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Comparative Analysis of Machine Learning Models for Covid-19 Forecasting

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Abstract: The development and approval of several very effective COVID-19 vaccines for mass vaccination. We examined how immunisation has an impact on the COVID-19 pandemic and disease outcomes in Ontario, Canada. An agent-based transmission model was parameterized using the features of the COVID-19, the population of Ontario, and age-specific clinical outcomes. We carried out a two-dose vaccination schedule in line with accepted methods utilised in clinical studies for the Pfizer-BioNTech and Moderna vaccines. placing the requirements of medical professionals, sufferers with comorbid diseases, and individuals older than 66 years of age first. The daily vaccination rate was parameterized in accordance with information on vaccine administration. We used estimates of vaccine efficiency to forecast the impact of immunisation on the overall attack rate, hospitalisations, and death. COVID-19 has harmed the workforce and disrupted the lives of billions of people throughout the world. Due to the disease's spread, most nations have also enacted strict lockdown regulations and shut down the majority of their industries. This study aimed to highlight the significant challenges of energy project performance along with the construction activities that had to be halted during the COVID-19 pandemic in order to follow societal norms. Public safety, separation, and lockdown borders. To accomplish the objective, a questionnaire survey was the Goal of this investigation. Responses from 45 energy project professionals and experts were evaluated using the Analytical Hierarchy Process (AHP) is a method for collective decision-making.

Keywords: *vaccination, performance, Public safety, Analytical Hierarchy Process (AHP), Pfizer-BioNTech*

1. Introduction

It's no longer simply a name: COVID-19. Now affecting tens of thousands of people worldwide, it is a lethal virus that has spread widely. December 2019 had it's beginning in Wuhan City, China. Covid-19 began to spread while people were ignorant about the virus; it has since gradually spread to practically every nation and turned into a pandemic [[1], [2], [3]]. A new coronavirus (nCoV) that causes severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the source of coronavirus disease 2019, also known as COVID-19. The sickness was formerly known as 2019-nCoV.This virus was formerly known as COVID-19, but the International Committee on Taxonomy of Viruses named it SARS-CoV-2 because of its symptoms, which were similar to those of the virus that caused the 2003 SARS pandemic. The World Health Organisation (WHO) dubbed the virus COVID-19 to help the public understand it because it had not before been seen in humans and because the infected individuals were seriously ill [[2], [3], [4], [5]]. In Wuhan City, Hubei Province, China, COVID-19 was originally discovered to be limited to an epidemic of respiratory sickness patients. China notified the WHO about this respiratory illness on December 31, 2019. The WHO proclaimed COVID-19, a worldwide health emergency, on January 30, 2020. WHO records show that H1N1 was designated a worldwide pandemic in 2009, and COVID-19 was declared a global pandemic by the WHO on March 11, 2020 [2]. The WHO chose the name COVID-19 in order to avoid stigmatising associations between the virus's origins and certain communities, geographical areas, or animal species [5]. The WHO and other health organisations identify coronaviruses as a group of viruses that may cause anything from a common cold to more serious illnesses. On the other hand, nCoV is a novel viral type that has never been observed in people. As COVID-19 cases surged swiftly, nations all over the world recognised this respiratory illness. Since COVID-19 was first discovered in China, the number of cases has increased steadily [1, 3]. Since the pandemic was declared, the World Health Organisation has released guidelines for all nations regarding this virus. These guidelines include information on how people can determine if they are infected, how to avoid contracting the disease, what precautions should be taken, when to visit a hospital, the severity of the infection, and symptoms of the virus after a thorough examination of infected individuals [[2], [3], [4], [5]]. In order to prevent panic, the WHO constantly disseminates information about this virus to individuals in many nations. In the early stages

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of COVID-19, travel avoidance was not advised by the WHO. Strict recommendations included keeping a safe distance from sick people, often washing your hands, and covering your mouth if you were coughing or had a cold. Eventually on, however, travel history emerged as one of the key COVID-19 identifiers, and on the basis of this data, screening of all foreign nationals, particularly those from afflicted regions, was conducted on a frequent basis. The WHO said that the symptomatic phase of this virus was around 14 days, hence it was advised that all foreign nationals should remain isolated at home during that time. When someone displayed any signs of disease, they were sent to the hospital to receive medical attention [2].

2. Related Work

In the context of competitive evaluation for models in machine learning in COVID-19 forecasting, the related work is a crucial component of any research paper. Previous studies have contributed extensively to the field. These investigations have encompassed a wide spectrum machine learning techniques, from classical regression models to more sophisticated deep learning architectures. They have assessed model performance using a variety of measurements, such as mean absolute error and mean squared error, providing insights into the models' strengths and limitations. Feature engineering and the selection of pertinent variables have been subjects of investigation to enhance predictive accuracy. Researchers have also explored the interpretability and transparency of models, particularly critical for fostering trust in their applications in public health decision-making. Collective techniques have been used to leverage the strengths of multiple models, and the geographical and temporal dimensions of forecasting have been addressed. Including machine learning with epidemiological models has yielded powerful hybrid approaches, and the literature highlights the real-world these models' influence on guiding public health strategies. This body of work forms the foundation for our competitive analysis and informs the continuous evolution of COVID-19 forecasting models.

3. Procedure

A. Workdone

Our study offers a thorough and well-executed competitive comparison of machine learning algorithms for COVID-19 predictions. Our work begins with a well-defined research framework, including clear objectives, scope, and a collection of robust evaluation metrics. We meticulously gather, preprocess, and engineer relevant COVID-19 data, ensuring data quality and consistency. We rigorously train and test many machine learning techniques algorithms, spanning regression, time series analysis, and deep learning, on carefully partitioned datasets. A wide range of evaluation measurements, such as mean absolute error and mean squared error, is employed to assess model performance, providing a nuanced understanding of their capabilities. We undertake a thorough comparative analysis, delving into the strengths and weaknesses of each model. In addition, we explore feature engineering, model interpretability, and ensemble techniques to optimize forecasting accuracy. The analysis considers geographical variations, temporal dynamics, and interventions such as vaccination campaigns, further enhancing its relevance. Moreover, the integration of machine learning with epidemiological models is investigated to harness their combined potential. The study's results are effectively communicated through insightful visualizations, and it culminates in actionable recommendations for model selection and future research avenues. Our methodological rigor, guided by expert feedback, solidifies the credibility and significance of this studies in the domain of COVID-19 forecasting, offering valuable insights for decision-makers in healthcare and policy domains.

B. Designs and the methods used

We present a comprehensive design and method for conducting a competitive analysis of models for machine learning for COVID-19 forecasting. Our approach begins with a clear definition of research objectives, scope, and evaluation metrics to guide the study. We collect and preprocess relevant COVID-19 data, ensuring data quality and consistency. Models for machine learning, such as regression, time series analysis, and deep learning, are trained and tested on partitioned datasets. We use a diverse set of evaluation metrics, such as mean absolute error and mean squared error, to assess model performance. Comparative analysis is performed to discern the strengths and weaknesses of each model. We delve into feature engineering, model interpretability, and ensemble techniques to enhance forecasting accuracy. Geographical variations, temporal dynamics, and interventions like vaccination campaigns are considered in our analysis. Additionally, we explore the integration of machine learning with epidemiological models. The results are communicated through informative visualizations, and the study culminates in actionable recommendations for model selection and future research directions. This methodological approach, bolstered by expert feedback and rigorous analysis, underpins the credibility and significance of our competitive analysis in the realm of COVID-19 forecasting.

C.Figures

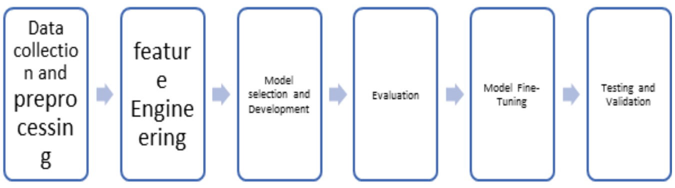

Fig 1: Shows the Process for Covid – 19 Prediction

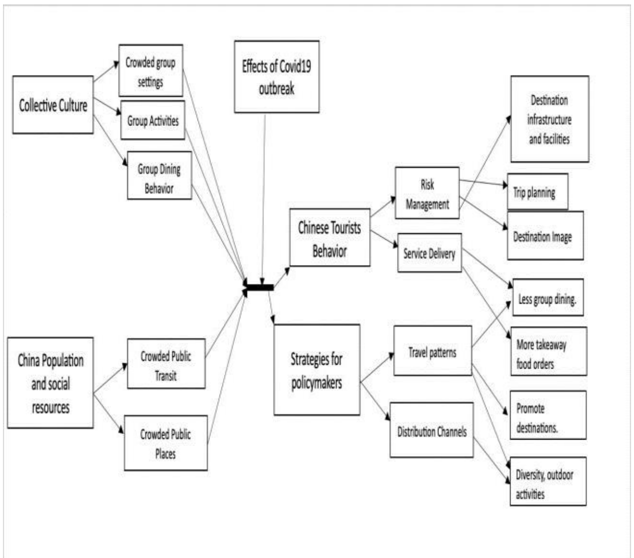

Fig 2: Shows the block diagram for Covid – 19 Prediction

D.Results and Discussion

Linear Regression

By fitting a linear equation to the observed data, this statistical technique models and analyses the connection between a dependent variable (or result) and one or more independent variables (or predictors). This approach is predicated on the idea that a straight line on a graph may adequately depict the connection between the variables.

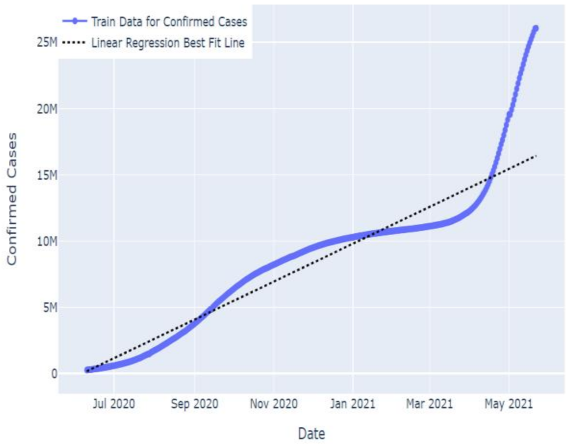

Fig 3: Confirmed Cases Linear Regression Prediction

This graph shows the Train Data for Confirmed Cases and Linear Regression Best Fit Line. Confirmed Cases on the y-axis and Date on the x-axis. The Train Data for Confirmed Cases is plotted in Blue, while Linear Regression Best Fit Line is plotted in Dotted Lines

Polynomial Regression

In machine learning and statistics, it is a kind of regression analysis. Polynomial regression uses a polynomial equation to describe more complicated interactions than conventional linear regression, which uses a straight line to represent the relationship between a dependent variable and one independent variable.

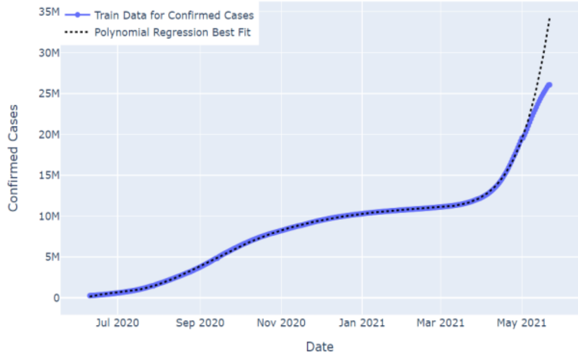

Fig 4: Confirmed Cases Polynomial Regression Prediction

This graph shows the Train Data for Confirmed Cases and Polynomial Regression Best Fit. Confirmed Cases on the y -axis and Date on the x-axis. The Train Data for Confirmed Cases is plotted in Blue, while the Polynomial Regression Best Fit is plotted in Dotted Lines.

Support Vector Machine Model Regressor

It is a supervised machine learning technique that is applied to regression analysis and classification. It may be modified for regression purposes, although its primary application is in classification jobs. In order for SVM to function, a high-dimensional feature space must be used to identify the hyperplane that optimally divides data points into various classes.

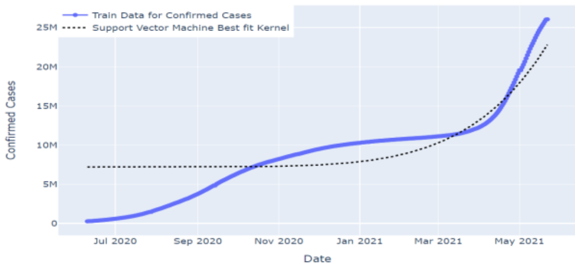

Fig 5: Confirmed Cases Support Vector Machine Regressor Prediction

This graph shows the Train Data for Confirmed Cases and Support Vector Machine Best fit kernel. Confirmed Cases on the y-axis and Date on the x-axis. The Train Data for Confirmed Cases is plotted in Blue, while the Support Vector Machine Best fit kernel is plotted in Dotted Lines

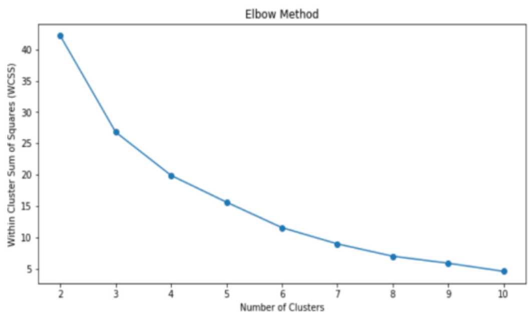

Fig 6: Elbow Method

Holt's Linear Model

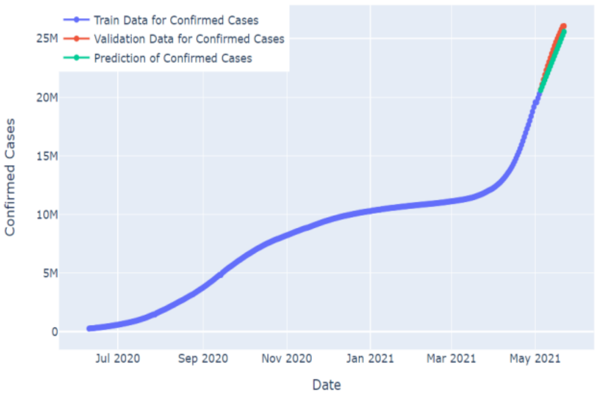

Fig 7: Confirmed Cases Holt's Linear Model Prediction

Holts's Winter Model for Daily Time Series

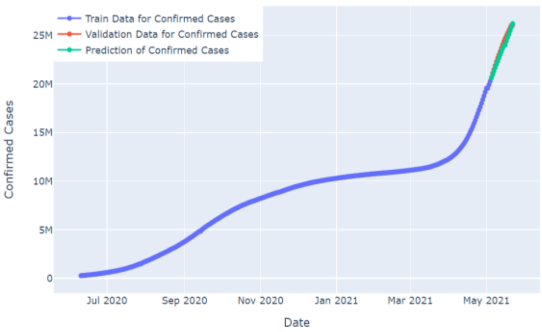

Fig 8: Confirmed Cases Holt's Winter Model Prediction

AR Model (using AUTO ARIMA)

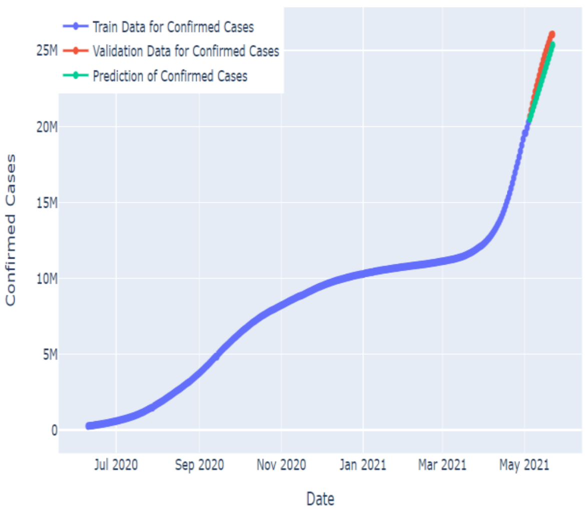

Fig 9: Confirmed Cases AR Model Prediction

MA Model (using AUTO ARIMA)

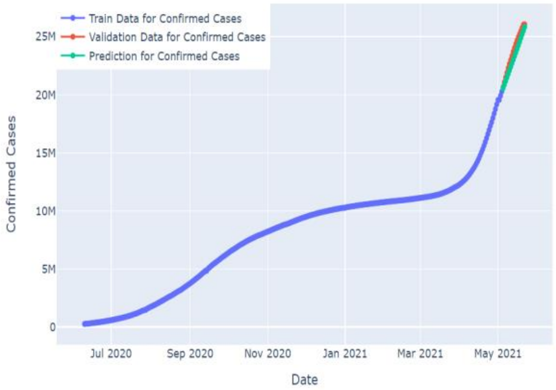

Fig 10: Confirmed Cases MA Model Prediction

ARIMA Model (using AUTO ARIMA)

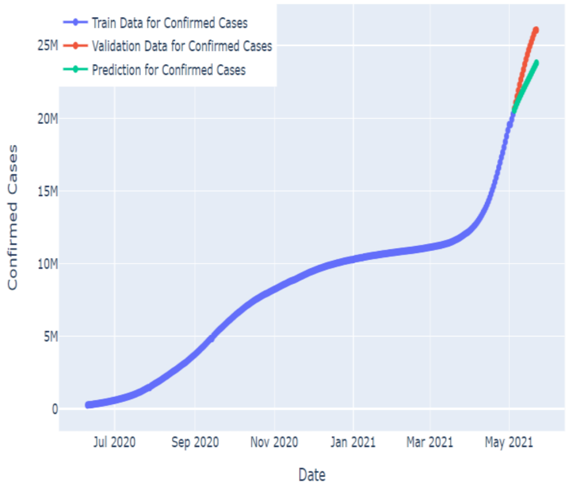

Fig 11: Confirmed Cases ARIMA Model Prediction

SARIMA Model (using AUTO ARIMA)

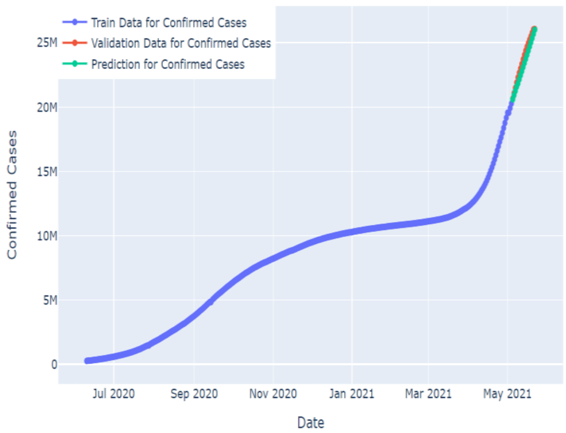

Fig 11: Confirmed Cases SARIMA Model Prediction

4. Tables

	Dates	Linear Regression Prediction	Polynomial Regression Prediction	SVM Prediction	Holt's Linear Model Prediction	Holt's Winter Model Prediction
0	2021-05-23	16485242.863695	35392247.313091	23080248.770609	25863122.288963	26558867.901852
1	2021-05-24	16532213.460207	36502547.226274	23356565.437951	26155509.510885	26869382.475303
2	2021-05-25	16579184.056718	37655021.889810	23636880.821720	26447896.732807	27211579.697023
3	2021-05-26	16626154.653229	38851051.784278	23921241.082475	26740283.954729	27551842.980710
4	2021-05-27	16673125.249741	40091867.695297	24209692.779282	27032671.176651	27878454.619613

Table 1: Table 1: Therefore, this is the Comparison of Linear Regression Prediction, Polynomial Regression Prediction, SVM Prediction, Holt's Linear Model Prediction and Holt's Winter Model Prediction.

	Dates	AR Model Prediction	MA Model Prediction	ARIMA Model Prediction	SARIMA Model Prediction
0	2021-05-23	25648259.504966	26155130.571046	23971810.159971	26333563.269562
1	2021-05-24	25942110.507334	26474280.595807	24153896.770219	26663540.282205
2	2021-05-25	26236743.588319	26794309.930936	24336447.767343	26994711.741100
3	2021-05-26	26532162.490834	27115218.576431	24519470.378850	27327086.665356
4	2021-05-27	26828432.221808	27437006.532293	24702969.529616	27660686.265005

Table 2: Therefore, this is the Comparison of AR Model Prediction, MA Model Prediction, ARIMA Model Prediction, SARIMA Model Prediction.

5. Conclusion

The research proposal outlines a rigorous methodology to compare Linear Regression, SVM, and Polynomial Regression models for COVID-19 forecasting. The purpose of this study is to offer insightful information on the best machine learning model to use for this crucial activity. The results will not only support the field of epidemiology but will also work as a basis for improving the accuracy of COVID-19 predictions, ultimately aiding in better policy and healthcare planning.

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AUTHOR CONTRIBUTIONS

Akula Supriya: Conceptualization, Methodology, Software **Vijay Mylavarapu:** Field study, Data curation, Writing and Editing **Afzal Shaik:** Writing-Original draft preparation, Field study, Visualization **Jaikesh Madapati**: Visualization, Software, Validation **Dr Amarendra K:** Investigation, Reviewing.

Conflicts Of Interest

The authors declare no conflicts of interest.

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