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Building a resilient health system to ensure the quality of health care during a public health emergency

July 2022

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Application of Deep learning for the prediction of COVID-19

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Introduction

- DL is a part of machine learning which is defined as the learning representation of data. If we human provides the system tons of information, it starts to understand it and respond.
- According to (Coronavirus, 2020), Coronaviruses are passed on from animals and people.

Introduction

- covid 19 Pandemic has largely disrupted several segments namely healthcare, the national economy, personal losses etc.
- DL is a part of machine learning which is defined as the learning representation of data. If we human provides the system tons of information, it starts to understand it and respond.
- According to (Coronavirus, 2020), Coronaviruses are passed on from animals and people.

Cont..

- The disease was firstly reported in China in December 2019 and then spread to many countries .
- Across the glob ,the challenge was to fight covid 19 to minimize the impact on the segment .

Cont..

- Deep learning has many applications for covid 19 which is include prediction, contact tracing, precision diagnostics, vision-based robotics, medical image analysis, and misinformation detection.
- Applying Artificial intelligence in health sector can prevent and detect disease like Covid 19 early which helps to save human life early.

Cont..

- Protective measures to reduce the risk of contracting the COVID19 such as
  - avoid touching your eyes, nose, and mouth,
  - avoid close contact with people who are sick, stay home, cover your cough with a tissue, then throw the tissue in the trash, clean and disinfect frequently touched objects and surfaces.

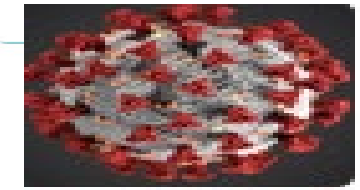
Cont..

- Contributions of our Proposed work
  - We use the modern approach which is a DL model for scalable and accurate prediction of Covid_19 which is effective in time and cost.
  - We use universal method.
  - We use the model that Can learn supervised, reinforcement, and unsupervised.

Objective

- Analysis statistics of people affected by the disease, recovered, and death are taken into account to predict the next day's trend and to prevent early.
- Make the decision making easy and simple.
- Predict the future cases.
- Compare and select the best algorithm.

Methods



Covid 19 Diseases

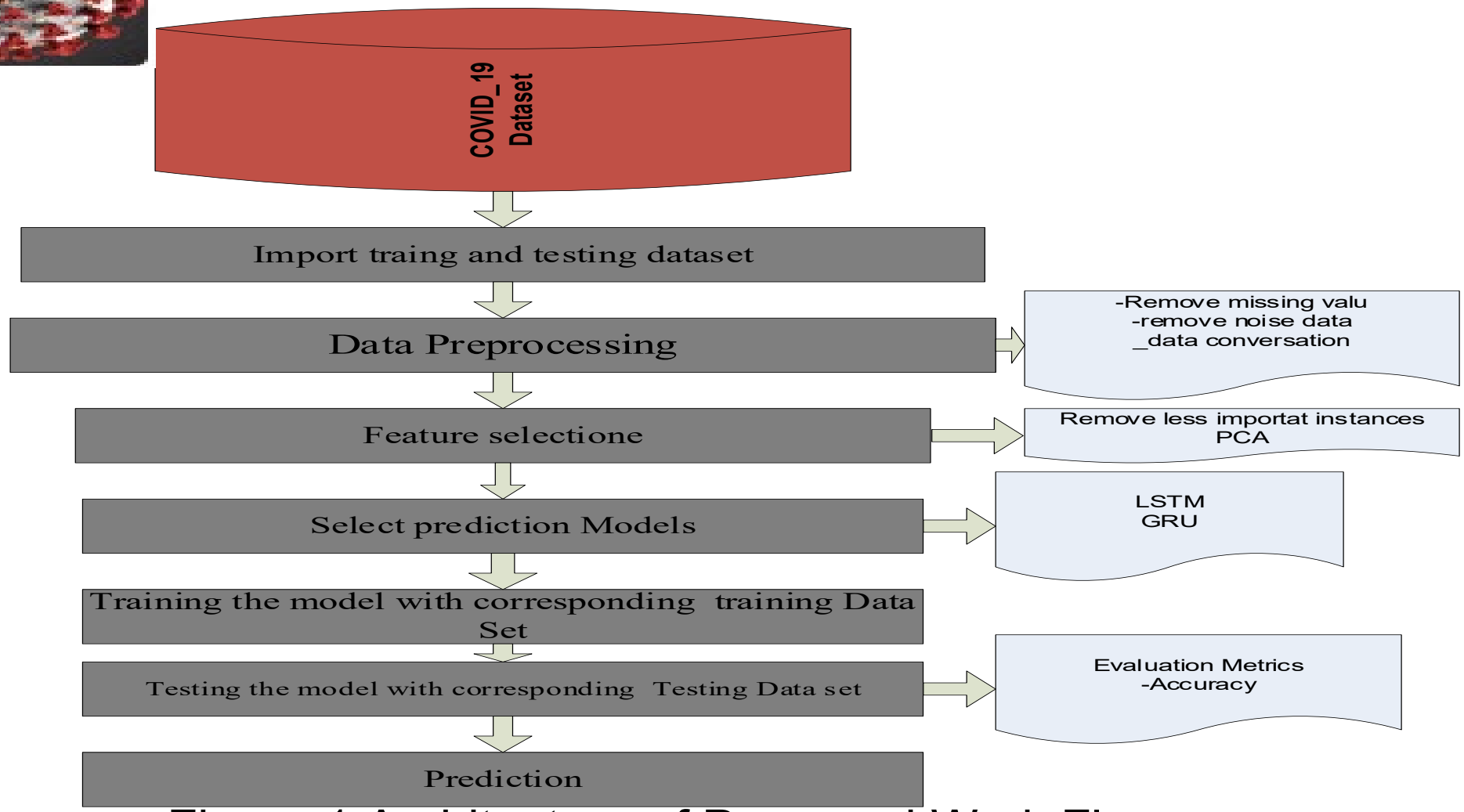


Figure 1:Architecture of Proposed Work Flow

Cont..

Data Collection

- Obtained from GitHub repository provided by the Center for Systems Science and Engineering, Johns Hopkins University .total of 35,000 datasets before applying pca and 256475 after applying pca

Cont....

- Data preprocessing
  - PCA, Data Conversion ,and Feature reduction.
- Algorithms used
  - LSTM(Long short-term memory), GRU(Gated Recurrent Unit), LSTM-PCA,and GRU-PCA.

Performance metrics

- Accuracy

$$\text{Acuracy} = 100 * \left(\frac{\text{TP} + \text{TN}}{\text{TP} + \text{FP} + \text{FN} + \text{TN}}\right)$$

- Precision

$$\text{Precision} = 100 * \left(\frac{\text{TP}}{\text{TP} + \text{FP}}\right)$$

- Recall

$$\text{Recall(Sensitivity)} = 100 * \left(\frac{\text{TP}}{\text{TP} + \text{FN}}\right)$$

- Fscore

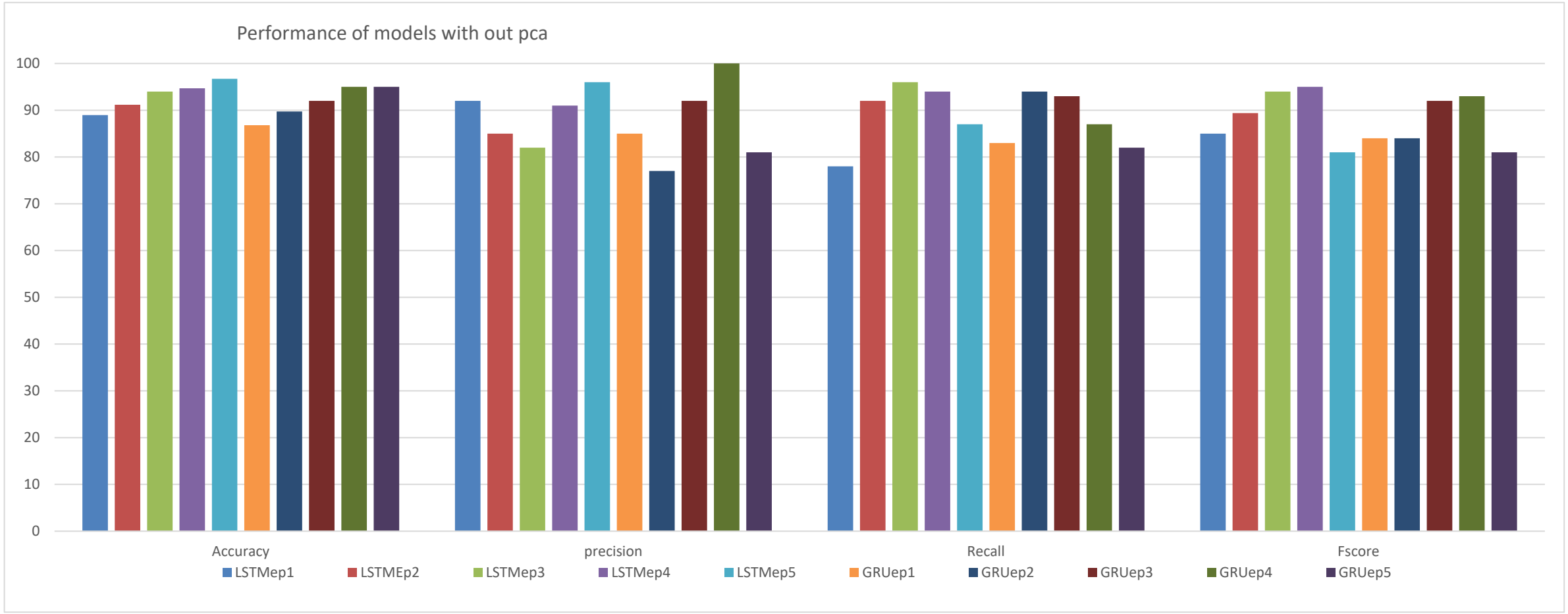
$$\text{FScore} = 100 * \left(\frac{2 * (\text{recall} * \text{precision}}{\text{Recall} + \text{Precision}}\right)$$

Result

Performance of Algorithms without PCA

Model	#epoch	1	2	3	4	5
LSTM	Accuracy	88.97	91.18	94	94.7	96.73
	precision	92	85	91	96	76
	Recall	78	92.01	96	94	87
	F score	85	89.4	94	95	81
GRU	Accuracy	86.79	89.74	92	95	95
	Precision	85	77.002	92	100	81
	Recall	83	94	93	87	82
	F score	84	84	92	93	81

Cont..


Performance of models with out pca
100
90
80
70
60
50
40
30
20
10
0
Accuracy
precision
Recall
Fscore
LSTMep1
LSTMEp2
LSTMep3
LSTMep4
LSTMep5
GRUep1
GRUep2
GRUep3
GRUep4
GRUep5

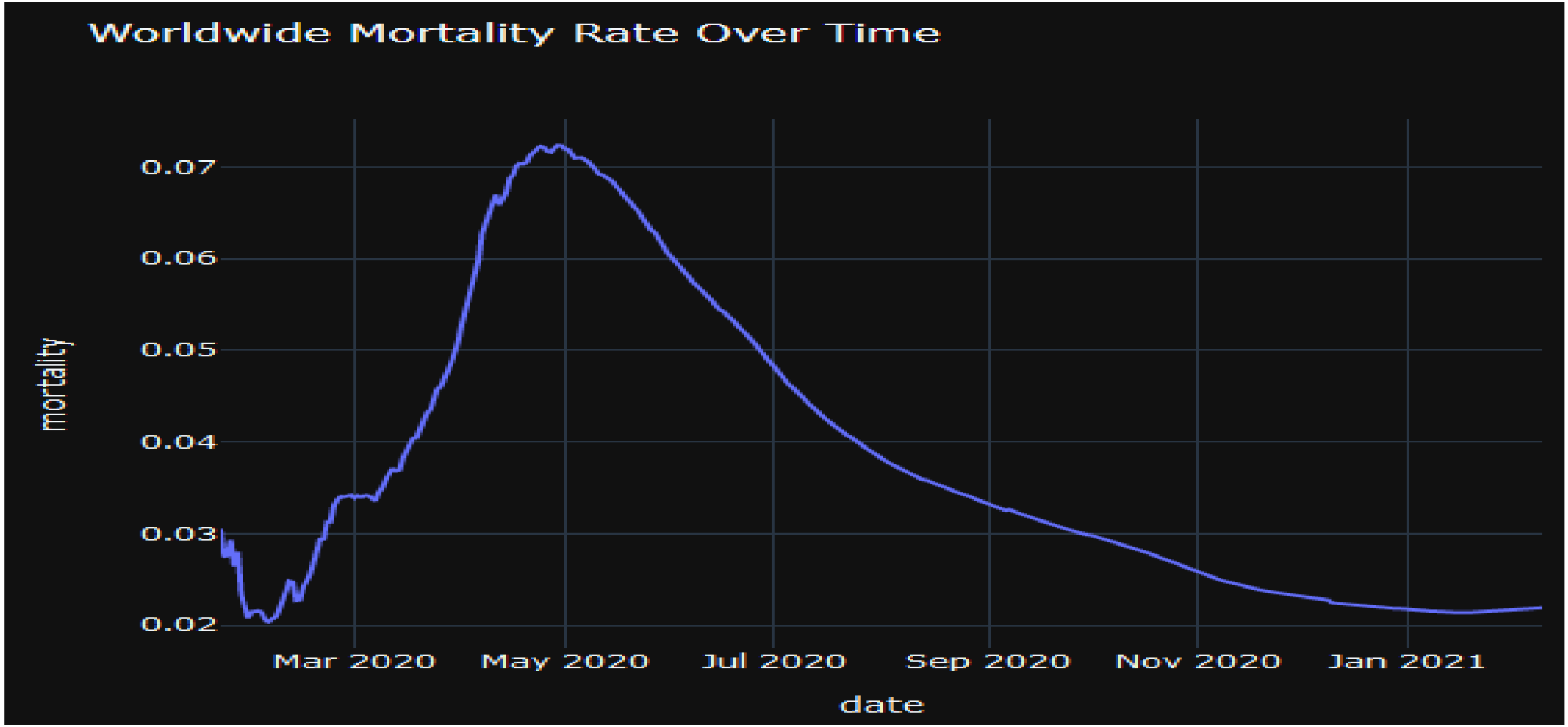
Performance of Algorithms with PCA

Model	#epoch	1	2	3	4	5
LSTM-PCA	Accuracy	93.97	95.18	96.34	96.57	97.05
GRU -PCA	Accuracy	89.43	91.64	93.27	95.98	96.61

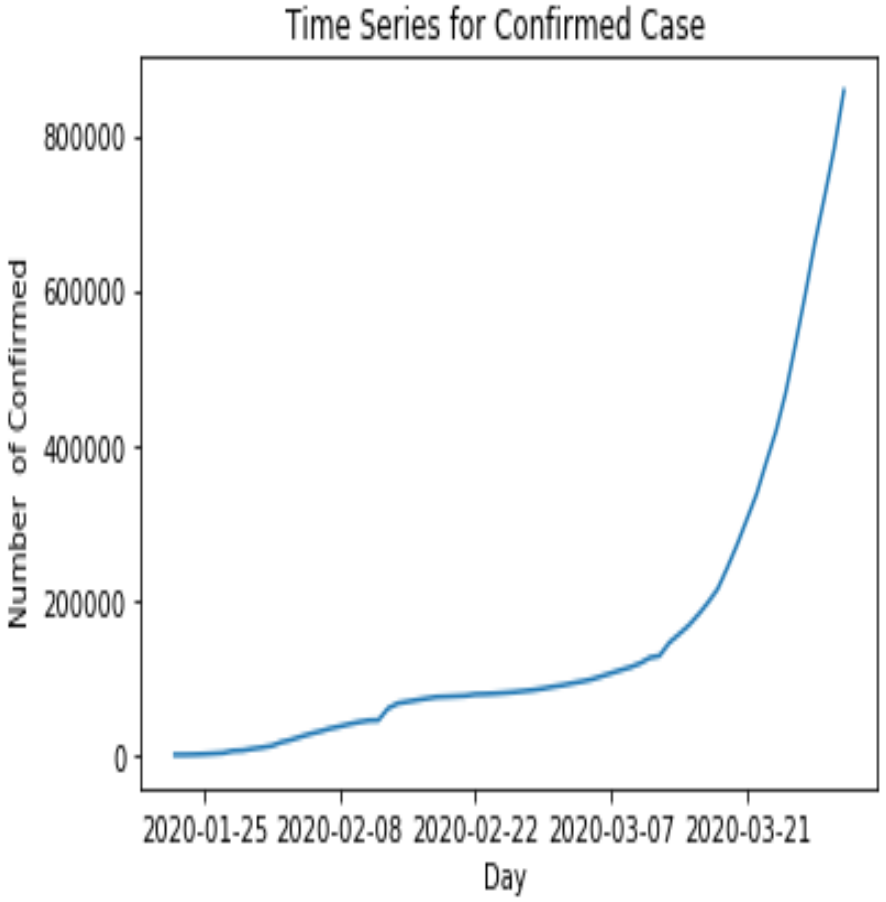
Cont..

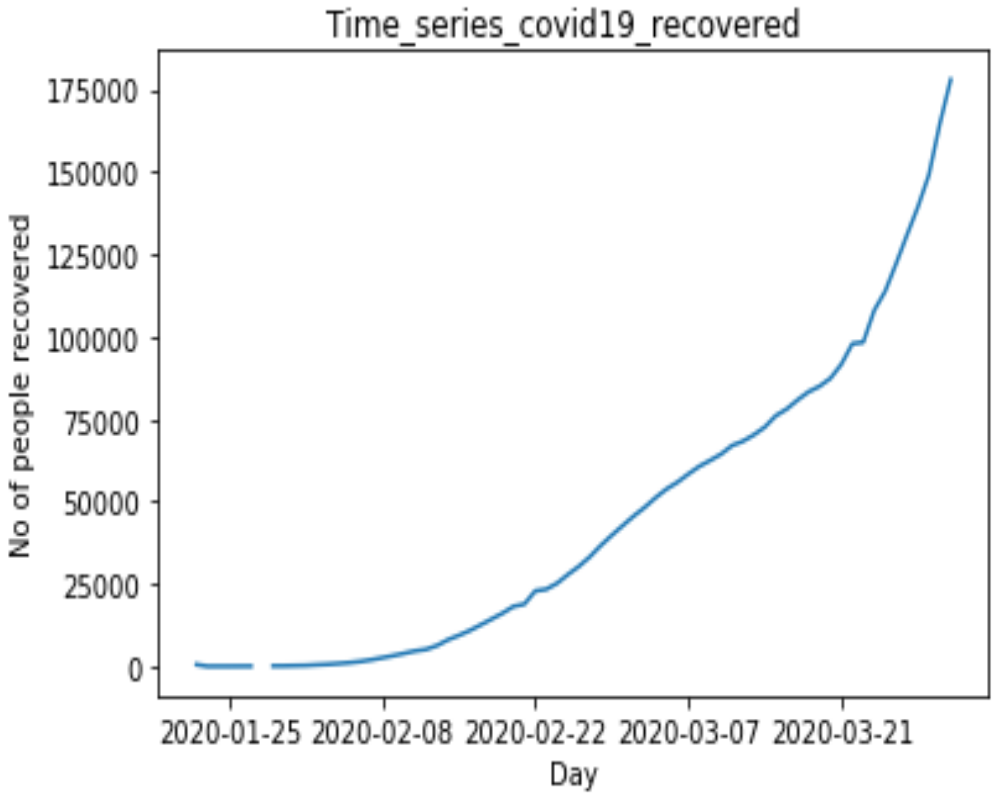

Accuracy of proposed model
100
90
80
70
60
50
40
30
20
10
0
accuracy %
Acuracy
LSTM-PCA ep1
LSTM-PCA ep2
LSTM-PCA ep3
LSTM-PCA ep4
LSTM-PCA ep5
GRU-PCA ep1
GRU-PCA ep2
GRU-PCA ep3
GRU-PCA ep4
GRU-PCA ep5

Cont..

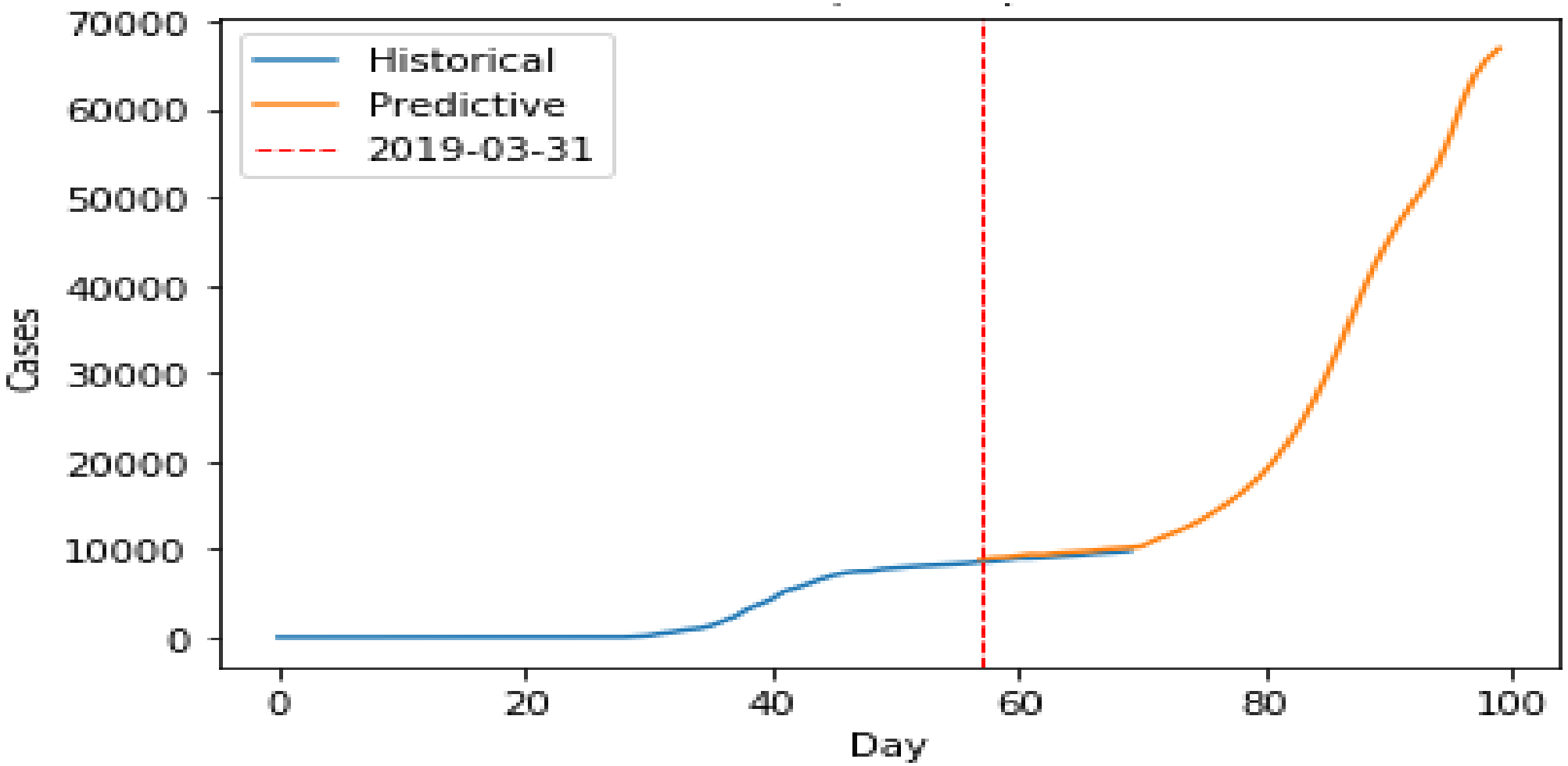

Worldwide Mortality Rate Over Time
mortality
0.07
0.06
0.05
0.04
0.03
0.02
Mar 2020
May 2020
Jul 2020
Sep 2020
Nov 2020
Jan 2021
date

Cont....


Time Series for Confirmed Case
Number of Confirmed
800000
600000
400000
200000
0
2020-01-25 2020-02-08 2020-02-22 2020-03-07 2020-03-21
Day


Time_series_covid19_recovered
No of people recovered
175000
150000
125000
100000
75000
50000
25000
0
2020-01-25 2020-02-08 2020-02-22 2020-03-07 2020-03-21
Day

Cont..


Historical
Predictive
2019-03-31
Cases
Day
70000
60000
50000
40000
30000
20000
10000
0
0
20
40
60
80
100

Discussion

- The modern approach is better than the old machine learning methods
- Applied feature selection is very important to increase performance of an algorithms.
- The role of Deep learning is very high in health industry/sector.
- The quality of data can affect the result.

Conclusion

- DL models are very powerful to forecast the coming based on the active given data in health industry.
- Without feature selection, the models provided the accuracy of 96.73% and 95% respectively .
- The proposed LSTM-PCA model Scores the highest precision of 96.61 and accuracy of 97.05%.

Cont..

- Deep learning has many applications for covid 19 which is include,
  - Prediction ,
  - contact tracing,
  - precision diagnostics,
  - vision-based robotics,
  - medical image analysis, and
  - misinformation detection.
- Applying Artificial intelligence in health sector can prevent and detect disease like Covid 19 early which helps to save human life early.

Next Plan

- validate the overall performance of our proposed version on larger datasets.
- Applying Deep learning method in other Chronic diseases .
- Apply an Ensemble approach for Covid 19 and other Chronic diseases.

Thank You

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