# **Stateful LSTM** shows promise as a tool to **forecast COVID-19**

## Application of a Stateful LSTM in the Forecasting of Covid-19 Cases in South Africa

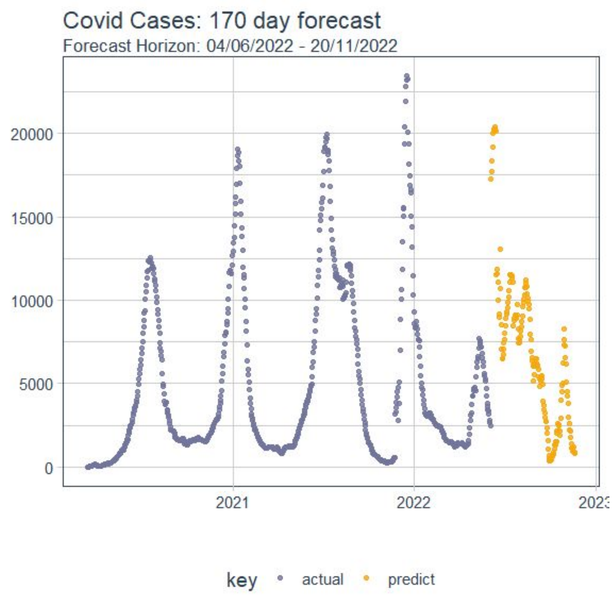
### INTRODUCTION

- Initial aim was to apply SIR models and apply to RSA data and incorporate vaccination.
- Stateful LSTM's are typically used in the finance sector for time series forecasting.
- Such LSTM's relies on the auto-correlation of time series data and uses a lag on the dependant variable as input.
- This modelling strategy is explored in the prediction of Covid-19 cases.

### METHODS

1. Dataset with daily Covid-19 cases for 812 days used
2. Used a stateful LSTM, with a lag of 170 (ACF: 0.54), batch size of 29 and trained on 70 epochs.
3. The structure contained an input layer with the lagged cases, two hidden layers and a dense layer.
4. The model is tested through a back testing strategy, with a 340/170 train-test split and 29 day skip for each subset used. The epochs were chosen from this to prevent overfitting on all subsets.
5. Finally a 170 day forecast is produced from the model

### RESULTS

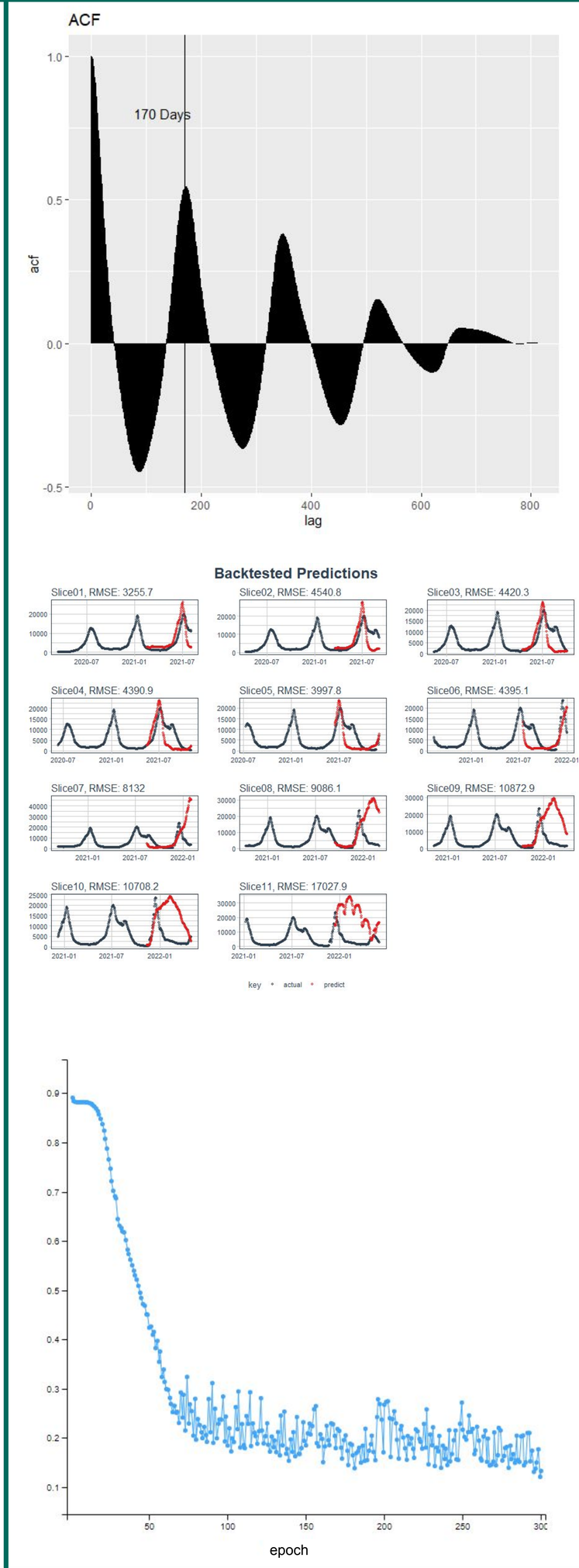



### DISCUSSION

- The LSTM predicts the third wave reasonably, but does not perform well past the fourth wave. The RMSE deteriorates significantly from the 7$^{th}$ subset in the back testing strategy. This indicates instability in the model, especially with the newest cases.
- The final model forecasts two small waves following the current wave.
- The good autocorrelation of 0.54 at a lag of 170 days is promising for long term forecasts of covid-19 cases

### RECOMMENDATION

Future work may look to leverage vaccination data into the model and determine whether this may improve the accuracy.

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