

Simultaneous Time Series Forecasting on the World's COVID-19 Daily Vaccinations

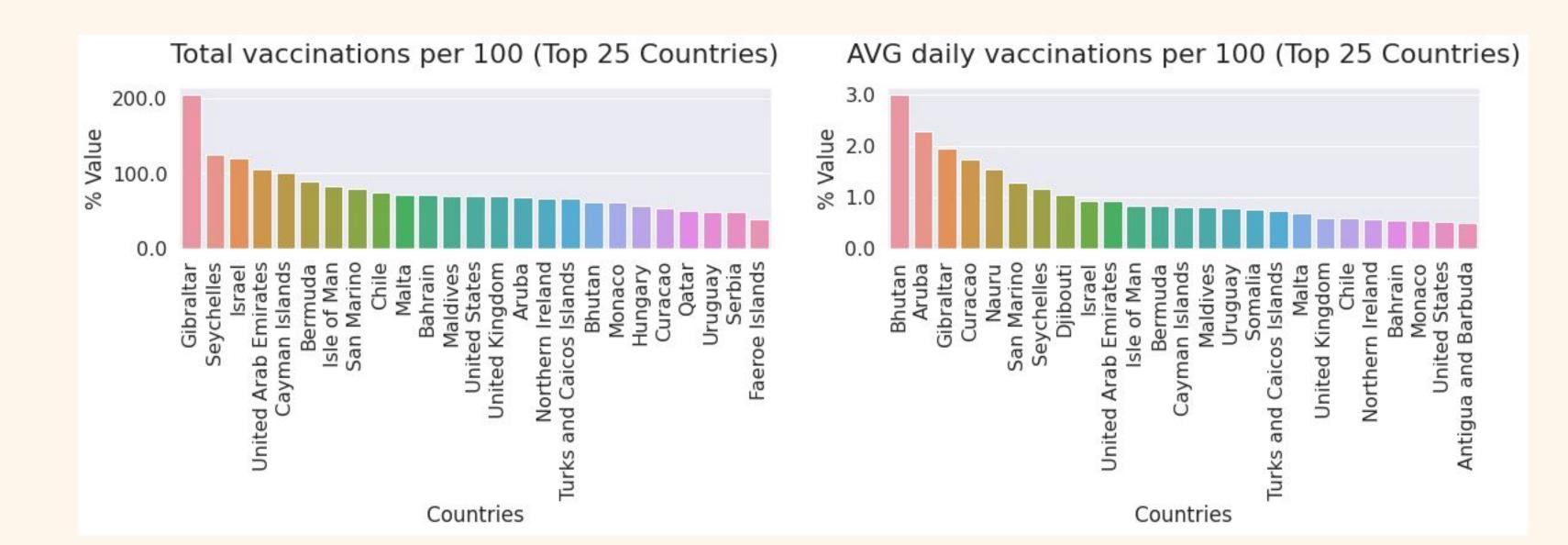
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Motivation

- The distribution of COVID-19 vaccines affects the health of billions of people as well as the state of the world's economies
- Many efforts have been made to extract useful insights from these data, but most of them are comparative analysis between two or more countries
- As of today, no method attempted to simultaneously predict the number of daily vaccinations of all the countries by utilizing the correlations between them
- We introduce a method that uses Encoder-Decoder Long Short-Term Memory Networks With Multivariate Inputs and Walk-Forward Validation of 10 days.



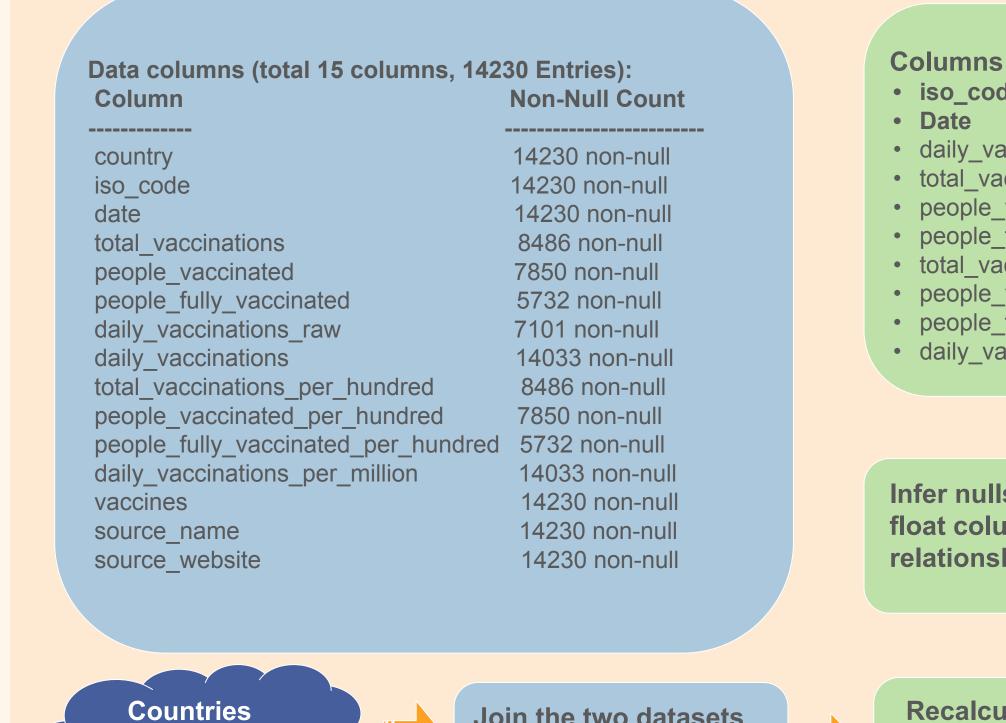
Dataset

- Contains daily vaccination data for 193 different countries and 135 dates
- 14230 15-dimensional data from which 8 dimensions where used
- The dataset has many null values, most of which can be inferred from other values



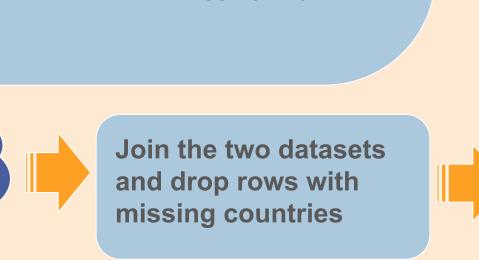
Workflow

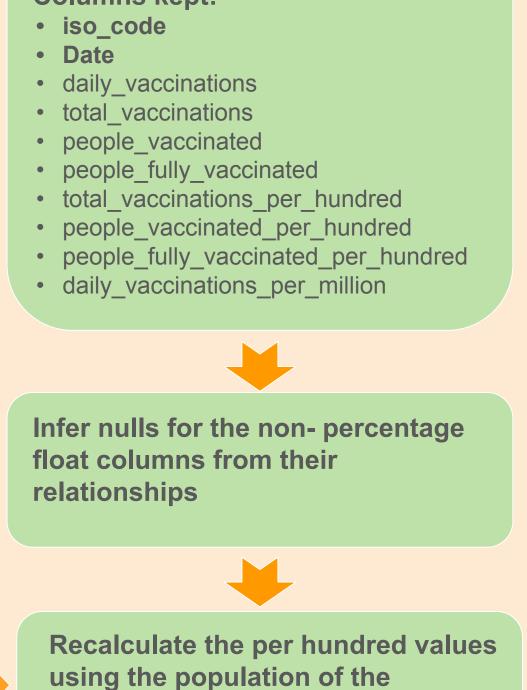
New Data Training Evaluation Preprocessing Dataset every day Group the Dataset in 10-day windows and Visualize: **Columns kept:** Data columns (total 15 columns, 14230 Entries): discard the excess days Histograms with countries and dates that • iso_code **Non-Null Count** lstm_input: InputLayer Column • 126 days → 12 10-day groups + 6 have the highest and lowest errors Date days discarded The test and predicted sets' daily daily_vaccinations 14230 non-null country

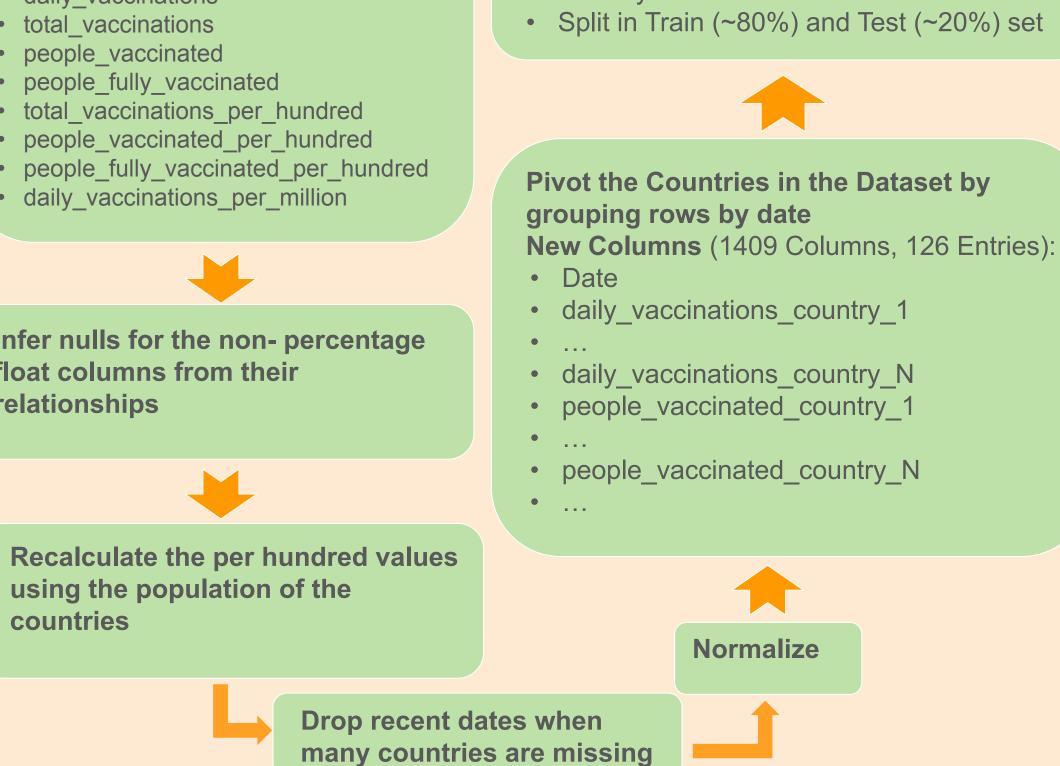


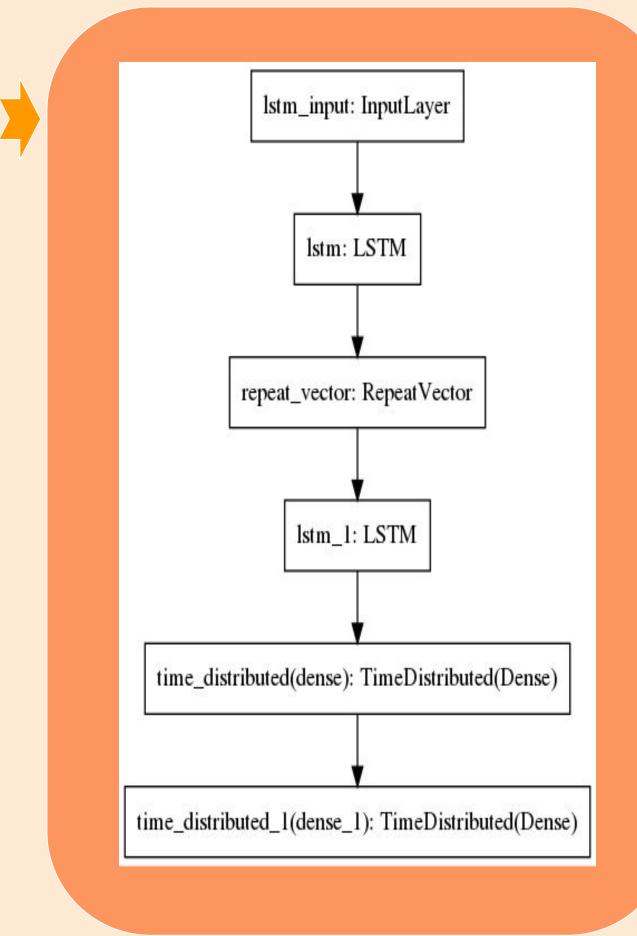
metadata

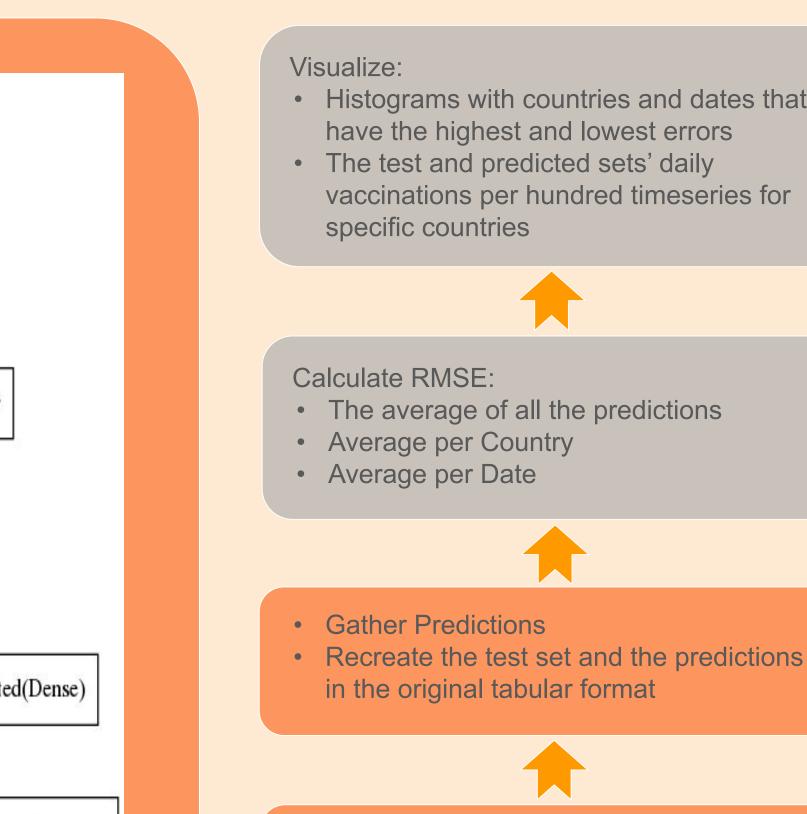
Dataset











Predict the Daily Vaccinations per

hundred people on the Test set

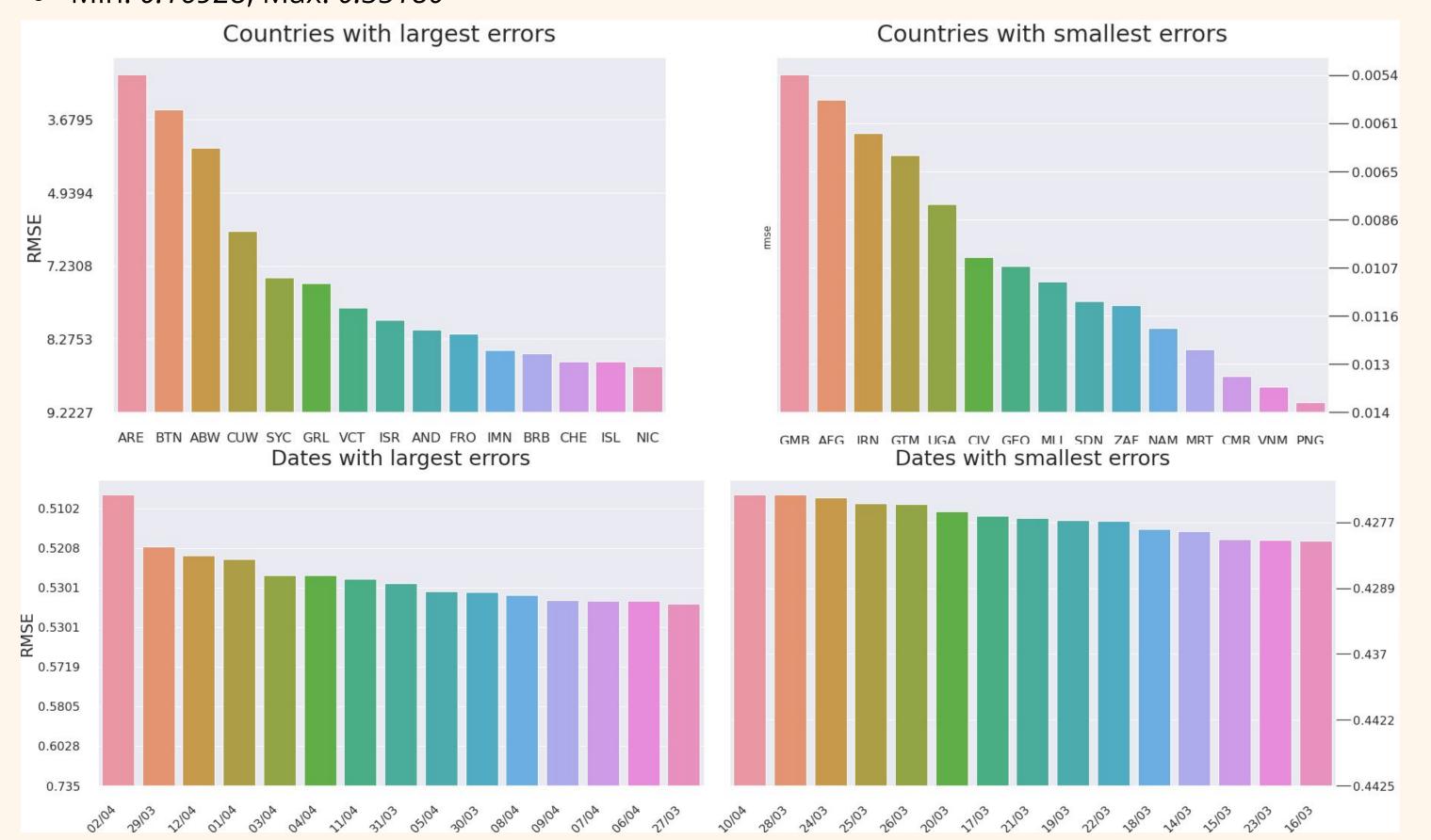
predict the 10 next

• Each time, use the 10 previous days to

Evaluation

Average RMSE: 0.246174

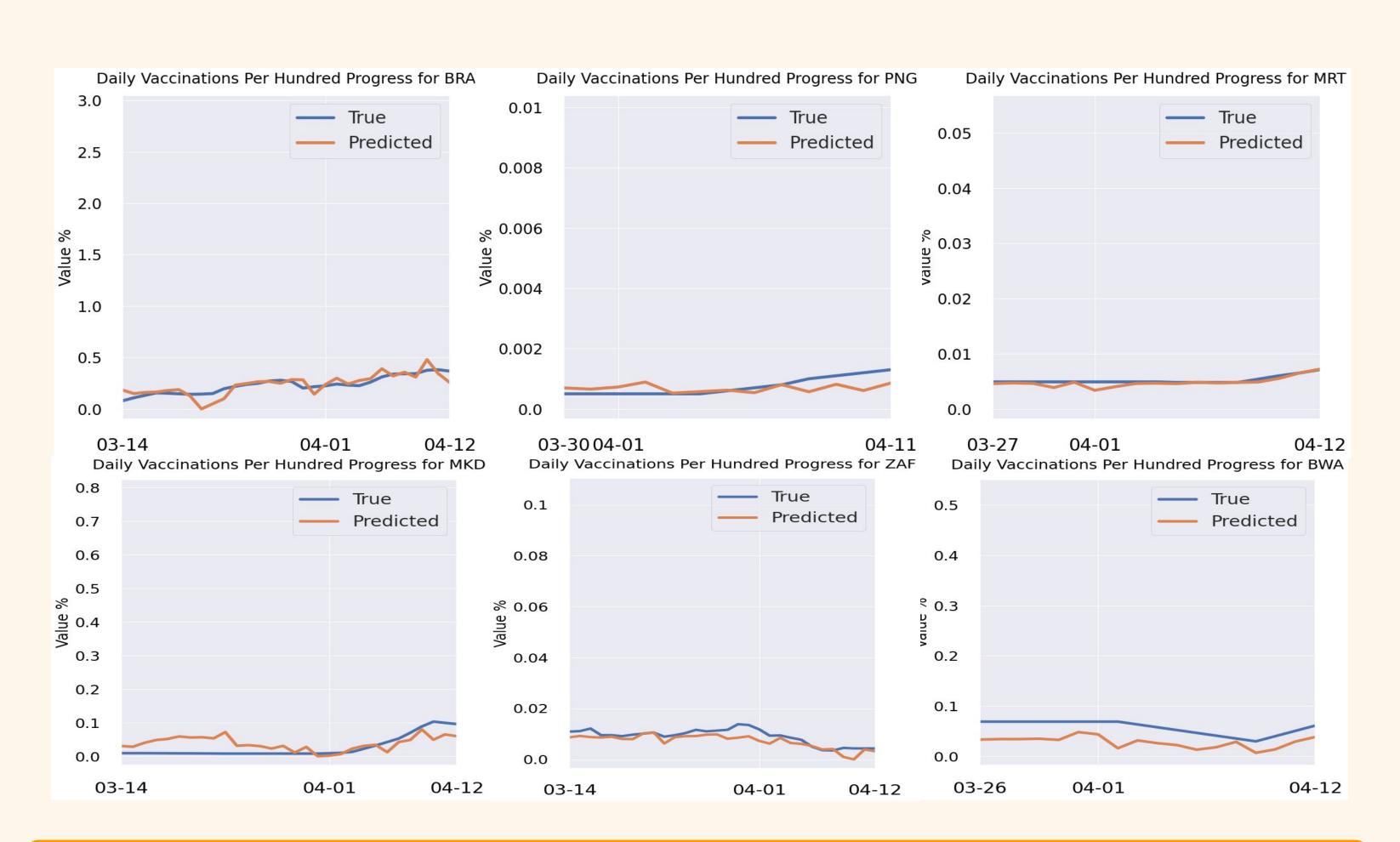
- Out of the 170 countries, 164 had mean RMSE less than 1.0, 153 less than 0.5, and 73 less than 0.1 o Min: 0.00023, Max: 5.5133
- Out of the 30 dates, 25 had mean RMSE less than 0.30, 15 less than 0.25, and 11 less than 0.20 o Min: 0.16928, Max: 0.35180



Conclusions

Results

True VS Predicted Daily Vaccinations per million for 6 countries



Future Work

Incorporate static features such as the Vaccines used, Health Expenditure per GDP and the Number of Physicians per Million, all of which are included in the metadata Dataset

Proved that it's possible to simultaneously predict the number of daily vaccinations of all the countries by finding correlations between their historical data