Review: machine and deep learning methods in Malaysia for COVID-19

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Article Info

Article history:

Received Oct 27, 2022
Revised Feb 14, 2023
Accepted Mar 23, 2023

Keywords:

COVID-19
Deep learning
Global pandemic
Machine learning
Vaccine

ABSTRACT

The global pandemic of the coronavirus disease COVID-19 has impacted a variety of operations. This dilemma is also attributable to the lockdown measures taken by the afflicted nations. The entire or partial shutdown enacted by nations across the globe affected the majority of hospitals and clinics until the pandemic was contained. The judgements made by the authorities of each impacted nation vary based on a number of variables, including the nation's severity of reported cases, the availability of vaccines, beds in intensive care unit (ICU), staff number, patient number, and medicines. Consequently, this work offers a thorough analysis of the most recent machine learning (ML) and deep learning (DL) approaches for COVID-19 that can assist the medical field in offering quick and exact COVID-19 diagnosis in Malaysia. This research aims to review the machine learning and deep learning methods that were used to help diagnose COVID-19 in Malaysia.

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1. INTRODUCTION

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), also known as 2019-nCoV, is a novel type of coronavirus that causes disease or infection under the name coronavirus disease (COVID-19). It was initially found in the Chinese city of Wuhan Hubei. The first COVID-19 case was reported to the World Health Organization (WHO) on December 31, 2019. On January 30, 2020, the COVID-19 outbreak was classified as a worldwide outbreak [1]. The WHO has classified H1N1 as an international pandemic disease since 2009; COVID-19 was the second pandemic disease to be identified. Although researchers are still looking into possible disease infection routes, the disease spreads mostly through intimate contact with afflicted people [2]. The major symptoms of COVID-19 infection include fever, a dry cough, and difficulty breathing. Up to 10% of patients may experience GI symptoms such as diarrhoea, while others may experience muscle aches, fatigue, and loss of taste or smell. (anosmia). As previously thought, direct contact is one of the possible routes for the virus to spread among humans. As a result, social isolation can reduce the likelihood of developing the disease. A disease can be separated from a person by as much as 6 feet. As a result, inhaling droplets created by an infected individual while talking or sneezing is one of the primary mechanisms contributing to disease dissemination. COVID-19 symptoms are also unnoticeable in some cases [3].

COVID-19 control measures were applied in Malaysia and classified as a movement control order (MCO) beginning March 18, 2020, with phases 1, 2, and 3. The MCO in Malaysia forbids all government and private activity except for a few vital areas. Universities and schools are prohibited from conducting educational activities, while day care centres and shopping malls are likewise prohibited. Tourism and recreational activities are also restricted, as are mass gatherings. The MCO's goal is to limit COVID-19 transmission nationwide. According to a study on COVID-19 control methods in China, control measures were successful in reducing the eventual epidemic size, meaning that careful monitoring and early detection of COVID-19 cases should continue until the end of April 2020 [4], [5].

COVID-19 can be detected via nucleic acid-based technologies such as polymerase chain reaction (PCR), next-generation sequencing, computed tomography (CT) scanning, chest X-ray (CXR), and paper-based detection. These pathological tests, which are used to monitor organ changes, may be required of patients. The CT scan and CXR are the two most commonly used pathological tests [6]. There were various advantages to using CT and X-ray chest procedures for COVID-19 diagnosis. For example, when compared to other technologies, CT provides more information about the patient's status and is relatively quick. X-ray chest results can be acquired for less money and with less radiation. CT scans of the brain can be affected by nearby bone, and X-ray chest imaging cannot offer 3D information, both of which are limitations that may affect the performance and usage of both technologies [7].

Doctors in general may make inaccurate diagnoses as a result of tiredness caused by long work days. COVID-19 patients may have aberrant CT or CXR findings, and many of the same lung concerns exist in COVID-19. A normal CT scan or CXR does not necessarily indicate a negative COVID-19 case. As a result, medical assistants are required to ensure an accurate diagnosis. For speedier and more reliable findings, new methods for identifying COVID-19 based on artificial intelligence (AI) ideas, particularly machine learning (ML), have been developed [8], [9].

Traditional ML approaches have been developed by researchers to assist doctors in making accurate diagnosis. Chest X-rays or CT scans can be classified as infected or noninfected. After reading an X-ray image and preparing and extracting unique features from input images, a final prediction choice is created utilising features that are then included into the ML or deep learning (DL) model. Furthermore, by analyzing COVID-19 data, these methodologies can be utilized to forecast outbreak separation, as well as estimate red zones and the number of infected cases using AI. Many AI algorithms, such as ML and DL, are used to test patients for COVID-19 utilizing X-rays and CT scans, such as:

- Support vector machine (SVM) was used to categories data acquired from Twitter, which assisted in the design and development of a web-based system for visualizing COVID-19 cases in Malaysia [10].
- Identify depressive tweets in Malaysian cities using natural language processing (NLP) and DL at the start of the COVID-19 period to enable individuals, caregivers, parents, and even medical professionals to identify linguistic clues that point to signs of mental health deterioration by developing an algorithm that can predict text-based depression symptoms using deep learning and NLP [5].

2. MACHINE AND DEEP LEARNING METHODS

Because coronaviruses are so ubiquitous, machine learning and deep learning are increasingly being utilized to improve the performance of existing approaches for identifying or predicting COVID-19. Machine learning instructs computers on what to do and educates them to perform tasks on their own. It is a data analysis method that entails the development and fitting of models that let machines to learn and anticipate using experience. Deep learning, on the other hand, is a type of machine learning based on artificial neural networks that use many processing layers to extract progressively higher-level features from data.

Several machine learning and deep learning techniques are also being researched in Malaysia for COVID-19. According to one researcher, they want to utilise sentiment analysis to examine Malaysian attitudes towards the COVID-19 immunisation booster. 788 tweets containing COVID-19 vaccine booster keywords were retrieved, and common topics discussed in tweets about the booster were identified using latent Dirichlet allocation (LDA), and sentiment analysis was performed to understand the determinants of sentiments in Malaysia towards receiving the vaccination booster. They later highlighted three crucial LDA topics: i) the type of vaccine booster, ii) the effects of vaccination booster, and iii) vaccination programme operation [11].

Another researcher focuses on the creation of a precise deep learning system for COVID-19 screening utilizing chest X-ray images. They create a lightweight deep learning model that can be used on mobile platforms [12]. They forecasted the peak of the epidemic in Malaysia using the susceptible-exposed-infectious-recovered (SEIR) model. The adaptive neuro-fuzzy inference system (ANFIS) model was also utilised to forecast the number of infected patients in real time. They have also shown that treatments are beneficial in delaying the epidemic's peak. They have also hypothesised that extending the intervention time may lessen the magnitude of the pandemic at its height. The values reported in this study for normalized root mean square error (RMSE), coefficient of determination (R2), and mean absolute percentage error (MAPE) were 46.87, 0.9973, and 2.79, respectively [13].

In another study, a team of Qatar University researchers, medical doctors from Bangladesh, and collaborators from Pakistan and Malaysia created the images of the chest taken from 53 patients with pneumonia, including both bacterial and viral forms. A dataset with 295 photos was developed by combining two datasets that contained COVID-19 images. The COVID-19 virus causes pneumonia in those who contract it, and if the lungs are irreversibly injured, it can even result in death. In this study, employing deep learning models to compare COVID-19 chest pictures, the second dataset is crucial. Images of the chest that are both normal and pneumoniarelated make up the second dataset [14].

The coronavirus was detected using a deep learning model. The collection is separated into three sections: coronavirus imagery, pneumonia imagery, and conventional X-ray imagery. The data classes were reformed using the fuzzy color approach as a preprocessing step, and the images that were structured with the original photos were stacked. After training the stacked dataset with deep learning models (MobileNetV2, SqueezeNet), the model feature sets were processed using the social mimic optimisation approach. The categorization of COVID-19 data was 100% effective, while the classification of normal and pneumonia images was 99.27 percent successful [14].

A lightweight deep learning model for screening COVID-19 is proposed in a publication. The whole dataset contains chest x-ray images of 219 confirmed positive COVID-19 patients, 1,341 healthy people, and 1,345 patients with different kinds of viral pneumonia. According to the performance data, the suggested SPP-COVIDNet achieves the best mean accuracy of 0.946 with the lowest standard deviation among the training folds accuracy. It has 862,331 parameters in total and uses less than 4 MegaBytes of memory storage. The concept is appropriate for rapid screening in order to perform more targeted diagnoses and reduce test time and expense [15].

Robust Weibull machine learning and Baseline Gaussion were used to forecast the possible threat of COVID-19 in countries around the world between July 6, 2020 and June 8, 2020. They show that the proposed Robust Weibull model based on iterative weighting can outperform the baseline in terms of statistical accuracy. In contrast, the baseline Gaussian model paints an unduly optimistic image of the COVID-19 scenario. This case study makes use of Hannah Ritchie's dataset our world in data [16].

Twitter is a well-known social media network where people may share their tales and opinions on any issue, including the COVID-19 epidemic. Because of the indirect influence of tweets on users and the rise in COVID-19 cases in Malaysia, it is critical to monitor pandemic information to avoid misinformation, panic, or confusion among the public. The purpose of this project is to design and construct a web-based system for visualizing the pandemic situation in Malaysia using Twitter data, as Twitter data is one of the useful raw data sources that can be utilized for data visualization. Sentiment analysis and one of the machine learning models, SVM, are used to classify the data SVM. The classification model's performance is evaluated using the following models: i) precision, ii) recall, and iii) F1-measurement [17].

A research study describes a method for detecting social distancing using deep learning and a convolutional neural network (CNN) to assess the distance between people. The proposed method was validated using a video of pedestrians strolling along the street that had been previously recorded. It has the potential to be expanded further as a detection tool for real-time applications [18].

The Malaysian government launched the national COVID-19 immunization programme (PICK) in early 2021 with the goal of achieving herd immunity by 2022. Accessibility, the role of social media, religious considerations, and a variety of other issues have all contributed to the programme's success. This study investigates the factors that influence youth perceptions of PICK in East Malaysia (Sabah). Table 1 (see appendix) lists the majority of the machine and deep learning methods used on COVID-19 in Malaysia, along with their algorithms, data used, results, and reasons for using them.

3. DISCUSSIONS OF DIFFICULTIES AND FUTURE DIRECTIONS

As previously stated, the ML and DL algorithms were used for COVID-19 in Malaysia. Although the ML and DL methods produce successful results for their COVID-19 examples, there are numerous problems that can be addressed to improve the study quality of this direction. These difficulties are summarized below:

- Data set used: literature contains datasets of varying sizes, but the limitation is focusing in short period with small data set such as [19], thus the results of COVID-19 prediction may can't be accurate because the virus can mutate into several strains.
- Vaccine affection: large vaccination reported at (*MySejahtera*, Ministry of Health of Malaysia, and *GitHub* COVID-19 malaysia) are not yet studied with ML and DL. However, some studies studied the wary of vaccinations in East Malaysians (Sabah) with few samples such as [20].

- Prototype of COVID-19: there is not yet a fully functional real-time system (*prototype*) that makes use of findings from machine learning research. Researchers can create a real-time system to detect and diagnose COVID-19 virus infection by employing deep learning and machine learning techniques. In order to check for the spread of pandemics, a system like this can be used in places like hospitals, airports, markets, schools, and other public gathering places [21].
- Others machine and deep learning: There is a lake of implementing others machine and deep learning methods to explore their ability and capability on handling COVID-19 data at Malaysia which may help the health sector to expect the impact of this disease and others that later may appear to the world.
- AI algorithms with ML and DL: The healthcare industry may be better prepared for the effects of COVID-19 and similar diseases if AI algorithms using machine and deep learning approaches are implemented and compared in Malaysia. In the context of solving problems requiring estimation or optimization, (artificial intelligence) algorithms like particle swarm optimization (PSO) and its variants, the genetic algorithm (GA), the African buffalo optimization (ABO), the ant colony algorithm (ACO), and the bat algorithm (BAT), are particularly well-liked [22]–[27].

4. CONCLUSION

This study provides a comprehensive assessment of deep learning and machine learning approaches used to diagnose the COVID-19 outbreak in Malaysia. This work's major purpose is to summarize prior studies and their applications to COVID-19. The studies featured here were selected from a wide range of public and credible research databases. The combined research on COVID-19 is examined and discussed using two major categories, machine learning and deep learning. However, the most popular COVID-19 algorithms are SVM and CNN. Furthermore, only a few researchers used machine learning or deep learning to forecast the COVID 19 outbreak in Malaysia. SVM, LDA, ANFIS, and Naive Bayes are used as machine learning algorithms, and LSTM, DNN, RNN, NN-TF, and NN-Keras are used as deep learning algorithms for COVID-19 diagnosis and epidemic prediction. The most generally used machine learning mechanism for COVID-19 diagnosis and epidemic prediction is SVM, while the most widely used deep learning mechanism is LSTM.

ACKNOWLEDGEMENTS

This study is supported by UMP-IIUM-UiTM sustainable collaboration research grant (RDU200756) under University Malaysia Pahang. We would like also to express our appreciation to the Institute for Big Data Analytics and Artificial Intelligence (IBDAAI), Kompleks Al-Khawarizmi, and Universiti Teknologi MARA (UiTM) for their assistance. Also, this work was supported by the National Natural Science Foundation of China (No.61862051), the Science and Technology Foundation of Guizhou Province (No. [2019]1299, No. ZK [2022]449), the Top-notch Talent Program of Guizhou province (No. KY [2018]080), the Natural Science Foundation of Education of Guizhou province (No.[2019]203) and the Funds of Qiannan Normal University for Nationalities (No. qnsy2019rc09). The Educational Department of Guizhou under Grant (NO. KY [2019]067).

APPENDIX

Table 1. The methods of machine and deep learning

	Methods	Data used	Results	Reasons
Machine learning	SVM [17]	Data gathered from Twitter (100,000 tweets)	Not shown	To keep track of pandemic-related information in order to avoid misinformation, panic, or confusion among the public.
	LDA, sentiment analysis [12]	788 tweets containing COVID-19 vaccine booster keywords	Multinomial logistics regression = 0.7143 accuracies, sensitivity of 0.333, and specificity of 0.6667.	Investigate the attitudes to the COVID-19 vaccination booster in Malaysia
	ANFIS	Daily confirmed cases from 22 March to 5 April 2020 Ministry of Health Malaysia [13]	NRMSE= 46.87, R^2= 0.9973, MAPE = 2.79,	Predict the epidemic peak using the susceptible–exposed–infectious–recovered (SEIR) model
	SVM [14]	Data of 76 images of MERS, SARS, COVID-19. 219 X-ray images of COVID-19.	SVM=96.32% accuracy.	Is to distinguish people with COVID-19-damaged lungs from healthy people or people with pneumonia.
	Naïve Bayes (NB), SVM [28]	Two distinct datasets of English-language news	NB= 86.50%, SVM= 88.83%.	Identifying false news

Table 1. The methods of machine and deep learning *continued*

	Methods	Data used	Results	Reasons
Deep learning	Deep neural network (DNN) and recurrent neural networks (RNN), and long short-term memory (LSTM) [12]	Frontal chest area X-ray images	LightCovidNet =0.9697 accuracy,	Fast and accurate screening test
	MobileNetV2 [14], SqueezeNet	Data of 76 images of MERS, SARS, COVID-19. 219 X-ray images of COVID-19.	SqueezeNet =84.56% accuracy, MobileNetV2= 97.06% accuracy.	Is to distinguish people with COVID-19-damaged lungs from healthy people or people with pneumonia.
	A lightweight [15]	X-ray images of 219 patients of confirmed positive COVID-19, 1341 images of normal people and 1345 images of other types of viral pneumonia patient.	Best mean accuracy of 0.946.	Alleviate the burden of mass diagnosis tests
	CNN [18]	Video	-	The separation of individuals to lessen the spread of the coronavirus pandemic
	LSTM, neural network with keras (NN-Keras), and neural network with tensorflow (NN-TF) [28]	Two distinct datasets of English-language news	LSTM =97.11%, NN-Keras =92.99%, NN-TF =89.065,	Identifying False News
	K-Means Clustering analysis [21]	814 participants using servuy	-	The goal is to examine youth perceptions of PICK based on the clusters formed.

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