# 1. INTRODUCTION

The COVID-19 pandemic has inspired various models based on machine learning and deep learning to model the spread of the virus. These models combine temporal and spatial dimensions to improve predictive performance. Most studies describe the trend or classification of COVID-19 cases. One of them proposed a deep learning model using Long Short-Term Memory (LSTM) and Convolutional Neural Network (CNN) networks to predict COVID-19 events, which has the potential to integrate temporal and spatial features in the prediction model [1].

Recurrent Neural Networks (RNNs) and their variants, such as Long Short-Term Memory (LSTM) models, have shown results in temporal forecasting of COVID-19 [2]. Recurrent Neural Networks (RNNs) and their variants, such as Long Short-Term Memory (LSTM) models, have shown results in temporal forecasting of COVID-19. A study conducted in Lampung Province, Indonesia, used an RNN-based model to predict active cases, recoveries, and deaths, achieving high accuracy with RMSE values as low as 0.001, 0.0027, and 0.001, respectively [3]. These results confirm that DL models are capable of handling time-series data with efficiency

Although the spatiotemporal dynamics of COVID-19 remains a challenging task, several studies have compared epidemiological models with ML models, where simpler models like SIR even outperformed complex models like SEIR highlighting the importance of effective feature engineering in the context of spatial data [4]. Similarly, a study advocated a probabilistic spatiotemporal neural network and estimated models with both spatial and temporal components, to improve the accuracy of COVID-19 case prediction [5].

Another study showed the prediction of cumulative confirmed cases, recoveries, and deaths trends over the next 60 days in top 10 countries using RNN with GRU and LSTM. A study presented the COVID-19 pandemic forecast for the next 60 days using RNN-LSTM and RNN-GRU models. For confirmed cases, the GRU model outperformed the LSTM model in countries like the US, Brazil, South Africa, Peru, Chile, and Iran, while for India, Russia, Mexico, and the UK, the growth of confirmed cases was predicted by the LSTM model and the GRU model provided a gradual improvement [6]. A study [7] using LSTM architecture in the US, India, and Italy predicted COVID-19 recovery cases for the next seven days. The performance was evaluated by MAPE, and the results showed that the error was small and never above 3%. Therefore, the deep learning model best fits the COVID-19 recovery dynamics and has made correct predictions with a total error of 1.46 to 2.65%.

Another study proposed the application of RNN and LSTM models to determine the level of Covid-19 transmission, obtaining optimum root mean square error values for the testing and training processes of 0.06 and 0.04, respectively. Although this study is efficient in predicting the pandemic, the study has not made predictions based on classification based on time [8]. In line with this, the study [9] used SVM in environmental modeling, the results obtained showed that SVM outperformed conventional geostatistical models with an accuracy rate of 95%. This study illustrates the ability of SVM to handle spatially distributed data and demonstrates its application for spatiotemporal modeling of COVID-19.

While [10] illustrates that the integration of Kriging with machine learning techniques, such as SVM, improves spatial data analysis learning by up to 25%. The study [11] presents that the integration of Kriging with machine learning techniques improves spatial data modeling, achieving an $R^2$ of 0.92. Similarly, urban flood prediction using machine learning was recently conducted in [12], whose model can achieve an F1 score of 0.89. This proves the relevance of the model for other types of environmental prediction tasks including pandemics. Hybrid models, such as the integration of SVM with Kriging, have also shown better performance compared to single models on various spatial data [13,14]. While research [15] illustrates how deep learning combined with spatial features of extreme weather can further improve performance with values of over 94%. This suggests that the hybrid approach could be useful in spatiotemporal COVID-19 prediction. While research [16] explains that model selection should be done based on context, including data availability, type, and distribution, important considerations in spatiotemporal forecasting.

Based on the reviewed studies, it is found that there are not many studies comparing the performance of conventional ML models, such as SVM, with DL models, such as RNN, in the case of predicting spatial-temporal data classification, one example of which is COVID-19. This study conducts a comparative performance analysis of the proposed SVM model using time-based features against RNN in predicting the spread of COVID-19 infection in Bandung, Indonesia. Preliminary studies show that while DL models are promising for temporal modeling, SVM excels in spatial data modeling. This comparison will help in building a robust framework for mapping the spread of COVID-19 and provide valuable insights for policymakers to assist in future pandemic preparedness..