



## COVID-19 Outbreak Prediction in Indonesia Based on Machine Learning and SIRD-Based Hybrid Methods

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**Abstract:** This paper aims to forecast and analyze the spread of COVID-19 outbreak in Indonesia by applying machine learning and hybrid approaches. We show the performance of each method, an ensemble-support vector regression (ensemble-SVR), a genetic algorithm and an SIRD model (GA-SIRD) and an extended Kalman filter, a genetic algorithm and an extended Kalman filter (EKF-GA-SIRD), in obtaining the prediction of the outbreak. The GA-SIRD model is built based on the data availability and is enhanced by employing an extended Kalman filter to better predict the spread of the outbreak. Without considering the epidemic model, the ensemble SVR can provide a higher accuracy compare to the two hybrid approaches in the case of short-term forecasting. Furthermore, the EKF-GA-SIRD can better adapt to the extreme change and shows a better performance than the GA-SIRD.

**Keywords:** *pandemic; SIRD model; Kalman filter; machine learning.*

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