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A Novel Hybrid Based Method in Covid 19 Health System for Data Extraction with Blockchain Technology

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Abstract: Millions of people have been afflicted by the COVID-19 epidemic, which has resulted in hundreds of thousands of fatalities throughout the world. Extracting correct data on patients and facilities with and without COVID-19 with high confidence for medical specialists or the government is extremely difficult. As a result, utilizing blockchain technology, a reliable data extraction methodology for the COVID-19 database is constructed. In this accurate data extraction model development and validation study in blockchain technology for COVID analysis, here a novel Hybrid Deep Belief Lionized Optimization (HDBLO) approach is proposed. The weights of the deep model are optimized by the fitness of lion optimization. The implementation of this work is executed using MATLAB software. The simulation outcomes shows the effective performance of proposed model in blockchain technology in COVID paradigm in terms of Mean Absolute Error (MAE), Root Mean Square Error (RMSE), accuracy, F-measure, Processing time, precision and error. Consequently, the proposed approach is compared with the conventional strategies for significant validation.

Keywords: Data Extraction, blockchain technology, COVID-19, optimization, Deep learning and performance metrics.

I. INTRODUCTION

In general, the healthcare approach has worked inside a closed loop system of submerged organizations, with physicians, radiologists, physicians, and academics serving as the key stakeholders of health data [1]. Information has only flowed in one direction, from healthcare professional to patient. Data is expanding and moving along a closed health system quicker than anything else in the era of computerized patient health information [2].Since the epidemic in Wuhan, China in December 2019, the new corona virus illness (COVID-19) has spread to practically every country. Together within month of the virus's widespread dissemination, the severity of the pandemic had grown significantly [3]. As a result, the World Health Organization (WHO) declared a Public Health Emergency of International Concern. To contain the spread of COVID-19, numerous countries had to block their borders, implement lockdowns, and employ social distance [4]. Many parts of the economy, including manufacturing, banking, agriculture, distribution networks, transportation, and tourism, experienced enormous disruptions as a result of these events [5].

In such instances, the majority of corona virus data gathered from the general population, hospitals, and diagnostic centers may be inaccurate [6]. Because of the immensity of computerized patient health information, data is not acquired according to specified criteria and is not managed or preserved effectively [7]. Existing healthcare equipment necessitates reliable data, which is critical for disseminating accurate information about the new corona virus [8]. Moreover, due of the inaccuracy and manually interpretation of huge amounts of data, viral testing utilizing medical equipment for identifying corona virus infections might take several days [9]. Lastly, following or monitoring sick individuals or their connections presents a number of privacy concerns. COVID-19's inadequacies have pushed healthcare companies to change their current digital healthcare infrastructure in order to prevent pandemic circumstances [10]. Moreover, leveraging digital platforms to battle COVID-19 and potential pandemics, it is critical to

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develop a more physician and democratized healthcare technology system.

Several scholars have recently concentrated on using emerging innovation like blockchain as well as Artificial Intelligence (AI) to propose answers for the continuing COVID-19 issues [11], [12], [13]. Blockchain is a novel and powerful technique that is mostly employed in situations where centralization is undesirable and anonymity is required. Health data is of special relevance to blockchain, with a focus on sharing, dissemination, and encryption [14]. Compatibility across diverse healthcare organizational systems, such as pharmacological demands, hospital records, supply chain operations, and insurance payments, can be improved by blockchain [15].

Blockchain is a distributed and distributed database that records transactions securely in blocks [16]. As a result, blockchain records the whole provenance of data. A blockchain digital record may be used to keep track of sample test results, patient information, discharge instructions, and immunization schedules [17].Traditionally, various methods are utilized in this application such as combined deep learning methods [18], Machine learning approach [19], Long short term memory [20], Recurrent Neural Network [21], Artificial Neural Network [22] and recent optimization methods like Particle swarm optimization [23] and Grey wolf Optimization (GWO) [24] and so on.

Despite the fact that several blockchain solutions were suggested or implemented during the COVID-19 epidemic, no optimistic data extraction work has been undertaken to find and summaries the main blockchain solutions to supplement public health efforts over COVID-19 to the finest knowledge [25]. As a result, the goal of this study is to close the gap by investigating blockchain solutions that have been suggested or implemented to address the COVID-19 problems as documented in the literature. To overcome such problems, a novel HDBLO method is developed for data extraction in blockchain technology based COVID system. Because the accurate extraction of data is necessary for analysis of parameters in COVID care centers to given the information to the government or medical authority. The extracting information via the blockchain technology such as Home isolation, hospitalization, first positive test, last positive test, ICU level of monitoring, supplemental oxygen, reported last day of symptoms, end of isolation precautions and death person's details. This study provides a data normalization strategy for correctly training the proposed model using data from various sources (e.g., hospitals) and medical institutions. Data extraction saves time and money in the healthcare business while maintaining data integrity. Data extraction is used to transmit data without losing crucial or relevant data. MATLAB software is taken for the execution of this work. The proposed outcome is compared with the conventional methods for validating the effectiveness of the developed model in blockchain framework with COVID care system in terms of various performance metrics.

The article is organized as follows: The recent works related to this research is summarized in Section 2. The system framework and its problem are defined in Section 3. The proposed model and its formulation are detailed in Section 4. In Section 5, the result, discussion along with the analysis of comparison is described. Finally, the article is concluded with the last Section 6.

II. RELATED WORK

In this section, the most up-to-date research on blockchain and AI-based healthcare solutions are explained. Large volumes of healthcare data (such as medical data on corona virus illness 2019) require safe updating and sharing in order to be transmitted efficiently and securely, which is difficult in hospital communication channels. As a solution, Mohsin, A. H., et al [26] presented a new steganography-based blockchain approach in the geographical domain. The suggested approach is unique because it uses the particle swarm optimization (PSO) algorithm to remove and create extra components. Furthermore, the hash function may be used to disguise private medical COVID-19 information in hospital networks while retaining strong embedding capacity and high resolution.

Kumar, Rajesh, et al. [27] provided a framework that takes a modest quantity of data from diverse sources (e.g. hospitals) and uses blockchain-based federated learning to train a global deep learning model. The data is authenticated using blockchain technology, and federated learning trains the model internationally while maintaining the organization's anonymity. To begin, a data normalisation approach is developed that addresses the variability of data obtained from various institutions using various types of computed tomography (CT) scanners. Furthermore, discovered COVID-19 patient data extraction using Capsule Network based classification method. Finally, a way for training a global model cooperatively utilized blockchain technology and federated learning while maintaining anonymity.

Currently, a COVID-19 is an outbreak disease that can be combated by employing real-time processing of huge amounts of testing set at the edge of healthcare, as well as wireless integration between the edge and a worldwide central cloud to upgrade any diagnostic or forecasting models worldwide. For this reason, Muhammad, Ghulam, and M. Shamim Hossain [27] used the B5G network to present an artificial-intelligence-enabled edge-centric COVID-19 clinical assessment system. The proposed system leverages

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strong edge devices that really can execute deep learning (DL) algorithms to perform monitoring and diagnostics at the edge.

A revolutionary XR as well as Deep Learning depend IoMT approach is introduced by Tai, Yonghang, et al [28] for the COVID-19 tele-health assessment, which integrates VR/AR distant surgery strategy equipment, tailored 5G cloud computing, plus deep learning techniques to deliver real-time COVID-19 management plan indications. The new COVID-19 proposed methodology is then trained using a revolutionary ACGAN-based intelligent prediction algorithm. In addition, to increase the security and performance of the IoMT, the Ripoff system is used for modeling hijacking and assault.

Since the advent of the COVID-19 epidemic, the globe has altered tremendously. This has had a negative impact on humans as well as the world's financial structure. Individuals are actively seeking for a miracle cure to the epidemic. Khan, Suleman et al [29] created taxonomy for the technologies employed in the current epidemic in this research. Artificial intelligence, cloud computing, big data analytics, machine learning, and blockchain are the most important advancements, according to the report. Furthermore, the study found that employing machine learning techniques combined with cloud computing and elevated computation, the epidemic may be contained at a low cost and in a short amount of time.

A corona virus outbreak caused by a new virus known as SARS-CoV-2 emerged in the start of 2020. Moreover, COVID-19's rapid emergence and unrestrained global spread demonstrate the limits of current healthcare systems in responding to health care in a reasonable timeframe. As a result, Nguyen, Dinh C., et al [30]contributed a comprehensive assessment on the application of blockchain and artificial intelligence (AI) to control COVID-19 infections. First, a novel conceptual framework is provided for combating COVID-19 that combines blockchain and artificial intelligence. A test case employing federated AI method for COVID-19 identification is also provided. Finally, the problems and potential options are identified that will spur more study into potential corona virus outbreaks.

Blockchain technology may also be used to store information in the cloud and connect to a large number of challenging and sophisticated health information. As the complexities of data analysis grows, it is becoming increasingly important to reduce the risk of computational complexity. Mallikarjuna et al [31] discussesed the use of deep neural networks (DNNs) in healthcare and the COVID-19 outbreak, as well as the cryptographic protocol technique for identifying feature extracted data (FED) from available data.

We concluded from the aforementioned works that, while numerous researches focused on the present COVID-19 epidemic scenario, they only gave a limited notion about merging blockchain and AI technology to combat COVID-19. No study has offered a decentralized, patient-centric paradigm that stresses the COVID-19 outbreak and its possible repercussions utilizing converging blockchain and AI technologies, to the state of the art and even at the time of this writing. To this purpose, the current study has a greater potential to fill research gaps by giving a theoretical foundation for COVID-19 data extraction utilizing blockchain technology, and a comprehensive description of each level and its functionality. The focus of this research was to give users a first look at how decentralized, physician blockchain and AI can help with conventional public healthcare techniques like patient information exchange, information management for diagnostic infections, infection prevention and control, monitoring, and prevention of the influence on health coverage, using the contemplated decentralized, physician frameworks.

III. SYSTEM MODEL AND PROBLEM STATEMENT

The blockchain-based COVID-19 platform might be used to combat COVID-19 infectious diseases by accurately identifying unknown infected and uninfected cases, as well as forecasting and calculating the COVID-19 epidemic transmission risk in actual for societies. In the case of infection detection, transmission risk forecasting, and COVID-19 virus estimate in real communities, peer-to-peer blockchain, representation of the data, and decentralized storage characteristics may support and reinforce the system with key features. The System model of blockchain based COVID-19 healthcare system is illustrated in Figure 1.

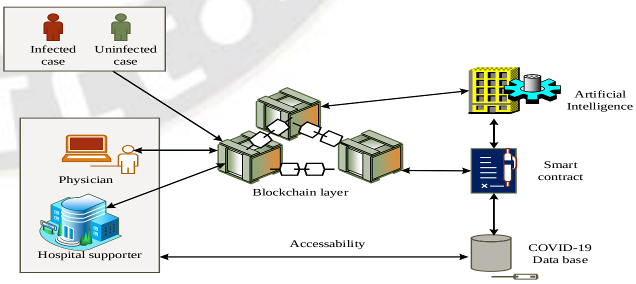

Figure 1: System model of blockchain based COVID-19 healthcare system

With the rise of COVID-19 instances around the world, a reliable method for diagnosing COVID-19 patients is needed. The biggest issue in detecting COVID-19 patients is a lack of testing kits that are both reliable and affordable. Due to the virus's rapid dissemination, medical professionals

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are having trouble finding positive cases. Consequently, the data extraction for both positive and negative cases should be needed for the remote monitoring of affected areas. The first issue is that sensitive data cannot be made available owing to a lack of privacy. Furthermore, training the global model through the blockchain network is a significant challenge. Furthermore, due to the lack of a dataset, collecting sufficient training data and developing a stronger extraction model is difficult due to hospital confidentiality. Finally, to provide the accurate data about each features of data to the government or stakeholders are the challenging task. So this motivated to do this research and to implement a novel artificial intelligence method for optimal extraction of data from affected areas using blockchain technology.

IV. PROPOSED MODEL

The 2133 viral variants using patient's health IC50 data are evaluated in this study. This approach, which makes use of artificial intelligence, would allow for the quick screening of possible COVID-19 impacted individual data and hospital data with high probability for distribution to medical professionals or the government. The research also explores an innovative extraction strategy for extracting all COVID-19 data in an ultra-fast, extensible, and accurate manner. The proposed model of data extraction in blockchain technology is illustrated in Figure 2.

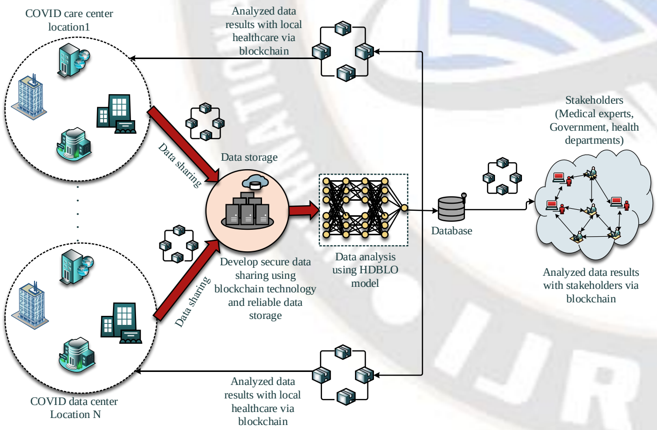

Figure 2: proposed model of data extraction in blockchain technology

V. DATA NORMALIZATION

Data normalization technique allows each data of an equivalence class of forms to be transformed into a particular one, which is defined and for everyone in each class, using a set of geometric transformations. The reduction of complicated user views and database servers into a set of simpler, more stable data types is called normalization. Normalized data models are easier to manage than most other types of data formations because they are easier and more reliable. Here, the min-max normalization approach is considered for the processing of data. The scales of data should be in the range of zero and unique. The normalization is expressed using eqn. (1),

$$d' = \frac{d - F_{\min}}{F_{\max} - F_{\min}} (F_{new\max} - F_{new\min}) + F_{new\min} \tag{1}$$

Where F is the present value of data feature. This method makes it simple to interpret data. There are no enormous numbers here, only simple data that doesn't need to be transformed and can be utilized in decision-making instantly.

VI. PROPOSED HDBLO MODEL

The Architecture of proposed HDBLO model in COVID Care system is illustrated in figure 3. Here, the normalized data of COVID health system is given to the proposed HDBLO method. The proposed approach trained the database and provides the optimal extracted data like Home isolation, hospitalization, first positive test, last positive test, ICU level of monitoring, supplemental oxygen, reported last day of symptoms, end of isolation precautions and death person's details. Here, the HDBLO method is the combination of deep belief approach and Lion optimization for the optimal solution.

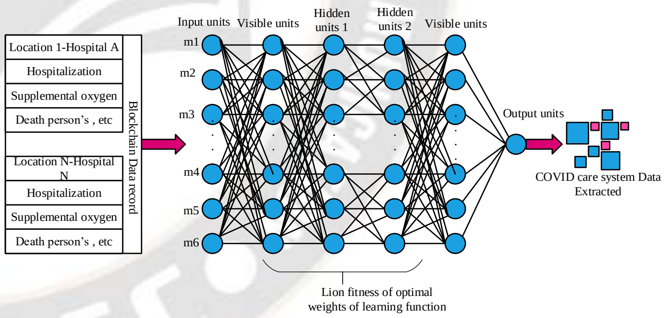

Figure 3: Architecture of proposed HDBLO model in COVID Care system

The selection of proposed HDBLO method is effective because of significant factors such as fast convergence at very starting stage, more accurate outcome and to give optimal solution to the critical issues. The normalized data is provided to the HDBLO method, in that the data has been separated into two such as training and testing phase. Primarily, the data is extracted with the training phase and then it validated with the data of testing phase. Furthermore, the performance of test data is evaluated with the different parameter metrics. The proposed HDBLO method has three units such as input unit, hidden unit and output units. The visible unit is enclosed with the input and

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output units and the learning function is controlled in the hidden units.

VI.1 Pre-training phase

Consider the visible unit as x_m of the data m and hidden unit as y_n of the data n. Then, x_m and y_n unit rates are in the form of binary values as 0 and 1. The visible unit probabilities are estimated using eqn. (2),

$$Px_m = \frac{1}{d}\sum_y e^{-s(x,y)} \tag{2}$$

Where N is the normalized data function $-s(x,y)$, is the data function of visible and hidden units. The proposed approach has been used because it may be a deep structure and considerable feed forward network. The samples are distributed from the input data to the final layer using large hidden units with additional layers. Furthermore, a Restricted Boltzmann Machine has been set up to address the problem of generating a workable activation function. The accurate x units is provided to the training function using eqn. (3),

$$F(x,y) = -\sum_{m=1}^{M}\sum_{n=1}^{N} W_{mn} x_m y_n - \sum_{m=1}^{M}\alpha_m x_m - \sum_{n=1}^{N}\beta_n y_n \tag{3}$$

Where, the weights of the data between the visible and hidden node is denoted as W_{mn} and M , N , are the quantity of visible units and hidden units. Also, α is the bias term. A training vector's following log possibility isconcerned with the weight of inconsistencies. The weights of the data is estimated for the gradient approach using eqn. (4),

$$W_{mn}(a+1) = W_{mn}(a) + \alpha \frac{\partial \log(P(x_m))}{\partial W_{mn}} \tag{4}$$

Where $\frac{\partial \log(P(x_m))}{\partial W_{mn}}$ is the gradient portion evaluated by the mean difference of tested and trained data. Moreover, hidden units from Boltzmann do not provide a specific response that aids in obtaining an ideal unbiased sample. The hidden units probabilities for parallel data is evaluated using eqn. (5),

$$Py_n = P(y_n = 1 \mid x) = \beta(p_n + \sum_m W_{mn} x_m) \tag{5}$$

Where the logiostic sigmoid action is represented as β . As a result, the state of binary is chosen for the hidden section, and the condition of the visible unit is one for which the probability is determined using eqn. (6)

$$Px_m = P(x_m = 1 \mid y) = \beta(p_n + \sum_m W_{mn} x_m) \tag{6}$$

VI.2 Optimized Fine tuning for data extraction

Initialize, the visible unit's data, algorithm parameters and node data. The data are randomly arranged using eqn. (7),

$$m_j = m_0, m_2 ....m_N \tag{7}$$

Where $m_j = 1,2,....N$ and the overall data quantity is represented as N . The optimal fine tuning is the main concern in the proposed algorithm. This data extraction function assumes the fitness as optimal data selection for each blockchain transaction with the finest outcome. The fitness value of each extraction is evaluated the objective function by eqn. (8)

$$Fitnessvalueofdata(F_d) = f(optimaldataextraction) = f(m_0, m_2 ....m_N) \tag{8}$$

Where F_d is the fitness function that gives finest data extraction as a finest solution. The dataset solutions are produced at random in search space in the first stage. As normalized data, a percentage of data group generated solutions is picked at random. The remaining data will be split into P sets at random. Every result in this method has a distinct gender, which was maintained throughout the optimization process.

VI.3 Optimal data selection

Some stakeholders in each database seek for data in a group to offer information for their authority. These parties have developed distinct strategies to enclose and capture the data. When it came to foraging, the recommended strategy followed almost the same trends. During data extraction, the suggested technique is chosen at random, and each picked data extraction is performed on a dummy database, with this procedure being specified subsequently according to the group to which the determined unit belongs. If a proposed technique increases its own finesses while extracting, data will evade extraction and a new place of data will be acquired as follows:

$$h'' = h + r(0,1) \times l \times (h - t_m) \tag{9}$$

Where h is the present weights of data, r is the random numbers, t_m is the new weights of data of training approach and the improved percentage of tuning fitness is represented as l. Moreover, at the fine tuning of deep methods, the new tuning ability of the data extracting methods for the left and rights of the database is evaluated using eqn. (10)

$$\hat{t}_m = \begin{cases} r((2 \times h - \hat{t}_m), h), & (2 \times h - \hat{t}_m) < h \\ r(h, (2 \times h - \hat{t}_m)), & (2 \times h - \hat{t}_m) > h \end{cases} \tag{10}$$

Consequently, the center part of the data weights in the learning unit is tuned using eqn. (11) as,

$$\hat{t}_{mc} = \begin{cases} r(\hat{t}_m, h), & \hat{t}_m < h \\ r(h, \hat{t}_m), & \hat{t}_m) > h \end{cases} \tag{11}$$

Therefore, this method shows the effective performance of optimal weights tuning of hidden layers to the exact data extraction. Also, the condition for the exact data separation is done by the eqn. (12), the blockchain database (B) the success of data selection (e) at the n^{th} iteration.

$$S(e,n,B) = \begin{cases} 1 & f_{e,B}^{n} < f_{e,B}^{n-1} \\ 0 & f_{e,B}^{n} = f_{e,B}^{n-1} \end{cases} \tag{12}$$

The huge number of successive rates demonstrates that the suggested algorithm has resulted in a fact that is far from the best point. After tuning the weights of the data, the outcomes are required to update for the further processing.

VI.4 Updating stage

The training function is then begun with the data from the visible layer. After that, eqn. (13) was used to run the samples data in the hidden layer. This process is continuous, as both visible and concealed data are saved and combined to generate a new state, which is referred to as

$$\Delta W_{mn} = \alpha(< x_m y_n >_{data} - < x_m y_n >_{reconstruction}) \tag{13}$$

Where α is denoted as the value of learning function and the expected training data is represented as $<.>$. Also, the test and trained data has been spliced. For the accurate extraction state, the weights of the data are updated by eqn. (14)

$$\Delta W_{mn} = < x_m y_n > + \alpha(< x_m y_n >_{data} - < x_m y_n >_{reconstruction}) \tag{14}$$

The proposed approach is well trained. If the input visible layer is organized as a vector, the attributes to units are converted adequately with hidden layers, using common weights and biases approaches. As a result, the final layer is subjected to individual training and therefore is locked into a unique strategy. The suggested approaches' attained weights are included in the fine-tuning step.

VI.5 Termination

This procedure is carried out using the back propagation approach. The resulting layer is arranged from the edge of network to extract the medical data into two phases. In addition, this suggested approach makes use of N input neurons and three hidden layers. Because the back propagation approach is initiated using the weights gained from the pre-training stage, a better weight must be produced in the training stage using a training dataset. As a result, a smaller error value has been estimated, and improved data extraction accuracy will be attained using optimized weights. The pseudo code of proposed procedure is provided in algorithm 1.

Algorithm 1 Proposed HDBLO method

```
Start
Initialize the normalized data, algorithm parameters
Estimate the pre-training stage
    Consider x_m and y_n // visible and hidden units
    Apply the training function F(x, y) // Restricted Boltzmann Machine
    Estimate the weights of units visible and hidden W_mn(a+1)
    Provide gradient function
    Evaluate the hidden and visible unit probabilities Py_n and Px_m
```

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$$Py_n = P(y_n = 1 | x) = \beta(p_n + \sum_m W_{mn} x_m)$$

$$Px_m = P(x_m = 1 | y) = \beta(p_n + \sum_m W_{mn} x_m)$$

Compute Optimized fine tuning for data extraction

Initialize $m_j = m_0, m_2 ......m_N$ *// the visible unit's data*

Calculate the fitness function

Optimal data selection by weights tuning

Compute $h'' = h + r(0,1) \times l \times (h - t_m)$ *// data selection state*

Estimate the data from left and right side of the data group by $\hat{t}_m$

Estimate the data from the center of data group by $\hat{t}_{mc}$

Successive weight tuning condition is evaluated by $S(e, n, B)$

Update the state of weights of the data

$$\Delta W_{mn} = < x_m y_n > + \alpha(< x_m y_n >_{data} - < x_m y_n >_{reconstruction})$$

If accuracy=high

Optimal solution is obtained *//optimal data has been extracted and then given to the stakeholders.*

Else

Stop the function, returns back for initialization

End if

VII. RESULT AND DISCUSSION

The implementation of proposed data extraction from blockchain technology based COVID-19 healthcare system is carried out using MATLAB 2018b software with the windows platform, RAM 4GB and processor is i5. The performance of this developed model is validated with the different evaluation metrics and compared with the conventional approaches.

VII.1 Case study

Consider, A is the corresponding area in India and B is the number of hospitals in the particular area. From that the data of patients and visitors to the hospital are updated to the COVID database using blockchain technology. In COVID data base, the data used to store such as Home isolation, hospitalization, first positive test, last positive test, ICU level of monitoring, supplemental oxygen, reported last day of symptoms, end of isolation precautions and death persons. The updated data in the COVID database is extracted to the government or medical authorities using proposed HDBLO method. Before giving to HDBLO method, the dataset has been pre-processed for eliminating the unwanted error and noises. Furthermore, the data has been applied to the HDBLO method for the appropriate data extraction. The workflow of proposed model in blockchain technology is illustrated in Figure 4.

In total dataset, 70% of data is considered for the training stage and 30% of data is provided for the testing phase. Based on this configuration the final optimal results are achieved. For the analysis, the training error rate and testing accuracy are estimated for the proposed model, which is shown in Figure 5.

The analysis shows that while increasing the level of iteration, then the training error of proposed method decreases and improves the testing accuracy for COVID-19 data extraction function. Moreover, the training level is stable at the 60^{th} iteration and the testing accuracy is also constant when it reaches 70^{th} iteration.

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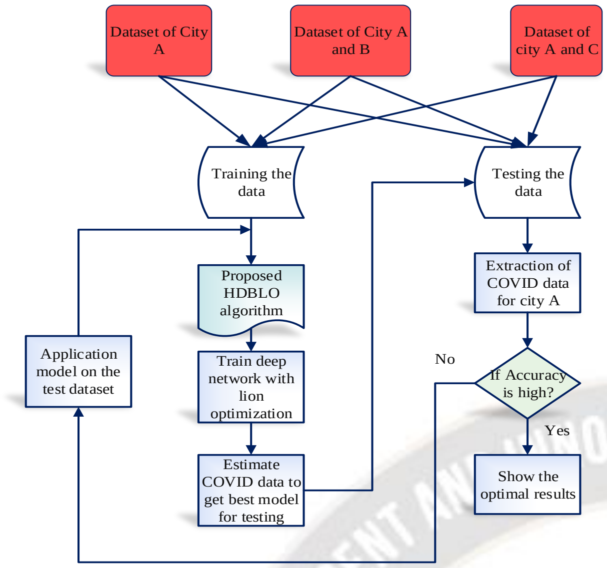

Figure 4: Work flow model of proposed method

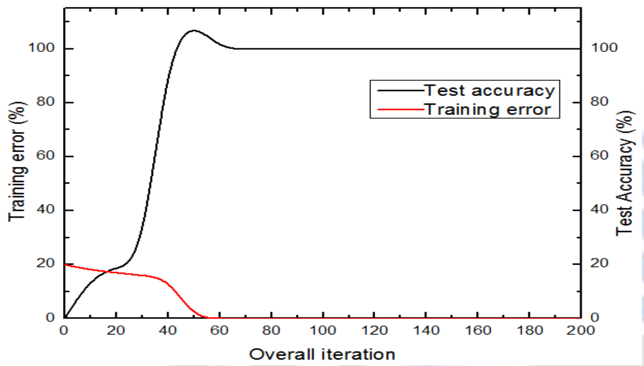

Figure 5: Training and testing performance

VII.2 Performance analysis

The proposed blockchain based HDBLO method is compared with various parameters. The estimated performance metrics such as "MAE, RMSE, Accuracy, R^2, Precision, Recall, F-measure, AUC, error rate and processing time" with KNN-ACGAN [29], SegCaps [27], Deep Learning (DL) [28] and Deep Neural Network (DNN) with Feature Extracted Data (FED) [32]. The MAE is evaluated as the ratio error rate between true data of data and extracted data, which expressed using eqn. (15)

$$MAE = \frac{\sum_{j=1}^{N} \left| D_j - T_j \right|}{N} \tag{15}$$

Where, D_j is the extracted data and T_j is the true rate of COVID data. The proposed model obtained MAE is compared with existing methods is shown in Figure 6. Here, the comparison shows that the proposed method has achieved very less MAE value as 0.01 for 5% of testing rate, while compared to the other methods KNN-ACGAN, SegCaps, DL and DNN-FED has achieved 5, 2, 1.09, 0.8 and 2.3. For 10%, 15% and 20% of testing rate for the existing KNN-ACGAN, SegCaps, DL, DNN-FED and Proposed has attained (2.03, 1.06, 0.6, 2.49, 0.016), (2.45, 1.42, 0.89, 2.50, 0.03) and (20, 2.9, 1.8, 0.9, 2.6, 0.1).

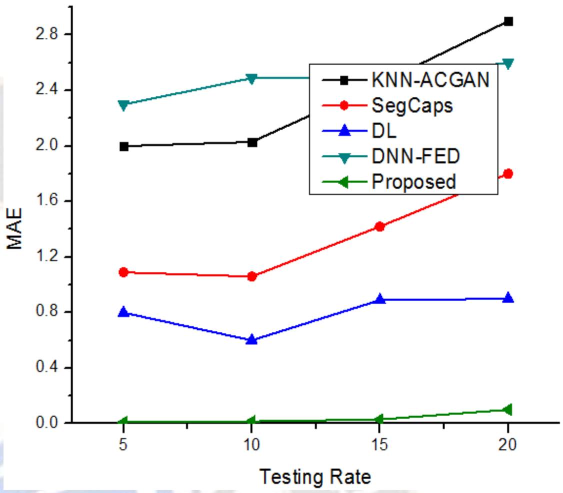

Figure 6: Comparative analysis of MAE

Moreover, the RMSE value is estimated by the square root of the average square error between the observation and extracted COVID data rate, which is evaluated by eqn. (16),

$$RMSE = \sqrt{\left(\frac{1}{N}\right)\sum_{j=1}^{N}\left(D_j - T_j\right)^2} \tag{16}$$

Where $\left(D_j - T_j\right)^2$ is the square root of the observed and extracted data at the point j and the overall data quantity is denoted as N. The value of RMSE obtained from the proposed system is compared with the conventional methods are shown in Figure 7. Consequently, The proposed RMSE value is achieved as 0.5, 0.56, 0.58, 0.8 for 5%, 10%, 15% and 20% of testing rate. However, the existing modes has attained high RMSE value over proposed approach KNN-ACGAN, SegCaps, DL, DNN-FED as 5% of testing rate has (7, 3, 4, 2, 0.5), 10% of testing rate has (6.5, 2.5, 3, 2.3, 0.56), 15% of testing rate has attained (6, 2, 2, 2.4, 0.58) and 20% of testing rate as (5.5, 1.5, 1.98, 2.6, 0.8), respectively.

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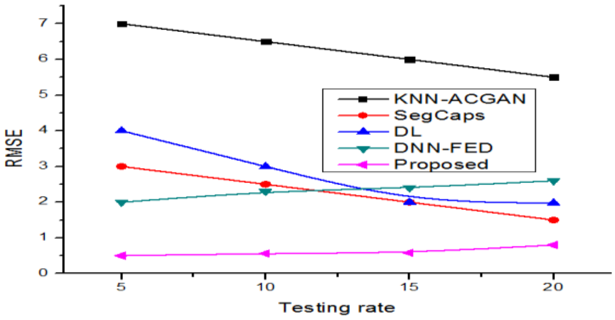

Figure 7 Comparative analysis of RMSE

The correlation coefficient (R^2) is defined to the ratio of unique obtained data is difference to the observed data variation that is evaluated by eqn. (17)

$$R^2 = 1 - \frac{SS_r}{S_t} \quad (17)$$

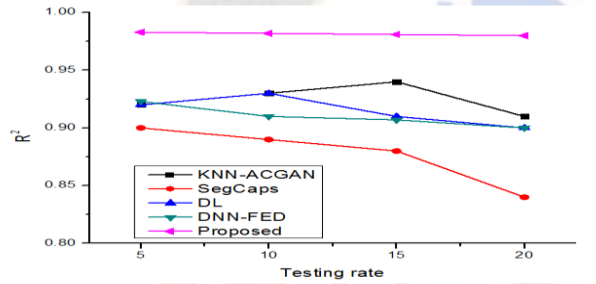

Figure 8: Comparative analysis of correlation coefficient

Where, the residual summation of square value is denoted as SS_r and S_t is denoted as the total summation of square values. Moreover, the proposed model obtained (R^2) is compared with the other conventional models are illustrated in figure 8.

The achieved correlation coefficient from this work is compared with the KNN-ACGAN, SegCaps, DL, DNN-FED methods for 5%, 10%, 15% and 20% of testing rate and attained as 0.92, 0.93, 0.94, 0.91 for KNN-ACGAN, 0.90, 0.89, 0.88, 0.84 for SegCaps, 0.92, 0.93, 0.91, 0.90 for DL and 0.923,, 0.910, 0.907, 0.90 for DNN-FED method. However, the proposed model has obtained superior performance as 0.983, 0.982, 0.981 and 0.98 for overall testing rates. The overall amount accurate data extraction rate is evaluated by the eqn. (18)

$$\text{Accuracy} = \frac{T_p + T_n}{T_p + T_n + F_p + F_n} \quad (18)$$

Where, the estimated data is accurately predicted is defined as True positive (T_p). If the extracted data is exact COVID-19 data then it is referred as true negative (T_n). Moreover, if the data is failed to extract correctly, then it is referred to as false positive (F_p) and the false negative (F_n) is indicated when the data is not COVID-19 information and its shows irreverent extraction. The proposed accuracy value is contrasted with the conventional methods are illustrated in Figure 9.

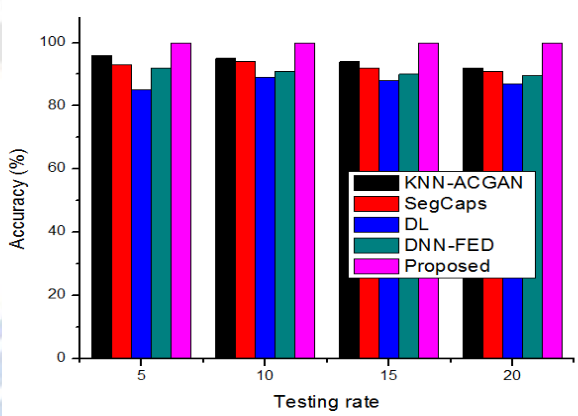

Figure 9: Comparative analysis of accuracy

The observation shows that the proposed method has achieved higher accuracy as 99.99%, 99.98%, 99.97% and 99.9% for the testing rate of 5%, 10%, 15% and 20%. Nevertheless, the existing methods KNN-ACGAN, SegCaps, DL, DNN-FED have attained lower accuracy than the developed model at the 5%, 10%,15% and 20% as 5% of (96, 93, 85, 92)%, 10% of (95, 94, 89, 91)%, 15%(94, 92, 88, 90)% and 20% of (92, 91, 87, 89.5)%. Moreover, the precision is the important metrics in the performance validation; it is defined by the ratio of particular exact data extraction to the overall data in the dataset, which is estimated by eqn. (19)

$$\text{Precision} = \frac{T_p}{T_p + F_p} \quad (19)$$

Then, the consequences value of precision obtained from the proposed method is compared with the other existing models are illustrated in Figure 10.

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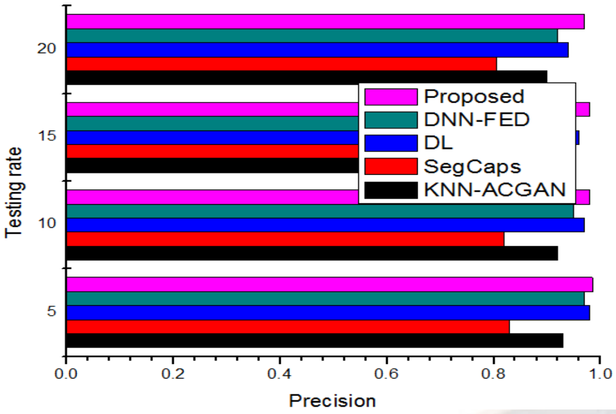

Figure 10: Comparative analysis of precision

Also, the estimated precision value is evaluated for the different testing rates of 5%, 10%, 15% and 20% for proposed and traditional models. However, at the time of 20% of final testing rate, the conventional methods have achieved less precision value than the developed model in this study. The precision value of proposed HDBLO method at 20% of testing rate is 0.97%, but the other methods KNN-ACGAN, SegCaps, DL, DNN-FED have achieved 0.90%, 0.806%, 0.94% and 0.92%. This shows the effective performance of proposed method in blockchain based data extraction in COVID care system. Furthermore, the parameter F-Measure is evaluated based on the ratio of average weight of precision and recall value using eqn. (20)

$$F - measure = \frac{2T_p}{2T_p + F_p + F_n} \quad (20)$$

The F-measure value is validated with the conventional approaches is shown in figure 11.The analysis shows that the developed model has attained high F-measure value for overall testing rate compared to the existing methods. The conventional KNN-ACGAN, SegCaps, DL, DNN-FED methods has achieved very less precision value for 5%, 10% 15% and 20% of testing rates. However, the overall of 20% of testing rates are attained for the conventional approach is 0.8710%, 0.75%, 0.89%, and 0.87%. Yet, the proposed method has attained 0.926% of high F-measure value at 20% of testing rate.

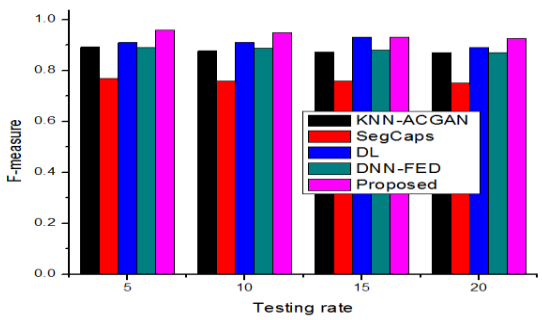

Figure 11: Comparative analysis of F- measure

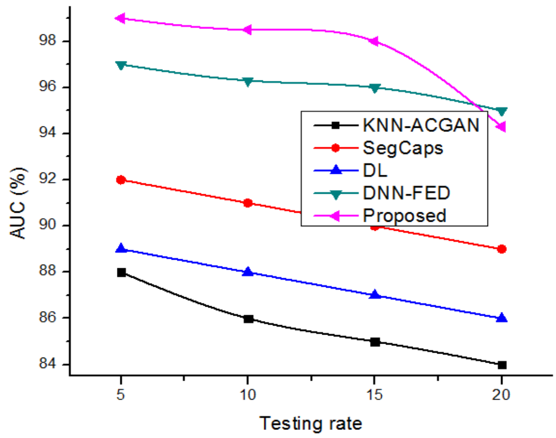

Figure 12 Comparative analysis of AUC

Consequently, the AUC value of the proposed method is compared with the conventional methods are illustrated in figure.12. The high value of AUC indicated as the proposed method has finest performance.

The compared AUC value obtained for KNN-ACGAN, SegCaps, DL and DNN-FED methods at 5%, 10%, 15% and 20% of testing rate is (88, 92, 89, 97)% for 5%, (86, 91, 88, 96.3)% for10%, (85, 90, 87, 96)% for 20% and (84, 89, 86, 95)% for 25%. However, the proposed method has achieved 99%, 98.5%, 98% and 94.3% for overall of testing rates. This high AUC from the proposed approach shows the effective performance of data extraction in COVID care system. The overall processing time is estimated for the proposed method is compared with the existing methods are demonstrated in figure 13.

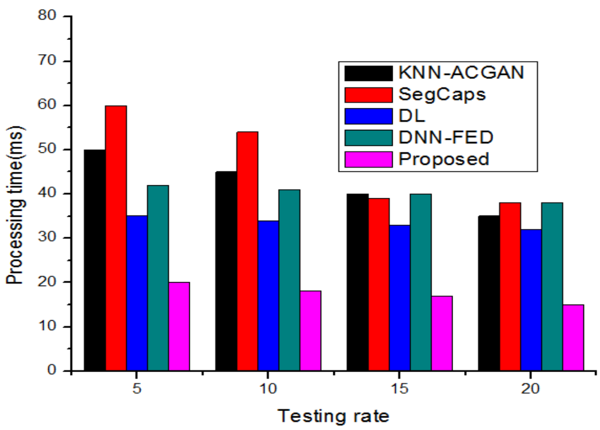

Figure 13: Comparative analysis of processing time

The analysis shows that the proposed method has achieved very less time for processing the data extraction function in blockchain technology based COVID care system. The developed model has obtained 15ms at overall 20% of testing rates. But, the traditional models has consumed more time for the proper extraction performance.

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The error rate is evaluated as ratio of the amount of incorrect extraction over the total dataset. The optimal error value is articulated as less than 1% and it is calculated for the developed models using eqn. (21)

$$Error = 1 - Accuracy \tag{21}$$

The error rate of the proposed model is equated with the conventional methods is illustrated in Fig.14. The traditional method has carried out with the more error values during the 5%, 10%, 15% and 20% of testing rates. The high amount of error indicates the traditional model has less performance. However, the proposed model has attained 0.02%, 0.03%, 0.05% and 0.08% of error value at the 5%, 10%, 15% and 20% of testing rates. This shows the improved performance of accurate data extraction in the blockchain technology to the stakeholders.

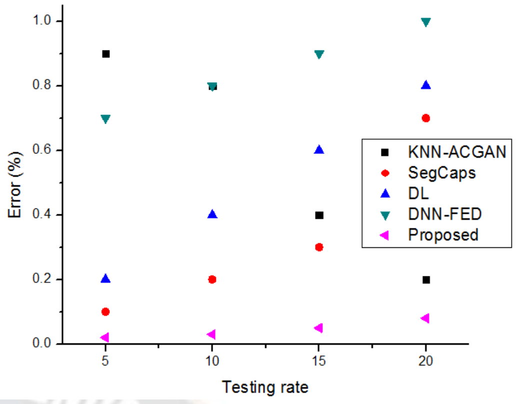

Figure 14: Comparative analysis of error value

Table 1 Comparison of proposed and existing methods at testing rate 5%

Methods & Parameters	KNN-ACGAN	SegCaps	DL	DNN-FED	Proposed
MAE	2	1.09	0.8	2.3	0.01
RMSE	7	3	4	2	0.5
R^2	0.92	0.90	0.92	0.923	0.983
Accuracy (%)	96	93	85	92	99.99
Precision (%)	0.93	0.83	0.98	0.97	0.985
F-Measure (%)	0.8926	0.768	0.91	0.89	0.96
AUC	88	92	89	97	99
Processing time (ms)	50	60	35	42	20
Error (%)	0.9	0.1	0.2	0.7	0.02

VII.3 Analytical study of proposed and existing methods

In this section, the efficiency of the proposed model over the conventional methods such as KNN-ACGA, SegCaps, DL and DNN-FED while testing the data is diverse from 5, 10, 15 and 20. Moreover, the contributed method findings are detailed in Table.1, Table.2, Table.3 and Table.4. The proposed method outperforms over the existing methods in terms of accuracy, precision, processing time, error and MAE for the testing rate of 5 is demonstrated in Table.1. Mainly, the accurate data extraction obtained by the proposed method is attained as 99.99%. However, the conventional methods are performed very poor in COVID-19 data extraction. Consequently, the proposed method has demonstrates the finest consequences in terms of MAE, RMSE, accuracy , R^2, accuracy, precision, F-measure, processing time, AUC and error rate.

Table 2 Comparison of proposed and existing methods at testing rate 10%

Methods & Parameters	KNN-ACGAN	SegCaps	DL	DNN-FED	Proposed
MAE	2.03	1.06	0.6	2.49	0.016
RMSE	6.5	2.5	3	2.3	0.56
R^2	0.93	00.89	0.93	0.910	0.982
Accuracy (%)	95	94	89	91	99.98
Precision (%)	0.92	0.82	0.97	0.95	0.98
F-Measure (%)	0.8768	0.758	0.912	0.889	0.95
AUC	86	91	88	96.3	98.5
Processing time (ms)	45	54	34	41	18
Error (%)	0.8	0.2	0.4	0.8	0.03

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Table 3 Comparison of proposed and existing methods at testing rate 15%

Methods & Parameters	KNN-ACGAN	SegCaps	DL	DNN-FED	Proposed
MAE	2.45	1.42	0.89	2.50	0.03
RMSE	6	2	2	2.4	0.58
R^2	0.94	0.88	0.91	0.907	0.981
Accuracy (%)	94	92	88	90	99.97
Precision (%)	0.91	0.81	0.96	0.94	0.979
F-Measure (%)	0.8726	0.76	0.93	0.88	0.93
AUC	85	90	87	96	98
Processing time (ms)	40	39	33	40	17
Error (%)	0.4	0.3	0.6	0.9	0.05

Table 4 Comparison of proposed and existing methods at testing rate20%

Methods & Parameters	KNN-ACGAN	SegCaps	DL	DNN-FED	Proposed
MAE	2.9	1.8	0.9	2.6	0.1
RMSE	5.5	1.5	1.98	2.6	0.8
R^2	0.91	0.84	0.90	0.90	0.98
Accuracy (%)	92	91	87	89.5	99.9
Precision (%)	0.90	0.806	0.94	0.92	0.97
F-Measure (%)	0.8710	0.75	0.89	0.87	0.926
AUC	84	89	86	95	94.3
Processing time (ms)	35	38	32	38	15
Error (%)	0.2	0.7	0.8	1	0.08

Also, with respect to the testing rate 20% shown in Table.4 demonstrates that the proposed method has attained high accuracy at all the testing rates when conventional methods are failed with less accurate extraction. This shows that the suggested work is more applicable for the accurate COVID data extraction in blockchain technology. Moreover, all the testing rates are shown approximate similarities.

VIII. CONCLUSION

Blockchain technology establishes a shared system and peer-to-peer infrastructure to disseminate digital information to all end-users, both privately and publicly. In this research, the blockchain technology is employed for COVID-19 healthcare system for extracting the data from the affected networks to the stakeholders (i.e. medical experts, government, and health organizations). The accurate data extraction is done by the proposed HDBLO algorithm. The learning parameters of the deep method are optimized by the fitness of lion algorithm. Moreover, a new normalization method is applied to the datacenter before extracting the data for better outcomes. This article uses blockchain technology to categorize a healthcare dataset in India and create extracted data based on the input dataset. There is a lot of focus on the healthcare business, almost in all areas. The suggested technique has the potential to convert the existing way of preserving patient information to blockchain. The suggested model ensures the data transmission's confidentiality and accuracy. The simulation results shows the proposed model has achieved finest outcomes in terms of high accuracy, precision, F-measure, and less processing time, error, MAE and RMSE over the traditional methods. In future, the security of data sharing for COVID-19 can improve using intelligent optimization approach.

ETHICAL STATEMENT:

Compliance with Ethical Standards

Conflict of interest

The authors declare that they have no conflict of interest.

Human and Animal Rights

This article does not contain any studies with human or animal subjects performed by any of the authors.

Informed Consent

Informed consent does not apply as this was a retrospective review with no identifying patient information.

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Conflicts of interest Statement: Not applicable

Consent to participate: Not applicable

Consent for publication: Not applicable

Availability of data and material:

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Code availability: Not applicable

Authors' contributions

DD agreed on the content of the study. DD, DM and DVB collected all the data for analysis. BS and DM agreed on the methodology. SSS, DD and DVB completed the analysis based on agreed steps. Results and conclusions are discussed and written together. Both author read and approved the final manuscript.

REFERENCES

[1]. Chunara, Rumi, et al. "Telemedicine and healthcare disparities: a cohort study in a large healthcare system in New York City during COVID-19." Journal of the American Medical Informatics Association 28.1 (2021): 33-41.
[2]. Ćwiklicki, Marek, Jacek Klich, and Junsong Chen. "The adaptiveness of the healthcare system to the fourth industrial revolution: A preliminary analysis." Futures 122 (2020): 102602.
[3]. Guo, Yan-Rong, et al. "The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak–an update on the status." Military Medical Research 7.1 (2020): 1-10.
[4]. Bassareo, Pier Paolo, et al. "Learning from the past in the COVID-19 era: rediscovery of quarantine, previous pandemics, origin of hospitals and national healthcare systems, and ethics in medicine." Postgraduate Medical Journal 96.1140 (2020): 633-638.
[5]. Kaye, Alan D., et al. "Economic impact of COVID-19 pandemic on healthcare facilities and systems: International perspectives." Best Practice & Research Clinical Anaesthesiology 35.3 (2021): 293-306.
[6]. Tam, Chor-Cheung Frankie, et al. "Impact of coronavirus disease 2019 (COVID-19) outbreak on ST-segment–elevation myocardial infarction care in Hong Kong, China." Circulation: Cardiovascular Quality and Outcomes 13.4 (2020): e006631.
[7]. Søreide, Kjetil, et al. "Immediate and long-term impact of the COVID-19 pandemic on delivery of surgical services." Journal of British Surgery 107.10 (2020): 1250-1261.
[8]. Stevens, Michael P., et al. "Impact of COVID-19 on traditional healthcare-associated infection prevention efforts." Infection Control & Hospital Epidemiology 41.8 (2020): 946-947.
[9]. Khurshid, Zuneera, et al. "Virtual adaptation of traditional healthcare quality improvement training in response to COVID-19: a rapid narrative review." Human resources for health 18.1 (2020): 1-18.
[10]. Andryukov, Boris G., et al. "Laboratory-based resources for COVID-19 diagnostics: Traditional tools and novel technologies. a perspective of personalized medicine." Journal of personalized medicine 11.1 (2021): 42.
[11]. Xiong, Yin, et al. "International policies and challenges on the legalization of traditional medicine/herbal medicines in the fight against COVID-19." Pharmacological research (2021): 105472.
[12]. Rahmatizadeh, Shahabedin, Saeideh Valizadeh-Haghi, and Ali Dabbagh. "The role of artificial intelligence in management of critical COVID-19 patients." Journal of Cellular and Molecular Anesthesia 5.1 (2020): 16-22.
[13]. Jabarulla, Mohamed Yaseen, and Heung-No Lee. "A Blockchain and Artificial Intelligence-Based, Patient-Centric Healthcare System for Combating the COVID-19 Pandemic: Opportunities and Applications." Healthcare. Vol. 9. No. 8. Multidisciplinary Digital Publishing Institute, 2021.
[14]. Iqbal, Shazia, et al. "A Systematic Review: Role of Artificial Intelligence During the COVID-19 Pandemic in the Healthcare System." International Journal of Intelligent Information Technologies (IJIIT) 17.1 (2021): 1-18.
[15]. Fusco, Antonio, et al. "Blockchain in healthcare: Insights on COVID-19." International Journal of Environmental Research and Public Health 17.19 (2020): 7167.
[16]. Mashamba-Thompson, Tivani P., and Ellen Debra Crayton. "Blockchain and artificial intelligence technology for novel coronavirus disease 2019 self-testing." (2020): 198.
[17]. Resiere, Dabor, Dajour Resiere, and Hatem Kallel. "Implementation of medical and scientific cooperation in the Caribbean using blockchain technology in coronavirus (Covid-19) pandemics." Journal of medical systems 44 (2020): 1-2.
[18]. Rakib, Gazi Abdur, et al. "DeepHealth: A Secure Framework to Manage Health Certificates Through Medical IoT, Blockchain and Deep Learning." 2021 IEEE International Symposium on Medical Measurements and Applications (MeMeA). IEEE, 2021.
[19]. Li, Yang, et al. "Literature review on the applications of machine learning and blockchain technology in smart healthcare industry: a bibliometric analysis." Journal of Healthcare Engineering 2021 (2021).
[20]. Štifanić, Daniel, et al. "Impact of COVID-19 on forecasting stock prices: an integration of stationary wavelet transform and bidirectional long short-term memory." Complexity 2020 (2020).

[21]. Natarajan, Sathish, et al. "Outbreak prediction of COVID-19 using recurrent neural network with gated recurrent units." Materials Today: Proceedings (2021).

[22]. Mistry, Chinmay, et al. "MedBlock: An AI-enabled and blockchain-driven medical healthcare system for COVID-19." ICC 2021-IEEE International Conference on Communications. IEEE, 2021.

[23]. Patibandla, RSM Lakshmi, and V. Lakshman Narayana. "Computational intelligence approach for prediction of COVID-19 using particle swarm optimization." Computational Intelligence Methods in COVID-19: Surveillance, Prevention, Prediction and Diagnosis. Springer, Singapore, 2021. 175-189.

[24]. Chattu, Vijay Kumar. "A review of artificial intelligence, Big Data, and blockchain technology applications in medicine and global health." Big Data and Cognitive Computing 5.3 (2021): 41.

[25]. Idrees, Sheikh Mohammad, Mariusz Nowostawski, and Roshan Jameel. "Blockchain-based digital contact tracing apps for COVID-19 pandemic management: Issues, challenges, solutions, and future directions." JMIR medical informatics 9.2 (2021): e25245.

[26]. Mohsin, A. H., et al. "PSO–Blockchain-based image steganography: towards a new method to secure updating and sharing COVID-19 data in decentralised hospitals intelligence architecture." Multimedia tools and applications 80.9 (2021): 14137-14161.

[27]. Kumar, Rajesh, et al. "Blockchain-federated-learning and deep learning models for covid-19 detection using ct imaging." IEEE Sensors Journal (2021).

[28]. Muhammad, Ghulam, and M. Shamim Hossain. "A Deep-Learning-Based Edge-Centric COVID-19-Like Pandemic Screening and Diagnosis System within a B5G Framework Using Blockchain." IEEE Network 35.2 (2021): 74-81.

[29]. Tai, Yonghang, et al. "Trustworthy and intelligent covid-19 diagnostic iomt through xr and deep learning-based clinic data access." IEEE Internet of Things Journal (2021).

[30]. Khan, Suleman, Muhammad Khurram Khan, and Rizwan Khan. "Harnessing intelligent technologies to curb COVID-19 pandemic: taxonomy and open challenges." Computing (2021): 1-20.

[31]. Nguyen, Dinh C., et al. "Blockchain and AI-based solutions to combat coronavirus (COVID-19)-like epidemics: A survey." Ieee Access 9 (2021): 95730-95753.

[32]. Mallikarjuna, Basetty, Gulshan Shrivastava, and Meenakshi Sharma. "Blockchain technology: A DNN token-based approach in healthcare and COVID-19 to generate extracted data." Expert Systems (2021): e12778.