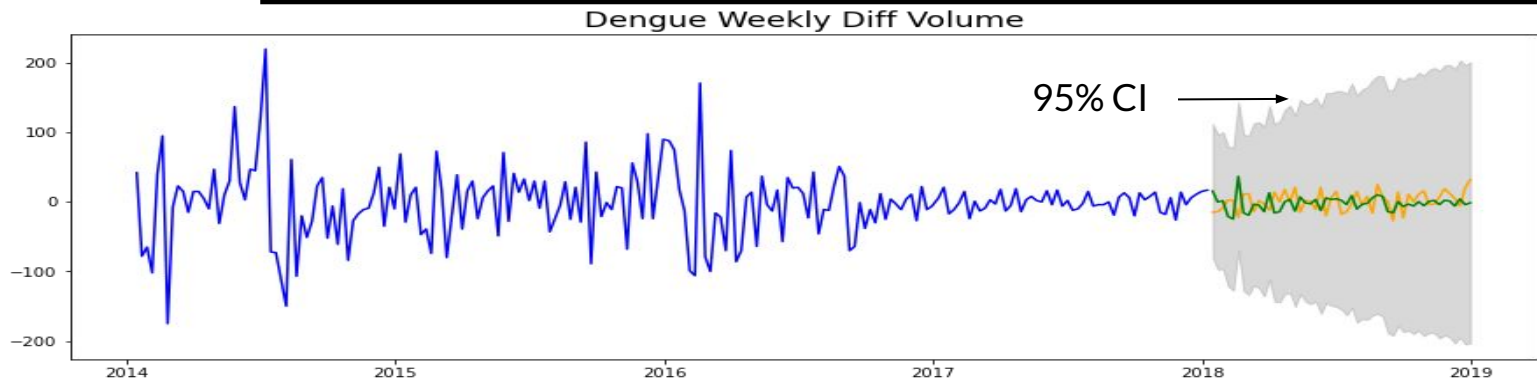
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# SARIMA

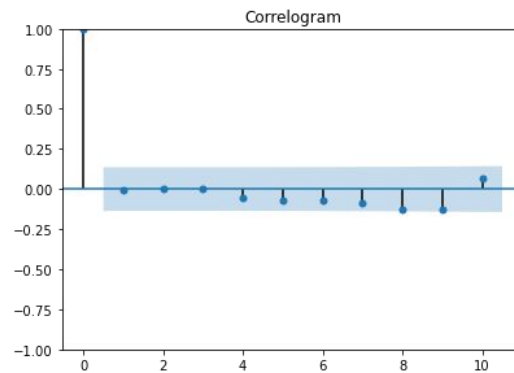
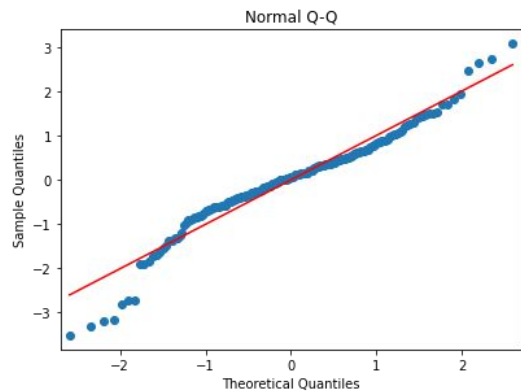
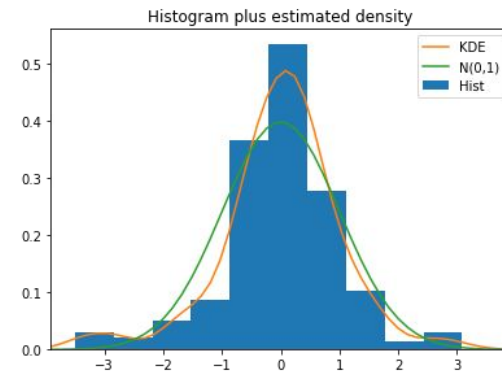
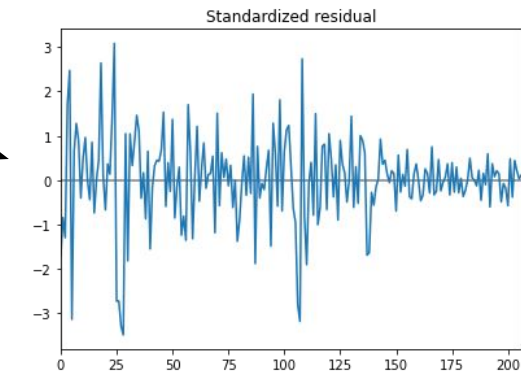
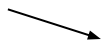
The Sarima Model can't predict properly. Probably annual cycle for weekly data is too large and it leads to inaccurate result.



# Vector ARIMA

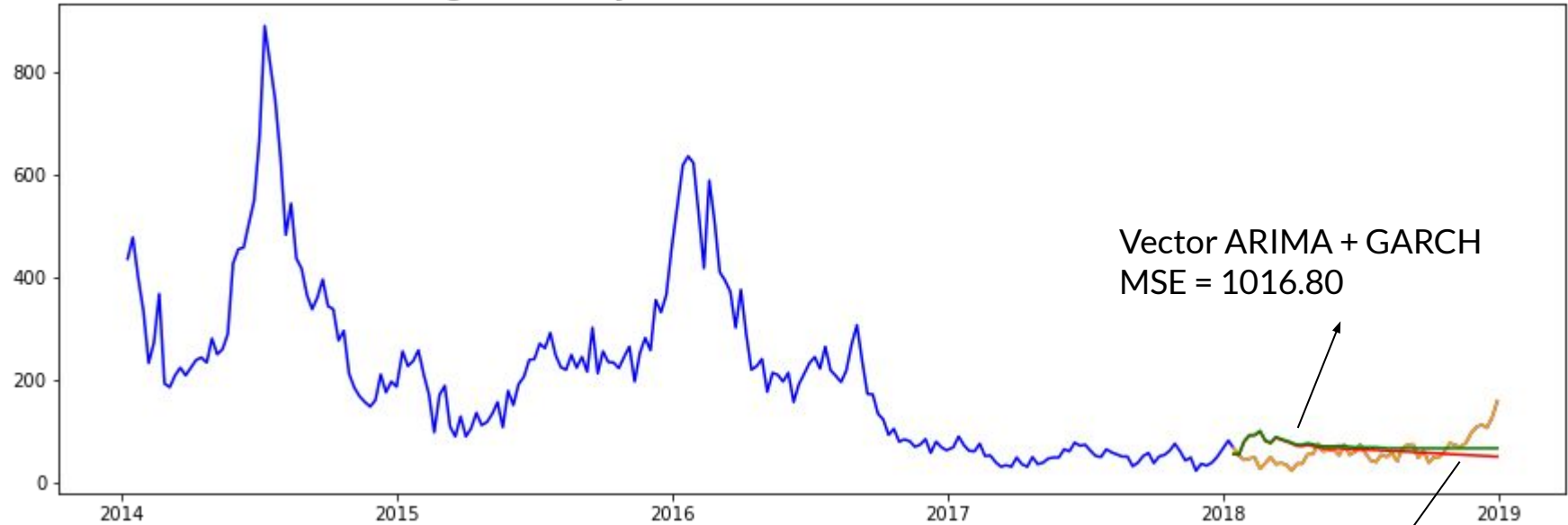


Variance  
not  
constant



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Dengue Weekly Volume with VarARIMA(9) Predictions



Further Improvement : LSTM Model /  
Collect more exogenous features

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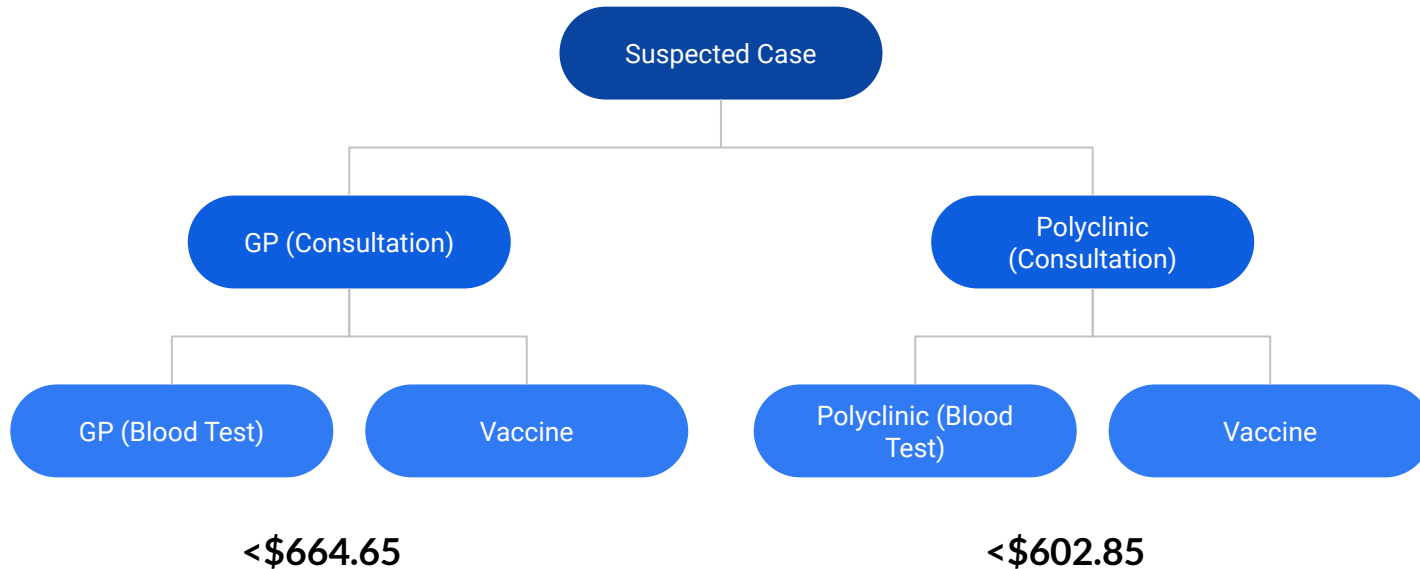
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## Cost Benefit Analysis (Uninsured)

Dengue fever treatment & costs	
<b>GP (Consultation)</b>	\$20 to \$55
<b>GP (Blood Test)</b>	\$70 - \$80
<b>Polyclinic (Consultation)</b>	\$13.20
<b>Polyclinic (Blood Test)</b>	\$50 - \$60
<b>A&amp;E</b>	\$120
<b>Dengue fever vaccine (Dengvaxia)</b>	\$529.65

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# Cost Benefit Analysis (Uninsured)





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# Cost Benefit Analysis (Insured)

<b>Insurance - TM Protect MosBite Plan A</b>	<b>\$39/\$59 yearly (\$1500/\$3000 Insured)</b>
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# Cost Benefit Analysis

It costs an uninsured person \$664.65 to treat his/her dengue symptoms once infected.

Dengue intervention strategies have to be less than \$664.65 per unit population.

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