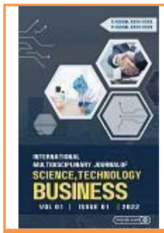

International Multidisciplinary Journal of Science, Technology, and Business

Volume No: **02** Issue No: **04 (2023) DOI: 10.5281/zenodo.10613350**

Intelligent Disease Prediction System for Hepatitis C Patients

Salman Muneer[1],
Department of Computer Science, UMT, Lahore, Pakistan.
Email: mrsalman2013@gmail.com
Shan Khan[2],
Department of Computer Science, UCP, Lahore, Pakistan.

Abstract:

Accurate and timely predictions are essential for minimizing the devastating side effects of medical therapies, especially when dealing with serious illnesses like hepatitis C. In this research, a machine learning-based classification framework has been proposed to enable more reliable predictions of treatment responses in hepatitis C patients. The focus of this framework is to explore the potential of Machine Learning Techniques (MLT) in predicting, forecasting, and treating chronic diseases such as tumors, hepatitis, and heart diseases. In the proposed model, five ML algorithms - Naïve Bayes (NB), Decision Tree (DT), Bayesian Nets (BNs), Support Vector Machine (SVM), and Random Forest (RF) - are employed to predict the outcomes of hepatitis C patients undergoing treatment. The AI-enabled medical services model that has been developed is capable of delivering accurate predictions for hepatitis C with improved results in the future. Furthermore, the framework can be further enhanced by including additional ML techniques, such as deep learning or reinforcement learning, to achieve even more accurate results.

Keywords: *Disease Prediction, Machine Learning, Hepatitis C.*

Introduction:

Biomedical information has expanded decisively in the previous years because of the outstanding development of information in the biomedical area. The measures of information produced by medical care exchanges are excessively intricate and enormous to be handled and dissected by customary strategies. This information frequently conceals important information. Biomedical scientists deal with the issue of tracking down significant information from this immense measure of information. So, well-being informatics is a quickly developing field that is worried about applying software engineering and data innovation to clinical and well-being information. Wellbeing informatics is comprehension, everything being equal, to advance the compelling association, examination, the board, and utilization of data in medical services. It includes the utilization of informatics in the disclosure and the board of new information connecting with wellbeing and sickness. Fitting PC-based frameworks and effective insightful systems can assist with finding significant concealed information from immense clinical data sets. So, in the present period, information mining is becoming famous in the medical care field (Kashif et al.).

Each year, millions of people become infected with the hepatitis C virus. This highly contagious illness can be spread when an infected person's blood enters the body of an uninfected individual. In this paper, a machine learning-based system based on Artificial Neural Networks (ANNs) was proposed to aid doctors in the diagnosis of hepatitis C. The system is designed to help medical professionals make more accurate and timely diagnoses of the virus and ultimately save lives (Abd El-Salam et al.).

Building expectation models from different clinical information sources is conceivable involving an information revelation in information or information mining (DM) move toward in light of various ML calculations and the forecast precision of the came about clever frameworks might arrive at high exactness. It is the most common way of tracking down relationships or examples among various fields in huge clinical data sets. The utilization of DM in the clinical field can be utilized to break down and find stowed-away examples inside patients' datasets or clinical data sets (Ahammed et al.).

Advances in Artificial Intelligence (AI) over recent years have made it possible to build predictive models depending on medical data. AI algorithms, such as Naïve Bayes (NB), Decision Tree (DT), Bayesian Nets (BNs), Support Vector Machine (SVM), and Random Forest (RF), have been applied to anticipate changes in chronic hepatitis C patients. By using filter and wrapper feature selection techniques to decrease redundant elements, the accuracy of the predictions is improved. The performance of the proposed algorithms is evaluated using metrics such as accuracy, sensitivity, and specificity. The results indicate that AI algorithms are capable of providing accurate predictions and improved outcomes in the treatment of hepatitis C. Therefore, AI has the potential to greatly benefit the treatment of this disease (Chicco et al.).

Literature Review:

The Authors expressed that the biomedical area addresses one of the rich information spaces. A broad measure of biomedical information is at present accessible, going from subtleties of clinical side effects to different sorts of biochemical information and results of imaging gadgets. The fundamental center is to examine AI methods (MLT) which are broadly used to foresee and treat significant incessant infections like tumors, hepatitis, and heart sicknesses. The procedures to be specific Artificial Neural Network, K-Nearest Neighbor, Decision Tree, and Associative Classification are delineated and broken down. The accomplished precision for the board of sicknesses utilizing various strategies is contrasted and gone from 70% to 100 percent as indicated by the tackled issue, infection, and the pre-owned method. The most elevated exactness for coronary illness is 99.87% utilizing ANN to construct a choice emotionally supportive network for arranging the gamble of inherent heart medical procedure. The best exactness for hepatitis infection is 100 percent utilizing ANN (Syafa'ah et al.).

The creators expressed that a programmed determination framework given Neural Network for hepatitis infection is presented. This programmed determination framework manages the combination of element extraction and arrangement. The framework has two phases, which are highlight extraction - decrease and grouping stages. In the arrangement stage, these diminished elements are given as data sources Neural Network classifier. The order precision of this ANN (Indira et al.) finding a framework for the conclusion of hepatitis. They got precision from our applied cycle was 100 percent for testing information and 99.1% for preparing data.

In recent times, tremendous efforts have been made to develop AI-driven computer-aided diagnostic systems to avoid errors in medical diagnosis. AI plays a critical role in computer-aided diagnosis, particularly in the field of biomedicine. Design recognition and AI guarantee more accurate detection and diagnosis of diseases. They also increase the accuracy of the dynamic interaction between doctors and patients. AI offers a viable solution for analyzing complex and multi-modal biomedicine data, providing automated and sophisticated calculations for diagnosing diseases and tracking the progression of illnesses. Thus, AI algorithms and tools are being used extensively to examine diseases and monitor their development (Fatima et al.).

The scientists endeavor to propose a faster and more proficient strategy for infection conclusion, prompting opportune patient treatment. Our technique dissected 4,962 patients with ongoing hepatitis C from fifteen distinct focuses in Egypt somewhere in the range of 2006 and 2017. The proposed model utilized six normal calculations including NNs, NBs, DT, SVM, RF, and BN to accomplish our goal. The outcomes showed that connection and (p-esteem) given channel strategy and Bayesian Network calculation are appropriate for this examination. At long last the Bayesian Net calculation accomplished 68.9% for exactness and 74.8% (Jilani et al.).

The creators showed clinical gamble expectation models utilizing ML are getting potential for additional compelling symptomatic modalities without the requirement for intrusive techniques. With such models, medical care experts might be enabled towards a more precautionary approach in administration, hence working on clinical results. Despite the presence and severity of liver fibrosis, the management of patients with prolonged Hepatitis C remains inadequate. To further improve the diagnostic potential of Machine Learning (ML) models, several considerations should be taken into account. Specifically, the Egyptian dataset used in this study comprises only patients diagnosed with chronic hepatitis C due to viral genotype 4a, out of the eight known genotypes of HCV that are further subdivided (Polaris Observatory HCV Collaborations 2017). Therefore, future investigations should focus on other HCV genotypes to expand the scope of such models (Akella et al.).

Numerous intelligent and smart frameworks, such as ML techniques, have been implemented and developed (Ali et al: Ali et al.: Amjad et al.), Deep Learning (Abbas et al.: Said et al.), Explainable Artificial Intelligence (Muneer et al.: Raza et al.), Fusion based approaches (Gai et al.: Ma et al.) and Map Red (Asif et al.), that can offer support in creating emerging explanations for the growing disputes in developing smart cloud-based checking management systems.

Proposed Methodology:

Early detection of hepatitis is vital for effective treatment of the disease, particularly among adults and elderly individuals. To that end, this work proposes an Artificial Intelligence (AI) based hepatitis prediction framework designed to detect and diagnose the disease at its early stages. The proposed framework is capable of identifying the presence of hepatitis in a patient and predicting the future course of the disease. The framework is designed utilizing current ML algorithms and techniques, such as Naïve Bayes (NB), Decision Tree (DT), Bayesian Nets (BNs), Support Vector Machine (SVM), and Random Forest (RF). It is expected that this AI-enabled system will provide accurate and timely predictions of hepatitis, allowing for early and prompt treatment of the disease, thus improving patient outcomes and reducing the burden of the illness on society. In the future, the performance of this framework can be further improved by incorporating other ML algorithms, such as deep learning and reinforcement learning.

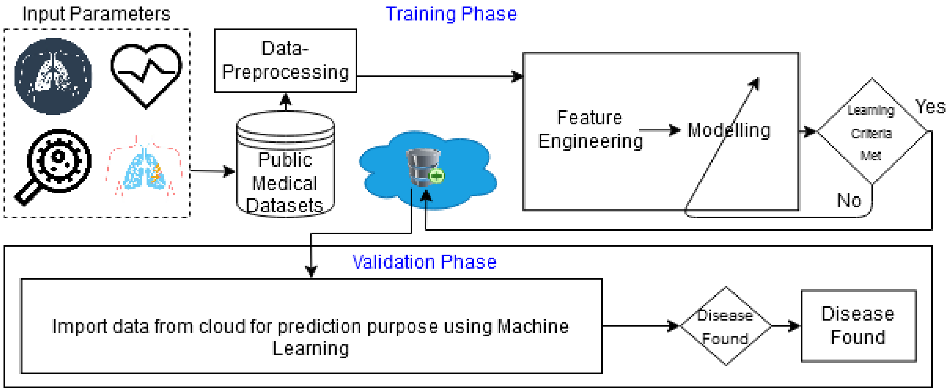

Figure 1: Proposed model

As depicted in Figure 1, the proposed continuous asthma disease prediction approach comprises two stages: training and inference. The training stage starts by inputting raw data obtained from digital clinical devices into a public clinical dataset. This raw data may contain missing or noisy information, which is then handled by the preprocessing layer by utilizing techniques such as moving average and normalization to eliminate the raucous information. This is followed by feature engineering, a common approach used to extract, select, and transform raw data into features that can be used in supervised learning. These features are then used in the modeling stage, wherein AI algorithms are applied to predict the existence of hepatitis in a patient, based on the given set of features. Once the model is evaluated, if satisfactory results are obtained, the results are stored in a cloud dataset. In the inference stage, the trained model is imported from the input features and then passed to the AI system for prediction. If the prediction is negative, the cycle is terminated, but if the prediction is positive, a message is displayed indicating the presence of the disease.

Conclusion:

This work demonstrates the potential of AI-enabled healthcare models for accurately predicting the presence of hepatitis C in patients. Such a model has the potential to help healthcare professionals make better-informed decisions about treatments for this disease and could ultimately save lives and improve patient outcomes. With further research and development, it may be possible to extend the model to cover the early stages of the disease, which would further improve its accuracy and efficiency. To further extend the efficacy of this AI-enabled healthcare model for disease prediction in hepatitis C patients, research should be conducted to evaluate its performance in other contexts, such as with different patient groups or challenge datasets. Additionally, methods should be explored to leverage the model’s predictive power in more complex scenarios, such as incorporating patient history, environmental factors, and other datasets. By doing so, the model could be further improved and more accurately applied to predict the presence of the disease and its progression in individuals.

Limitations and Future Directions:

Artificial Intelligence (AI) plays a vital role in the medical field, especially in the prediction of various illnesses. Accurate prediction of diseases is an essential task for healthcare professionals to ensure that patients receive the right treatment. To this end, various healthcare models have been developed to make accurate predictions, although they still have many limitations. For example, in [36], a statistical analysis was conducted, in which Receiver Operating Characteristics (ROC) were used to analyze the accuracy of the non-invasive APRI and FIB4 tests for diagnosing hepatitis C and achieved an accuracy of 85%. In this work, an AI-enabled healthcare model is used to accurately predict hepatitis C. In the future, the suggested model could be extended to monitor and predict the onset of hepatitis C during early stages of life, which could lead to better outcomes and improved results.

References:

Kashif, A.A., Bakhtawar, B., Akhtar, A., Akhtar, S., Aziz, N., Javid, M.S., 2021. Treatment Response Prediction in Hepatitis C Patients Using Machine Learning Techniques. Int. J. Technol. Innov. Manag. 1, 79–89.

Abd El-Salam, S.M., Ezz, M.M., Hashem, S., Elakel, W., Salama, R., ElMakhzangy, H., ElHefnawi, M., 2019. Performance of machine learning approaches on prediction of esophageal varices for Egyptian chronic hepatitis C patients. Informatics Med. Unlocked 17, 100267.

Ahammed, K., Satu, M.S., Khan, M.I., Whaiduzzaman, M., 2020. Predicting Infectious State of Hepatitis C Virus Affected Patient’s Applying Machine Learning Methods. 2020 IEEE Reg. 10 Symp. TENSYMP 2020 1371–1374.

Chicco, D., Jurman, G., 2021. An ensemble learning approach for enhanced classification of patients with hepatitis and cirrhosis. IEEE Access 9, 24485–24498.

Syafa’ah, L., Zulfatman, Z., Pakaya, I., Lestandy, M., 2021. Comparison of Machine Learning Classification Methods in Hepatitis C Virus. J. Online Inform. 6, 73.

Indira DN, Ganiya RK, Ashok Babu P, Xavier A, Kavisankar L, Hemalatha S, Senthilkumar V, Kavitha T, Rajaram A, Annam K, Yeshitla A. Improved artificial neural network with state order dataset estimation for brain cancer cell diagnosis. BioMed Research International. 2022 Apr 16;2022.

Fatima, S.A., Hussain, N., Balouch, A., Rustam, I., Saleem, M., Asif, M., 2020. IoT-enabled Smart Monitoring of Coronavirus empowered with Fuzzy Inference System. Int. J. Adv. Res. Ideas Innov. Technol. 6, 188–194.

Jilani, T.A., 2011. PCA-ANN for Classification of Hepatitis-C Patients 14, 1–6.

Akella, A., Akella, S., 2020. Applying Machine Learning to Evaluate for Fibrosis in Chronic Hepatitis C. medRxiv 2020.11.02.20224840.

Ali, N., Ahmed, A., Anum, L., Ghazal, T.M., Abbas, S., Khan, M.A., Alzoubi, H.M., Ahmad, M., 2021. Modeling supply chain information collaboration empowered with machine learning techniques. Intell. Autom. Soft Comput. 30, 243–257.

Ali, N., Ghazal, T.M., Ahmed, A., Abbas, S., Khan, M. A., Alzoubi, H.M., Farooq, U., Ahmad, M., Khan, Muhammad Adnan, 2022. Fusion-based supply chain collaboration using machine learning techniques. Intell. Autom. Soft Comput. 31, 1671–1687.

Amjad M, Raza H, Muneer S, Aslam MA. A Systematic Review on Brain Tumor Detection Using Machine Learning. Journal of NCBAE. 2022 Dec 30;1(4):11-6.

Abbas, A., Abdelsamea, M.M., Gaber, M.M., 2020. Classification of COVID-19 in chest X-ray images using DeTraC deep convolutional neural network. Appl. Intell.

Said RA, Raza H, Muneer S, Amjad K, Mohammed AS, Akbar SS, Zonain M, Aslam MA. Skin Cancer Detection and Classification Based on Deep Learning. In2022 International Conference on Cyber Resilience (ICCR) 2022 Oct 6 (pp. 1-11). IEEE.

Muneer S, Rasool MA. Enhancing Healthcare Outcomes with Explainable AI (XAI) for Disease Prediction: A Comprehensive Review. International Journal of Advanced Sciences and Computing. 2022 Jun 30;1(1):37-42.

Raza H. An IoMT-enabled smart healthcare model to monitor elderly people using Explainable Artificial Intelligence (EAI). Journal of NCBAE. 2022 Jun 30;1(2):16-22.

Gai, K., Guo, J., Zhu, L., Yu, S., 2020. Blockchain Meets Cloud Computing: A Survey. IEEE

Commun. Surv. Tutorials 22, 2009–2030.

Ma, F., Sun, T., Liu, L., Jing, H., 2020. Detection and diagnosis of chronic kidney disease using deep learning-based heterogeneous modified artificial neural network. Futur. Gener. Comput. Syst. 111, 17–26.

Asif, M., Abbas, S., Khan, M. A., Fatima, A., Khan, Muhammad Adnan, Lee, S.W., 2021. MapReduce-based intelligent model for intrusion detection using machine learning technique. J. King Saud Univ. - Comput. Inf. Sci.