Calculating Risk Index of Third Wave

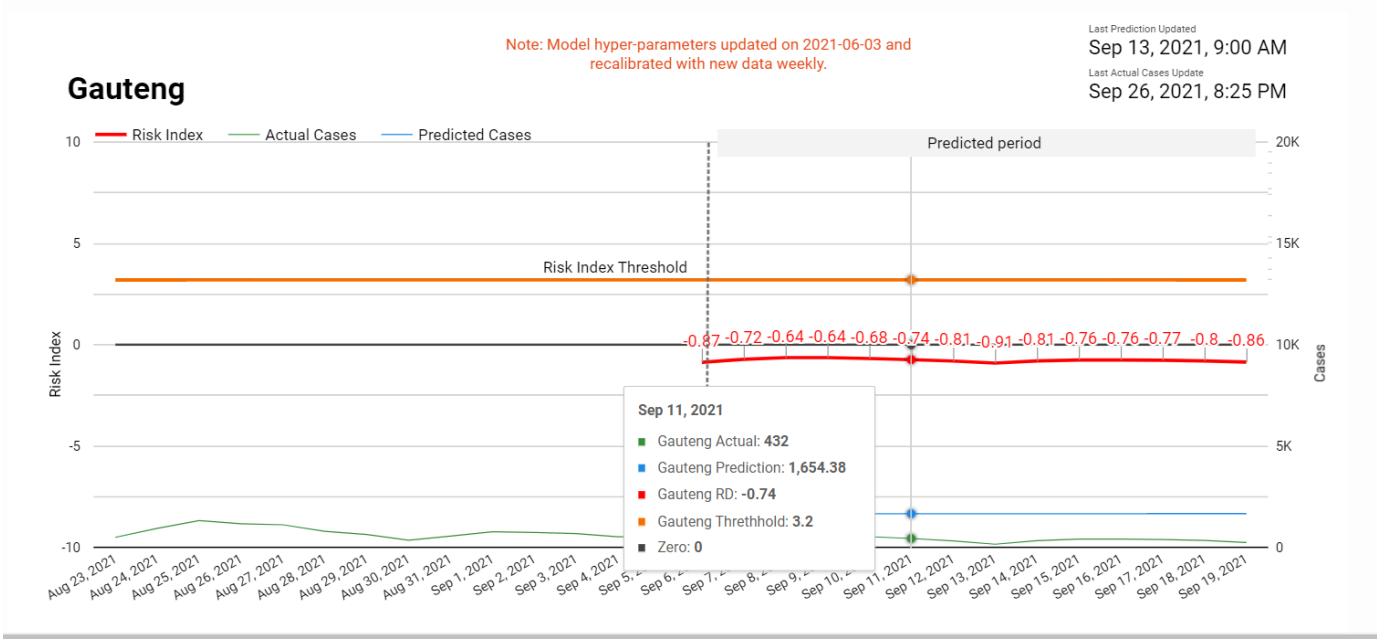
Artificial Intelligence Algorithm: LSTM RNN

Alert system for a third wave of Covid-19 cases in South Africa recognises an additional wave when the actual value of daily cases deviates from the predicted value for each province. The risk metric used for the alert system is the relative difference. The **Risk Index (the relative difference)** , is calculated using the following equation:

$$Risk\ Index = \frac{Actual\ dTCt - Predicted\ dTCt}{Predicted\ dTCt}$$

$$dTCt = Daily\ Change\ of\ Cases$$

Based on the relative differences between the predicted and measured values at steady-states between the first and the second waves, the **thres hold** for the possible onset of the third waves were determined



Risk Index = Relative Difference = (Actual cases - Predicted cases) / Predicted cases

Threshold = [RI (Second Wave) - RI (First Wave)] / RI (First Wave) ……divided by max value

Values Required = **1)** Overall actual cases and predicted cases , **2)** actual cases and predicted cases in the first wave as well as **3)** in the second wave

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Epidemiological model : SI model

Risk index gives a measure of the risk for the 3rd wave.

$$x = 100\frac{actual\ cases - present\ day\ prediction}{present\ day\ prediction}$$

$$y = 10\frac{1}{1 + \frac{actual\ cases}{Total\ prediction}}$$

$$If\ y > 8\ risk\ index = y + x\ else\ risk\ index = x$$

If Risk Index is ,

<0 = Very Low Risk

0 = Low Risk

7.5 = Medium Risk

10 = High Risk

>10 = Very High Risk

South Africa Risk Index for the 3rd Wave

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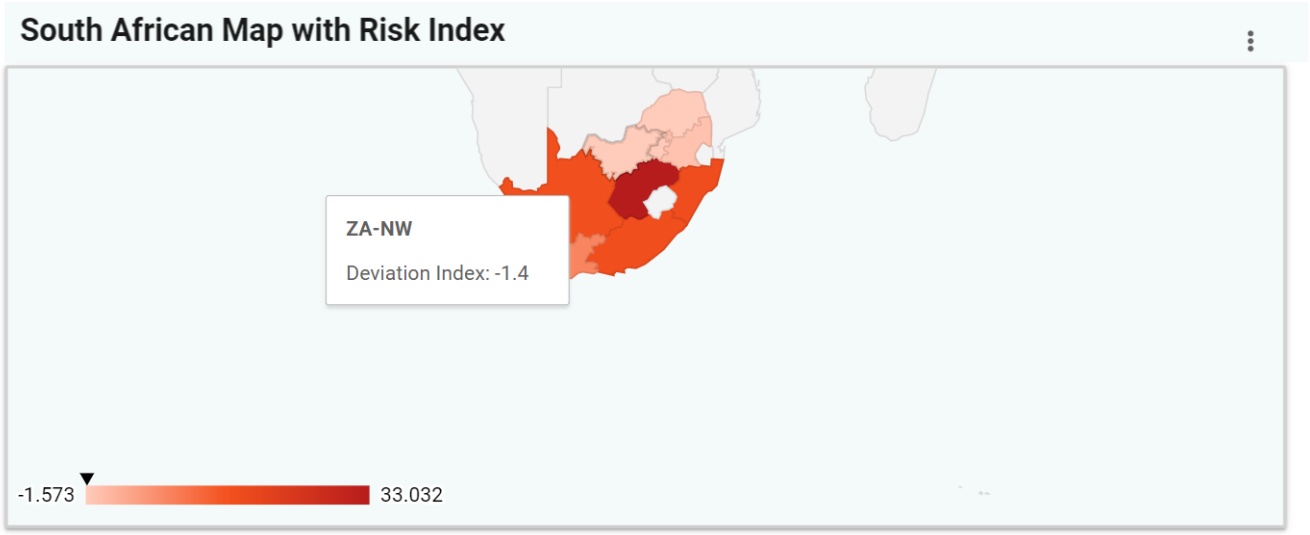
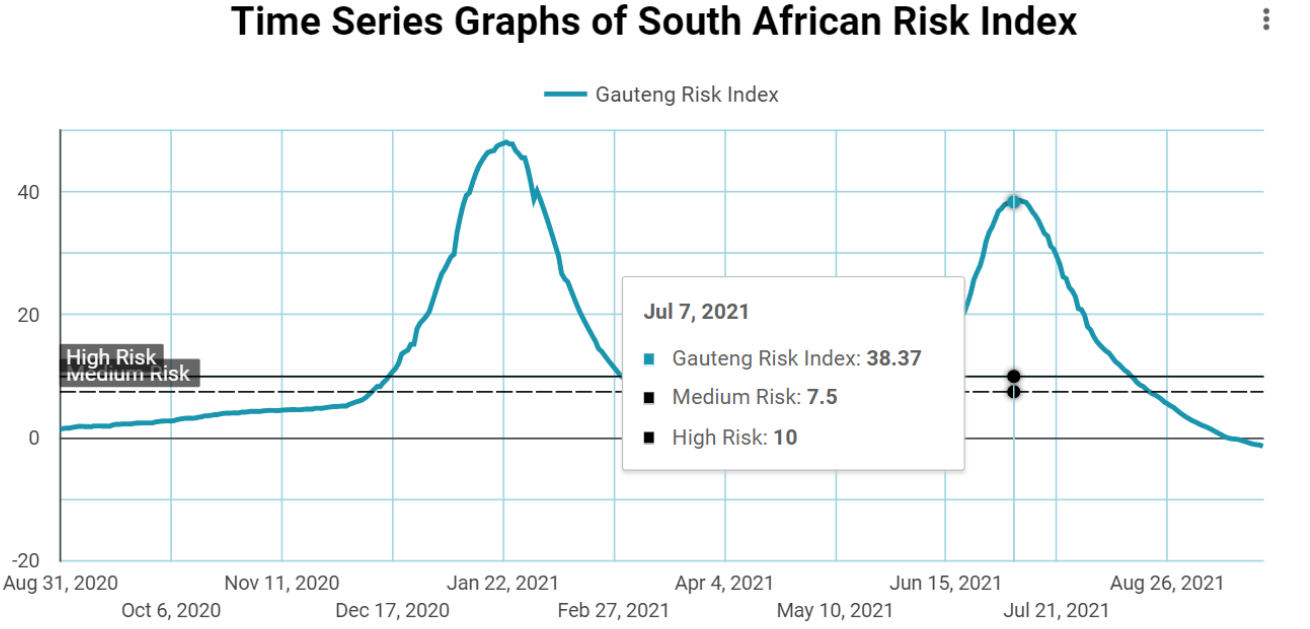




Values Required = **1)** Actual Cases

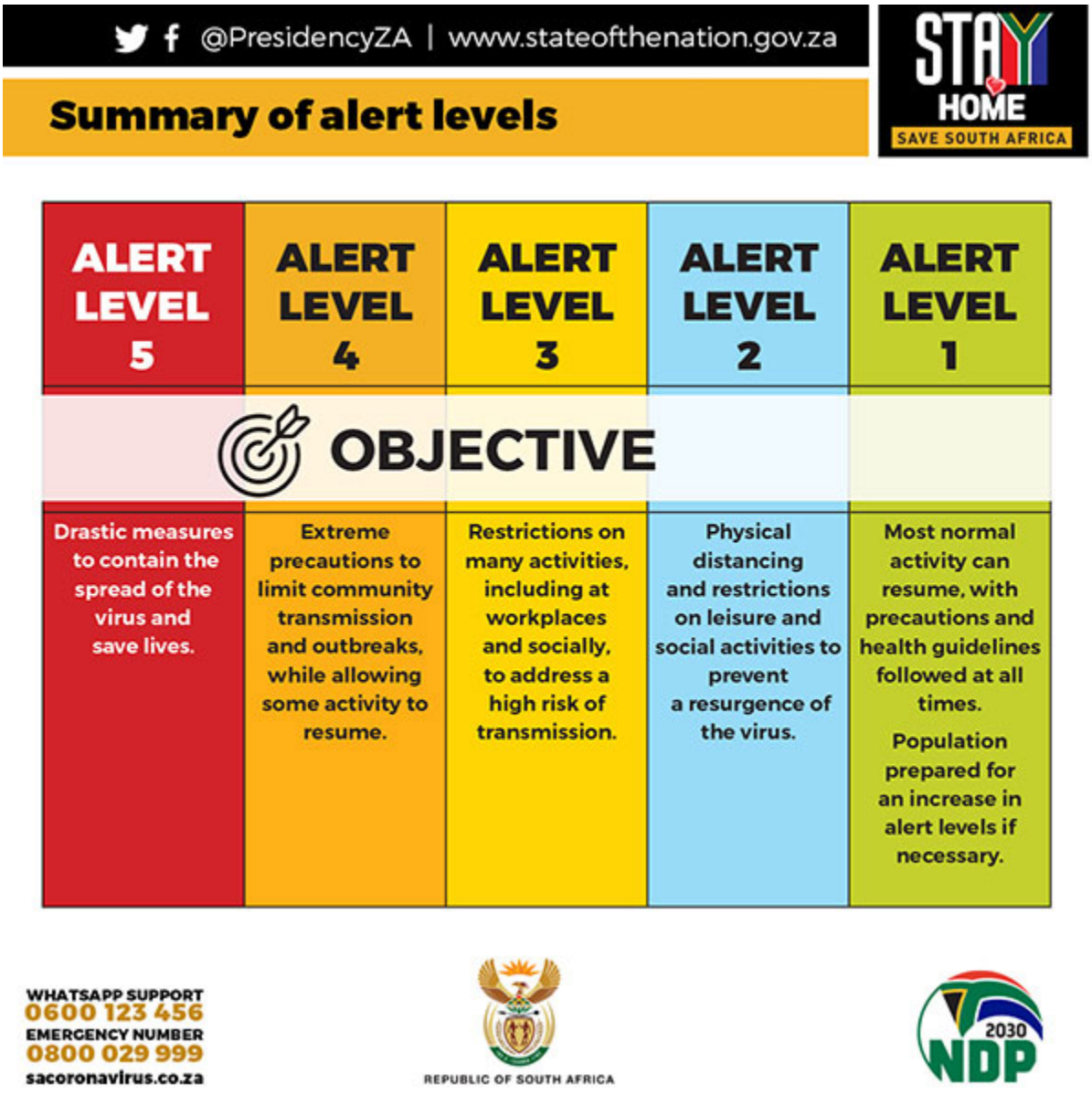
2) Present Day Prediction

3) Total Prediction

Stringency Index and Alert Level South Africa

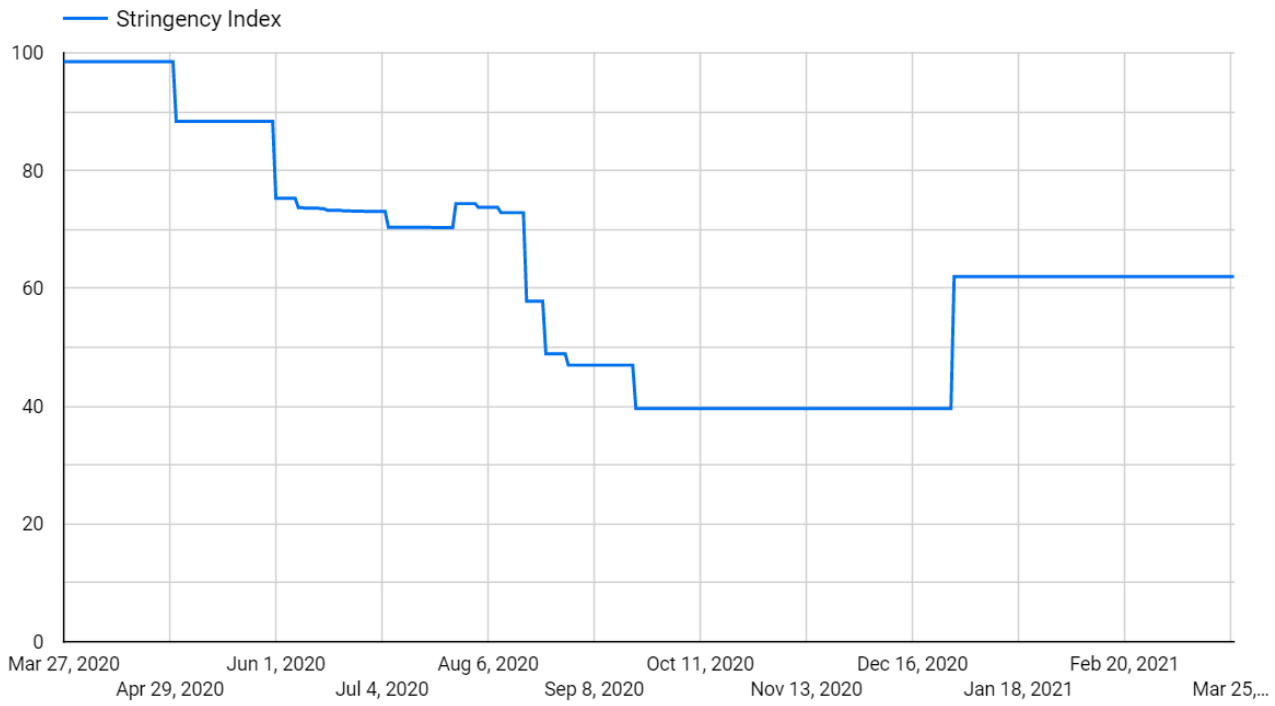
The South African Stringency index is a measure of the level of stringency of the accumulation of the Non-Pharmaceutical Interventions (NPIs) implemented by the government.The seven NPIs that are taken into account in the calculation are:

- S1: School Closure
- S2: Work Place Closure
- S3: Cancel Public Events
- S4: Close Public Transport
- S5: Public Information Campaign
- S6: Domestic Travel Ban
- S7: International Travel Ban

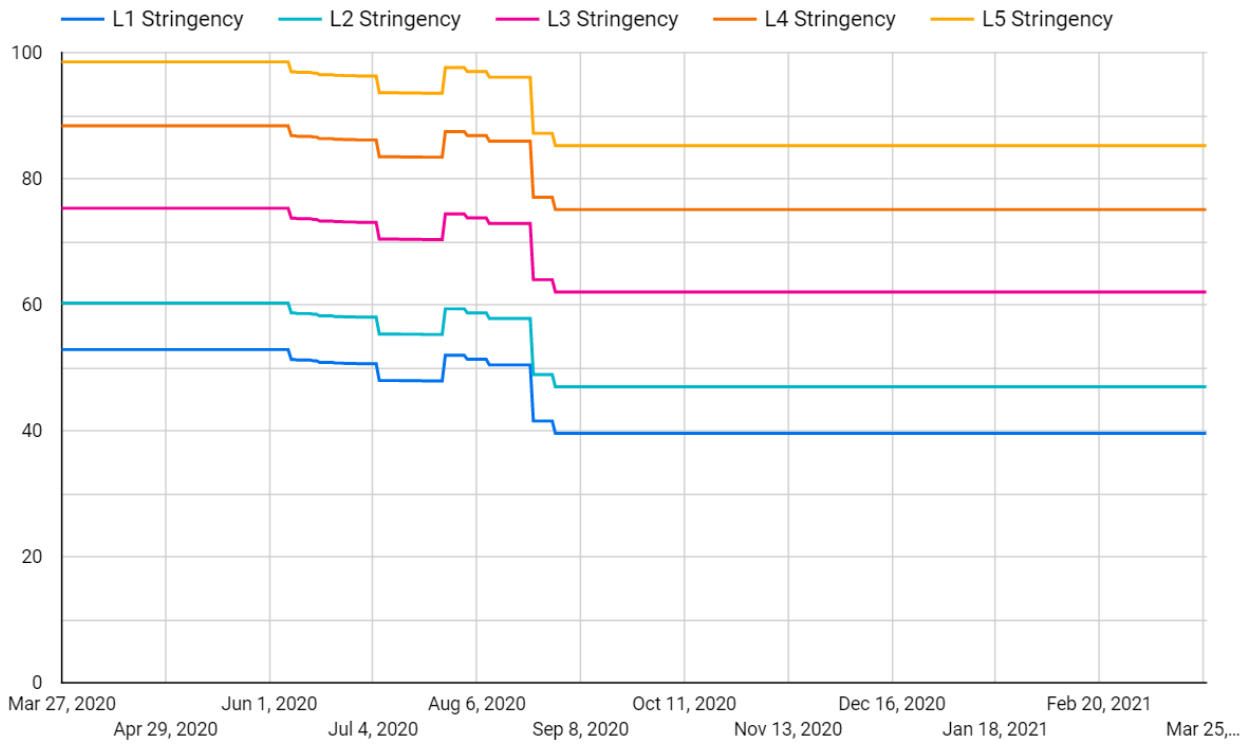


In order to quantify the effects of the alert system, a **Stringency Index was carefully created for each South African Alert Level**. The calculation of this Stringency index takes into account the status of various indicators that represent a number of Non-Pharmaceutical Interventions (NPIs).

Time Series Graph of South African Stringency Index



Comparison of Alert Level Stringencies



[Risk Adjusted Non-Pharmaceutical Interventions for the Management of COVID-19 in South Africa]

How to calculate stringency index : https://covidtracker.bsg.ox.ac.uk/