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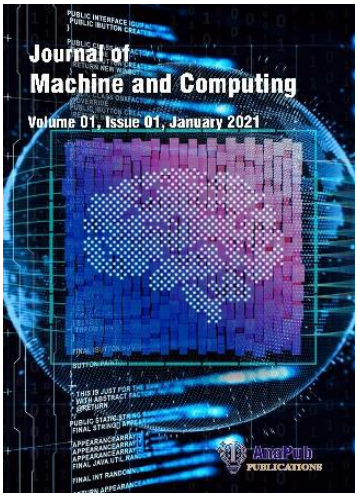

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HDLHDGAI: Hybridization of Deep Learning Model for Heart Disease Prediction using Generative Artificial Intelligence

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Abstract: As in heart disease patients in biomarkers such as heart rate, ECG (electrocardiogram), pulse rate slow due to blood pressure is essential to get to know about heart disease. Deep learning model for HD diagnosis as wearable sensors collecting and applied as a inputs for measurement. Data gathering and in balancing are observing by the model accuracy. In this current study DL frameworks such as CNN, BiLSTM, Bi,LRU model used with GAI hybridization technique. In this current study computed for the results on using the different machine learning techniques for also drug recovery in heart disease through deep learning. BiLSTM is a bidirectional model which s used to generate the better results through long short term memory. BILSTM-GAI & BILRU-GAI model hybridization technique to evaluate the framework by generative model. The deep learning model gives the better accuracy as in terms of prediction of heart disease. The generative artificial intelligence is computing on the patient attributes. Heart disease is a major disease at an early stages and it is very difficult to detect and diagnose by physicians. This model is train and test to diagnose the HD. The Cleveland dataset has taken for detects and diagnoses heart disease.

Keywords: Bidirectional long short term memory, generative artificial intelligence, heart disease, Convolutional neural networks etc.

1. Introduction

As per the medical science field role in the health care the deep learning is used to evaluated the "heart disease" and cardiovascular disease heart functionality and the blood vessel through it carries blood have referred to disorders due that a person kind of heart attack affected. Some of disorders are present in human at the time of birth like congential heart disease, heart valve thickness weaker, coronary artery disease, congestive heart failure etc. According to world health organization millions of people are died by the heart failure which as anthocorisidal. Due to heart failure many other risk factors are changeable, non changeable and miscallenous[2].

Change factors are those by which HDL,VDL and high blood pressure in respective to other non changeable factors are arrythymia without medical errors accurately dispense the pharmacy error are measuring , so that the at an early stages the heart disease diagnosed. In certain hospital various dispending systems in certain hospitals are indentifying their barcodes [3]. Storage location of medication are depending upon the code, name, appearance which is based on screen prediction. Pharmacists increase the processing by the different object detection by these systems. The deep when applied with other models they have a capabilities to learn from data by their own opinions. This method performs well in the area object detection and disease prediction at early stages. Deep earning requires the artificial intelligence by which compute the resources and over fitting in the dataset can reduced. The proposed work as divided into various sections [4].

1. Proposed a BI-LSTM and BI-LRU model with GAI (Generative AI) having large dataset samples. Firstly remove the missing values and training set included, after it improves their performance for results computation.

2. Dimension reduction techniques is employed on the model for quick diagnosis and fine tuned the different parameters to be compared with different models [5][28].

Researcher develops a system model to identify the drug medicine recovery by implemented with deep learning model.

In certain hospital dispensing systems is computed for problematic issues solving. When certain issues are creating drug identification. As n recent decades the technologies related to the pharmacy operation the some dispense errors always are creating. To detect the images computational resources were captured. When discussing the concept of heart disease detection through drug medicine recovery or early production by physician both concepts are very difficult in every aspects. Deep learning could not work without the neural network [6][27].

2. Related Work

Now a days due to the advancement in technology the deep learning with machine learning are grouping together to form a drug recovery with early detection of heart disease is computed. With help of deep learning recent technologies discussed as work done by existing researchers.

Budak. C et.al [16] in this study author proposed a work identify the similarity between the different diseases by using the convolution neural networks. The various analysis are computed on the basis of medications prescribed by the doctors with the help of deep learning methods.

Y.S et.al[17] in this author proposed a CNN model for implementing the two images classification model. It computes the 5-fold cross validation to predict and indentify the disease at early images by the images classification. In this proposed work trained the 1-N model with the help of deep learning.

In 2021 Han, Y., et al [6] author proposed a study to implementing the deep learning techniques For heart disease prediction for creating the image processing model. CNN extract the features from the image with the help of embedded technology.

In 2021 Kwon, H.J.in this author develop a deep learning framework for predicting the disease by recognizing the drug recovery pills. It extracts and detects the post processing features from the dataset. Drug recovery could easily compute the results on the basis of feature extraction and reduction techniques.

Ting, H.W., et al[8] in this author proposed a yolo model for indentifying the disease with the help of images and computed their accuracy as according to their resolution. The performance and their results are identifying by different parameters such as precision, recall, f1score etc. it obtained accuracy as 90 percentages for disease prediction.

Fan B et. al [10] in this research we developed a model for identification and prediction of pharmalogical side effects of bidirectional encoder for disease prediction . It computed the results using BERT model. It extracts and detects the model accuracy as in results with 94%.

Basiri, M.E., et al [22] in this proposed work the author analyze and computed the fusion model based on decision tree theory. The deep learning frameworks have different instances that classify the test samples of images for the heart disease. The author proposed three deep learning models by the different classifiers.

Eslami, T., Saboori, H. and Nourani, M., [23] in this proposed work drug detection helps to compute the heart disease at the early stages. Various network based framework and graph labeling method. It embedded the different graphs of heart prediction through embedded systems.

Gentile, F., et al [24] in this proposed work with the help drug detection discovery in heart disease by removing undesirable features using the deep learning models. It proposed the DD approach for fred docking software.

3. Algorithm used for different models

Various models are employed and discussed for these current works which are as following:-

3.1 BIlSTM algorithm in Heart disease

It is a type of RNN and a bidirectional long short term memory which have capabilities to capture the sequential data dependencies in forward as well as backward directions. In heart disease detection and diagnose by the drug medicine recovery widely used. In context of prediction of heart disease time series analysis noted. Bi-LSTM analyzes sequences for time series signals by processing tasks for medical data analyze by ECG readings for measuring HRV data by computing patient record as a time. In the BiLSTM algorithm following steps are to considered for their implementation. Input sequence as data points in which data samples for a time series as a

each point represented as a feature vector. As in second step it processes Forward LSTM layer in a sequentially .at each step input the data point from hidden state from the previous step, provide output based on the input data given as in sequence. Same as the backward LSTM computed in reverse direction and receive the input data from the hidden state .after that concatenate all the results received from different data points received. At last with the help of output layer classify the results based on the probability, after that trained the network model get the predictions by the new input sequences by feeding through the network [7][25].

Algorithm 1-BiLSTM:

Procedure:

1. Import library modules
2. For i= 0 to step 64 units execute as activation function.
3. Input the data points as shape by hidden layer
4. Call function softmax and create the BiLSTM model.
5. Compute the loss function with metrics and optimize the results for output.

Algorithm 2: BiLRU:

It used the phenomena of cache eviction algorithm. For cache performance combines the features of LRU and MRU in this algorithm least recently items are added.

Basic algorithm steps are:

Procedure initialize MRU and LRU list.

1. If neither item nor find in list then move to list LRU.
2. Go to step 1 if item not find.
3. Move to the item in the front of MRU, after the item remove from the list.
4. Add the item in list, eviction is necessary.
5. Remove the item at the tail of the LRU list. Adjust the size of both lists as needed (e.g., if the cache has a fixed size).

3.2 Hybridization BiLSTM and BilRU with GAI approach

Firstly collect the samples for heart disease from online repository by the given samples noisy data removed by first step in preprocessing[8] .In second step bidirectional LSTM with artificial intelligence using augmentation is employed .in proposed hybrization approach dimension reduction ability reduce the features as per given dimension set from the samples of heart disease[] as shown in figure 1.

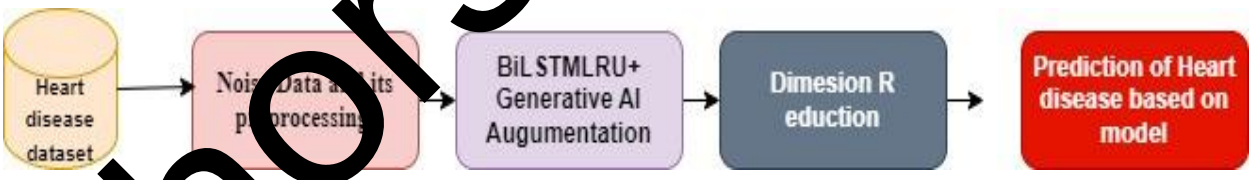


Figure 1: Preprocessing steps of proposed work

In the dimension reduction technique feature selection and extraction is computed on the LSTM+LRU model.

3.3 Preprocessing Data Techniques

The dataset for HD model as such collected from the online repository by using sensors. HD prediction is based on including age, chest pain, age, blood pressure, maximum heart rate and other number of attributes required for heart disease prediction. The presence or absence of disease by computing with the binary values. For better results remove all the missing values. In this proposed work for detecting the disease hybridization deep learning networks used for drug recovery in medicine [10][11][24].

In hospital or pharmacy store data are preprocesses using the adaptive modeling and deep learning such as BiLSTM and BilRU with GAI hybridization method. The preprocessed information regarding data fed into dataset

3.3.1 Data Collection

For computation the proposed work is implementing as in 150 kinds of medicine it collected data from nearby hospitals and the pharmacies. As in front and back near about 50 different views of each medicine has collected from the online repository. The dataset have a different angles perspective on front and back with total samples

images. The medications and medicine prescribes as per the patients' history [12][13]. The drug recovery is computed on the basis of different attributes of patients and data samples collection for the disease. The samples include the patient medical parameters and various packing classes, medications, syrups etc [14][15].

3.3.2 Data Processing

In hospitals and pharmacies using the unsharp mask guide filter technique using Bi-LSTM and bi LRU for filtering the dataset. to enhance the image quality and results appearance with characteristics rather determining effects based on the different predetermined parameters used. With the help of feature set the specific dataset values are computed to detect the relevant images features set from the predicted samples collected. Patterns collected from the images are resolute by minimizing the noise disruption rate in the images. Fiteration techniques are commuting by the BI–LSTM and Bi-LRUwith genartaive intelligence technique that gives better results in terms of their accuracy rate. Masking process is implementing on the given input images to improve the quality and disease prediction through the images dataset.

3.3.4 Motivation

In order to overcome the difficulties found in early detection of heart disease adapt the risk prediction and their related evolution changes that make technique to computed the tools in fields of healthcare.

3.3.4.1 Proposed methodology

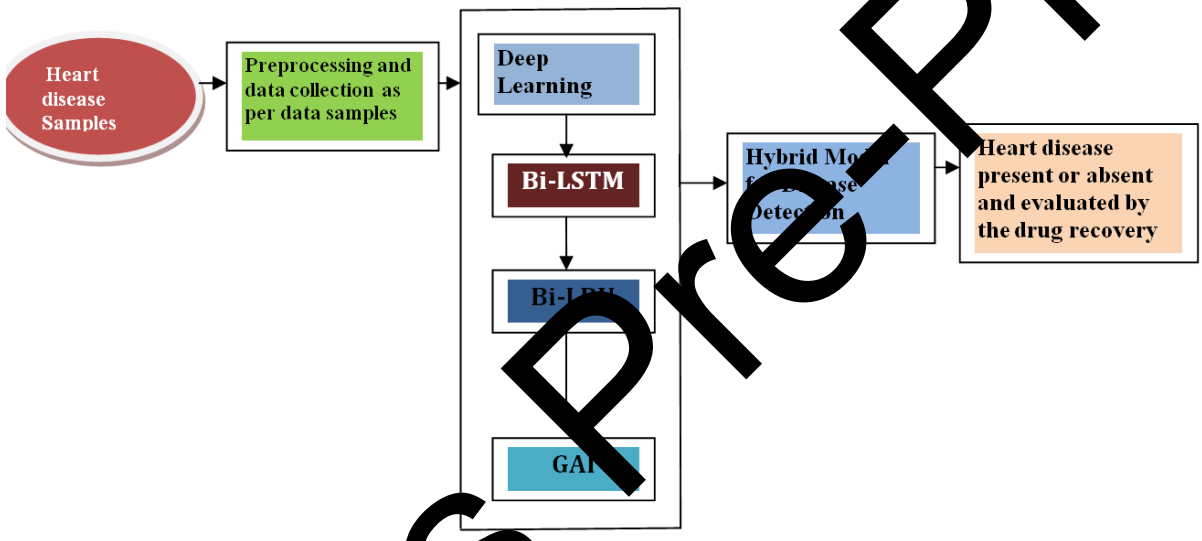
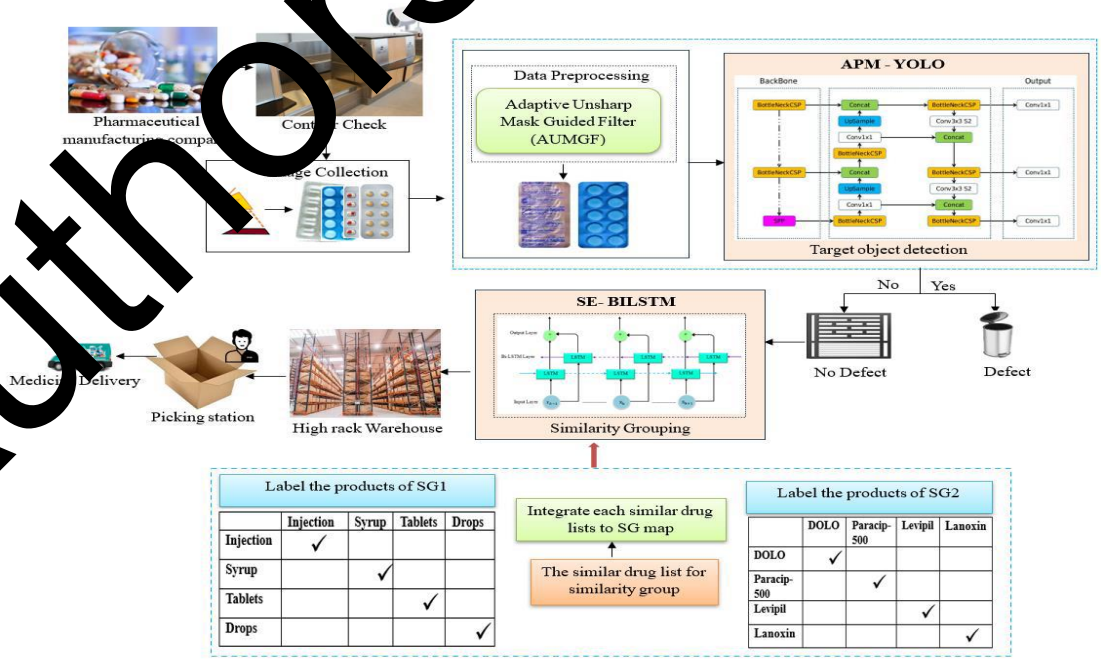


Figure 2. Proposed flow of work



	Injection	Syrup	Tablets	Drops
Injection	✓			
Syrup		✓		
Tablets			✓	
Drops				✓

	DOLO	Paracip-500	Levipil	Lanoxin
DOLO	✓			
Paracip-500		✓		
Levipil			✓	
Lanoxin				✓

Figure 3: Working model

3.3.5 Loss Function

The complete union loss is computed by proposes techniques Bi-LSTM and Bi-LRU with GAI model. It is hybrization method to improve the prediction rate in disease. With the help following: as shown by figure 5 and 6.

$$loss = AlL + PrL + AnL$$

Figure 4: Histogram results by correlating different features of heart

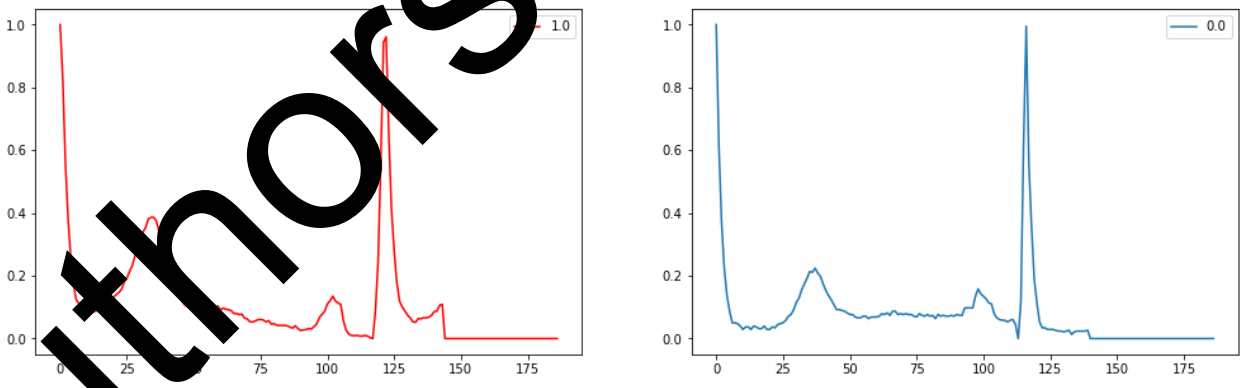


Figure 5: Results for heart disease for varying frequency

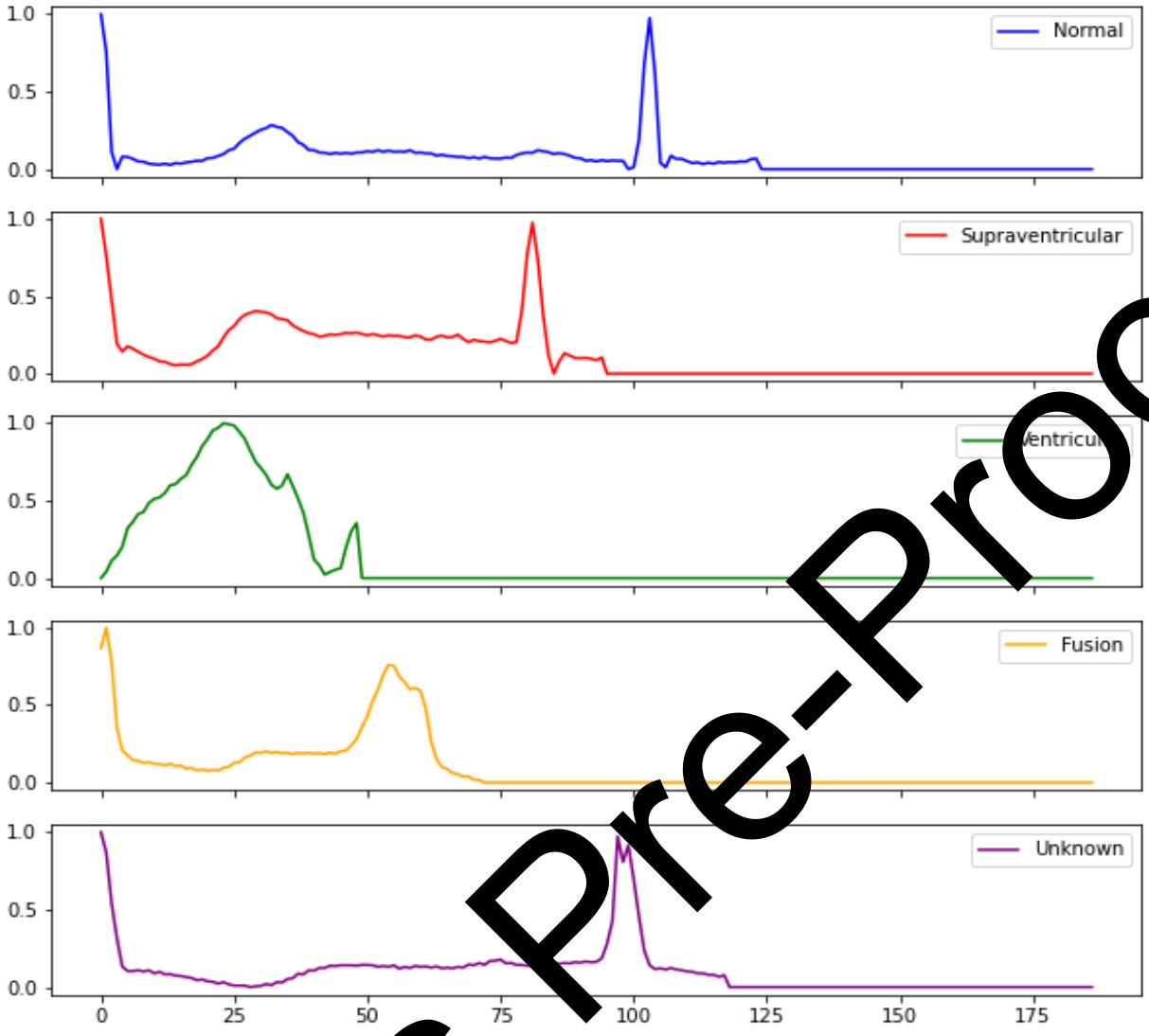


Figure 6: Heart disease results for normal and abnormal values

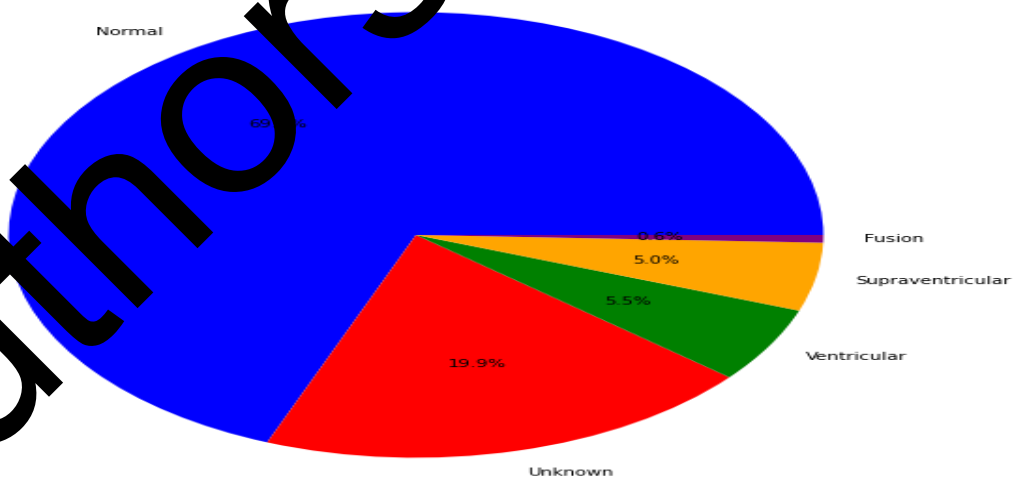


Figure 7: Graph of different attributes

3.4 BiGAITSMRU in Grouping

As classifying the disease on the basis of similarity algorithm BiLSTMRU with GAI model is computed. Pharmacists mostly focused on various packaging styles among various designs with a distinct drugs and medicine dispenser. Similar package of medicines results the resemblance of genetic medications[16][17]. To enhance the accuracy similar group items are packed and trained the model as per the heart disease attributes [18][19]. as per

the results computed accuracy, variable accuracy and loss is estimated. The results shown in figure epochs values computed [20][21].The results are computed as for Cleveland dataset and other which are slightly related to heart disease [22][23]. When the confusion matrix is generated for the results that are showing prediction rate of disease as shown by table 1

Table 1: Confusion matrix

	Instances	Features	Accuracy	Specificity	Sensitivity	F1-Score
Cleveland Dataset	303	14	96.30%	92.23%	91.42%	90.92%
Other disease related to Heart	170	13	87.28%	83.22%	84.57%	85.38%

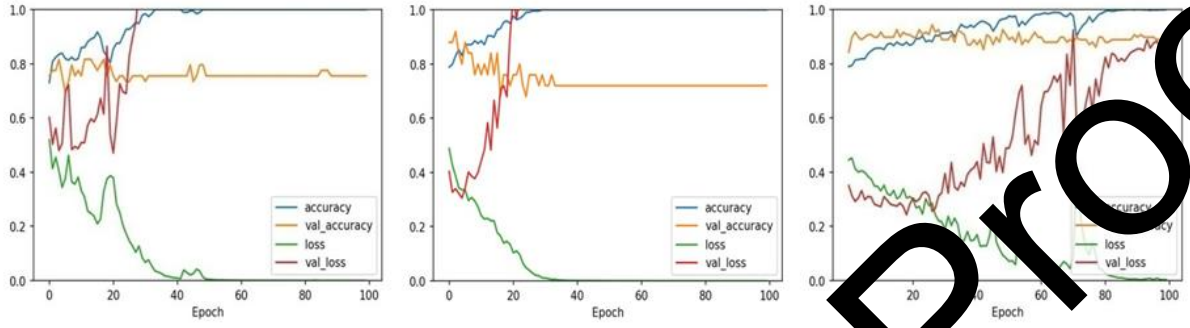


Figure 8: Epoch Rate for BILSTMGRU

Table 2: Results for Performance Metrics for Hybrid GAI

Method	Accuracy	Specificity (%)	Sensitivity (%)	F1-score(%)	Prediction Time (ms)
Bi-LRU	88.77	81.43	87.2	87.97	85.71
Bi-LSTM	89.8	89.18	88.8	87.64	86.34
Hybrid model with GAI	99.9	93.4	92.5	90.12	94.2

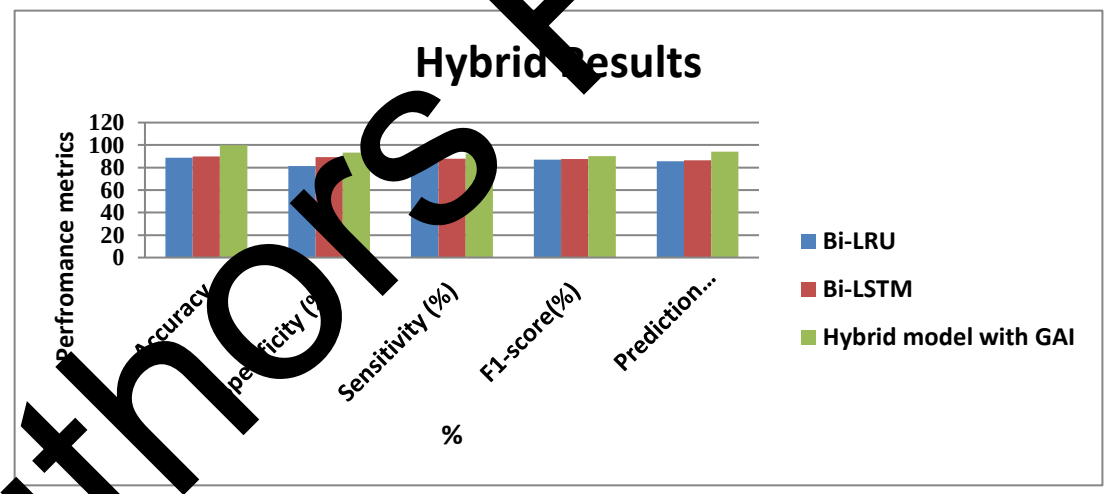


Figure 8: Hybrid Results for Multiple classifiers

5 Comparison Table for Results

By the comparison table shows the different results of work done by existing researchers or proposed study. With help of table could be easily indentifying and analyzing the results table 3.

Table 3: Comparative Analysis

Sr. No	Author & Year	Model used	Dataset	Results
1	Budak. C et.al [16]	Deep learning CNN	Heart Disease	**Not Defined**
2	In 2021 Kwon, H.J.[17]	Feature Extraction	Heart disease	**Not Defined**

3	In 2021 Han, Y., et al [18]	Image processing model and CNN	Heart disease	**Not Defined**
4	Ting, H.W., et al	Yolo model	Heart disease	**90%**
5	Fan B et. al	BERT model	Heart disease	**94%**
6	Basiri, M.E., et al [22]	Fusion model based on decision tree theory	Heart disease	**Not Defined**
7	Eslami Manoochehri, H. and Nourani, M., [23]	Graph labeling method	Heart disease	**Not Defined**
8	Gentile, F., et al [24]	DD approach for fred docking software.	Heart disease	**Not Define**
9	**Proposed work**	**CNN model Bi-LSTM and LRU have hybridized with GAI**	**Heart disease**	**99.9%**

4. Conclusions

For the heart disease detection making the use of patients data using physiological data as a input d for e patie s data. Patient physiological data including fasting blood sugar, heart rate, ECG ,blood pr re, c esterol level etc. The two different deep learning based HD diagnostic with the help of deep learning odel su Bi-L TM , Bi-LRU with GAI that is one dimensional prediction models [24][25]. In the HD detectio enhanc he vario prediction model. The proposed model is used for obtained the better accuracy in the predi n of eart disease at an early stage. To identify and evaluate the weights of various components to compute the ectiveness of clinical risk information. The fundamental advantages of this current study are used for sequen l processing and signal processing through ECG of patients. In CNN model Bi-LSTM and LRU have hy ized ith GAI for obtaining netter accuracy. This proposed model performance have better predict model in heart disease, as in future perspective different dataset and model could be used.

References

1. Chang, Wan-Jung, Liang-Bi Chen, Chia-Hao Ch Pei Lin, Tzu-Chin Yang.: A deep learning-based intelligent medicine recognition system fo chrom patien . IEEE Access 7, 44441-44458 (2019). DOI: 10.1109/ACCESS.2019.2908843
2. Gupta, R., Srivastava, D., Sahu, M., Tiw S., mbasta, R.K., Kumar, P.: Artificial intelligence to deep learning: machine intelligence approach fo g discovery. Molecular diversity, 25, 1315-1360 (2021). https://doi.org/10.1007/s11030-021-10217-3
3. Deng, Y., Xu, X., Qiu, Y., Xia, J., Zhang, W., Liu, . A multimodal deep learning framework for predicting drug–drug interaction vents. Bioinformatics, 36(15), 4316-4322 (2020). https://doi.org/10.1093/bioinf mati a501.
4. Budak, C., Mençik, V., C er, Determining similarities of COVID-19–lung cancer drugs and affinity binding mode analysis graph n twork-based GEFA method. Journal of Biomolecular Structure and Dynamics, 41(2), 659 71 (2023). https://doi.org/10.1080/07391102.2021.2010601.
5. You, Y.S. & Lin J.S. A Novel Two-Stage Induced Deep Learning System for Classifying Similar Drugs with Diverse P kaging. nsors, 23(16), 7275 (2023). https://doi.org/10.3390/s23167275
6. Han, Y., Chung S.L., Xia , Q., Wang, J.S., Su, S.F.: Pharmaceutical blister package identification based o ed d p learning. IEEE Access, 9, 101344-101356 (2021). htt doi.org 9.1109/ACCESS.2021.3097181.
7. Kwon H.J., Kim H.G., Lee, S.H.: Pill detection model for medicine inspection based on deep learning. hemos sors, 10(1), 4 (2021). https://doi.org/10.3390/chemosensors10010004
8. Ti H.W., Chung, S.L., Chen, C.F., Chiu, H.Y., Hsieh, Y.W.: A drug identification model developed usin learning technologies: experience of a medical center in
9. iwan. BMC health services research, 20(1), 1-9 (2020).
10. F B., Fan, W., Smith, C.: Adverse drug event detection and extraction from open data: A deep learning pproach. Information Processing & Management, 57(1), 102131 (2020). https://doi.org/10.1016/j.ipm.2019.102131.
11. Basiri, M.E., Abdar, M., Cifci, M.A., Nemati, S., Acharya, U.R.: A novel method for sentiment classification of drug reviews using fusion of deep and machine learning techniques. Knowledge-Based Systems, 198, 105949 (2020). https://doi.org/10.1016/j.knosys.2020.105949
12. Eslami Manoochehri, H., Nourani, M.: Drug-target interaction prediction using semi bipartite graph model and deep learning. BMC bioinformatics, 21, 1-16 (2020). https://doi.org/10.1186/s12859-020-3518-6.
13. Gentile, F., Agrawal, V., Hsing, M., Ton, A.T., Ban, F., Norinder, U., Gleave, M.E., Cherkasov, A.: Deep docking: a deep learning platform for augmentation of structure based drug discovery. ACS central science, 6(6), 939-949 (2020). https://doi.org/10.1021/acscentsci.0c00229.
14. Liu, X., Meehan, J., Tong, W., Wu, L., Xu, X., Xu, J.: DLI-IT: a deep learning approach to drug label

identification through image and text embedding. BMC Medical Informatics and Decision Making, 20(1), 1-9 (2020). https://doi.org/10.1186/s12911-020-1078-3.
15. Klein, R., Peto, T., Bird, A. & Vannewkirk, M. R. The epidemiology of age-related macular degeneration. Am. J. Ophthalmol. 137 486–495 (2004).
16. Mitchell, P., Liew, G., Gopinath, B. & Wong, T. Y. Age-related macular degeneration. Lancet 392, 1147–1159 (2018).
17. Lim, L. S., Mitchell, P., Seddon, J. M., Holz, F. G. & Wong, T. Y. Age-related macular degeneration. Lancet 379, 1728–1738 (2012).
18. Klein, R., Klein, B. E., Tomany, S. C., Meuer, S. M. & Huang, G.-H. Ten-year incidence and progression of age-related maculopathy: The beaver dam eye study. Ophthalmology 109, 1767–1779 (2002).
19. Elsharkawy, M. et al. Role of optical coherence tomography imaging in predicting progression of age-related macular disease: A survey. Diagnostics 11, 2313 (2021).
20. Lakshmi Narayana Reddy, D., Mahaveerakannan, R., Kumar, S., Chenni Kumaran, J., & Bhanuranga, P. M. (2024, January). A Structure for Forecasting Stomach Cancer Using Deep Learning and Advanced Tongue Characteristics. In International Conference on Smart Computing and Communication (pp. 1-14). Singapore: Springer Nature Singapore.
21. Hernández-Zimbrón, L. F. et al. Age-related macular degeneration: New paradigms for treatment and management of AMD. Oxidat. Med. Cell. Longevity. 2018, 1–14 (2018).
22. Sudhakar, K., & Mahaveerakannan, R. (2024, March). Prospects of Deep Learning with Blockchain for Securing the Digital Radiography Data in Smart Healthcare. In 2024 International Conference on Distributed Computing and Optimization Techniques (ICDCOT) (pp. 1-7). IEEE.
23. Ferris, F. L. et al. A simplified severity scale for age-related macular degeneration: AREDS report no. Arch. Ophthalmol. (Chicago, Ill.: 1960) 123, 1570–1574 (2005).
24. Tyagi, S., Rajput, I. S., & Pandey, R. (2023, March). Federated learning: Applications, Security hazards and Defense measures. In 2023 International Conference on Device Intelligence, Computing and Communication Technologies,(DICCT) (pp. 477-482). IEEE.
25. Rajput, I. S., Gupta, A., Jain, V., & Tyagi, S. (2024). A transfer learning-based brain tumor classification using magnetic resonance images. Multimedia Tools and Applications, 83(7), 20487-20506.
26. Rajput, I. S., Tyagi, S., Gupta, A., & Jain, V. (2024). Sine cosine algorithm-based feature selection for improved machine learning models in polycystic ovary syndrome diagnosis. Multimedia Tools and Applications, 1-25.
27. Sudhakar, K., & Mahaveerakannan, R. (2023, November). Monitoring the Heart Patient Status Using Hybrid ML with GSO Models in Cloud Computing. In 2023 7th International Conference on Electronics, Communication and Aerospace Technology (ICECA) (pp. 1548-1554). IEEE.