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Artificial Intelligence - Driven Prediction of Health Issues in Infants – A Review

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ABSTRACT

Advances in technology and data availability have helped in improving the quality of care and in predicting health issues in infants. Currently, Information and Communication technology aids in reaching the essentiality and the applications of infant health to a greater extent. Over a few decades, researchers have dived into sensing and the prediction of Artificial Intelligence (AI) for infant health. Since these healthcare systems deal with large amounts of data, significant development is seen in several computing platforms. AI, including both machine learning (ML) and deep learning (DL), plays a crucial role in the medical industry in the prediction and classification of various infant diseases. The prediction of diseases in infants using extubation readiness and their utility ranges is still lacking. Thus, the present study aims to present a complete review of the adaption of ML and DL approaches to infant health prediction. The current review paper provides a complete overview of the research predicting infant health issues. Effectual comparisons are made among the AI approaches performing infant disease prediction. Furthermore, the paper identifies the research gaps and the future direction of the research in the present domain. A comprehensive form of analysis of the current landscapes involved in predicting infant health issues using AI is presented.

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1. INTRODUCTION

Neonatal diseases are one of the main causes of morbidity and are a significant contributor to under-five mortality worldwide. Maternal and Infant healthcare are indispensable for a healthier society [1]. The neonatal period is a crucial time in human life for a newborn to adapt to the current environment and several physiological adjustments essential for lifestyle [2]. The major infant health problems are due to growth retardation, asphyxia, and infection in the vaginal region during delivery. The complications of both maternal and infant health have to be identified and communicated in a timely manner to the healthcare takers and the professionals. Who is involved in taking action against them? Concurrently, approaching an opportune medical assistance is one of the difficult tasks, especially in the case of rural areas. At the same time, the current era of information and communication technology has evolved to enable the medical field to address each of the complications of infant health in an appropriate manner [3].

Preventive approaches focus on maternal healthcare before birth. Thus, maternal immunization and efforts guarantee a healthier delivery [4]. Detection of diseases at an early stage is an essential approach for effective treatment and for preventing complications

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[5]. Infant mortality rates have been reduced from 5 million in 1990 to a rate of 2.4 million in 2019, as newborns face a greater risk term in their initial 28 days of birth. These days, they are easily applicable to harmful pathogenic diseases due to poor immunity conditions [6]. Rapid and accurate forms of medical information and diagnosis are needed for healthcare professionals to plan and devise treatments for each infant. Incorporating AI into the clinical domains and workflows to improve patient safety, minimize human error, and enhance the quality of care in these specialized settings [7]. Recent echo-cardiogram diagnoses have been developed and have achieved unprecedented performance in data collection, exceeding an expert level. However, when these are applied to cases that are not trained, the end diagnostic results are highly inaccurate. A feasible way to identify the cases is to measure the reliability of the end diagnostic results [8].

Similarly, the DL approach has become one of the standard approaches for analyzing fetal images, which are obtained using ultrasound technologies [9]. Concurrently, the recommended approach has been used to detect ventricular hemorrhage in pre-term neonatal patients using Long Short-Term Memory (LSTM) Autoencoders. These are analyzed among the 37 weeks before born older infants, who are highly prone to develop Intraventricular Hemorrhage (IVH). The hemodynamic patterns for monitoring the Neonatal Intensive Care Unit (NICU) have been accepted for analyzing vast amounts of data. LSTM Autoencoders have been able to predict the IVH with an average rate of precision and accuracy but are comparable with lower specificity rates [10].

Similarly, conventional approaches have used both ML and DL-based models for the prediction and classification of various neonatal and infant diseases. However, a comprehensive form of review and an improper form of recognition and prediction of disease with comparatively higher accuracy rates are recommended for the infant healthcare domain. Hence, the projected study aims to resolve the gap by presenting an intelligent evaluation of each of the successful ML and DL approaches involved in infant disease prediction. The literature survey encompasses the approaches that consider the ML and DL models renowned for performing infant disease prediction and classification.

1.1 Contribution of the Study

The major contribution of the study is as follows,

- To review the recent research approaches (2019-2023), which are related to disease detection and classification in infants among infants.
- To compare both the ML and DL algorithms performing infant disease prediction.
- To highlight each of the research gaps obtained from the conventional studies and to afford the applicable future recommendations that can aid future researchers in resolving the existing issues of the domain.

1.2 Paper Organization

The paper is organized subsequently. Initially, the survey methodology process is explored in Section 2. Following this, the role of AI in the healthcare domain is explained in Section 3; following this, the significance of early disease prediction is represented in Section 4. Then, ML and DL techniques involved in infant healthcare monitoring are presented in Section 5. Subsequently, a complete tabular analysis of ML and DL approaches considered is presented in section 6. Followed by, the challenges among the disease prediction in AI are presented in section 7. Then, in section 8, the discussion is explained. The clinical implications are stated in Section 9, while the entire study is concluded in Section 10.

2. SURVEY METHODOLOGY

The survey methodology was accomplished through Google Scholar. The terms observed for examining key are "Infant disease prediction using AI," "infant disease detection by ML," and "DL in infant disease prediction." The related and appropriate publications were designated for the years 2019 and 2023. In the preliminary stage, studies were chosen based on the significance of the label. Consequently, screening of the abstract was done, and while supposed to be suitable, the general script was also deliberated. In addition, further citations of the paper were considered and included as required, with a total of 25 distinguished studies that match the conception. The procedures followed in studying these approaches are shown in Figure.1.

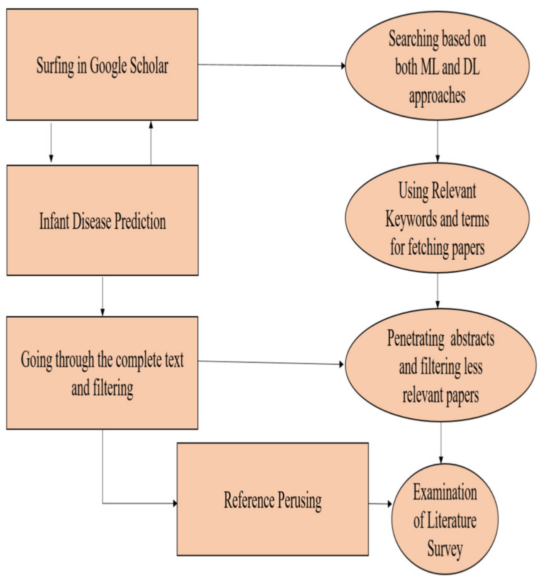

Fig.1: *Flow chart indicating the Methodologies Involved in the Literature Review.*

3. ROLE OF AI APPROACHES IN HEALTHCARE

Global sciences have faced a growing demand for high-quality healthcare as a significant consequence of the aging population with an increased prevalence of patients experiencing both multiple and chronic conditions [11]. AI refers to machines, which are able to perform tasks with no requirement of human intervention. ML encompasses various techniques that can be used in achieving AI and refers to computer learning that requires no explicit programmers. ANN is one of the Neural Networks which are used in simulating the human brain [12]. Healthcare decision-making is one of the complicated aspects that requires an association among the stakeholders to ensure the sustainability for addressing the healthcare facilities. AI in healthcare decision-making is based on general knowledge and data, which are grained as a path to enhance healthcare delivery by taking up a smart diagnosis and effective treatment suggestions. However, a comprehensive form of inspection and evaluation is needed to ensure the sustainability of the decisions made using AI [13]. Figure.2. depicts the relationship between the AI and its sub-domains [14].

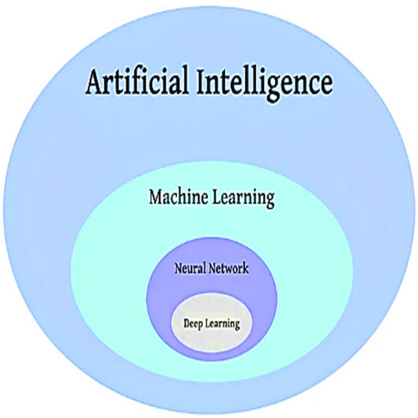

Fig.2: *Relationship among AI, ML, and the DL approach [14].*

AI and its sub-domains are extensively used in clinical medicine and are witnessing increasing innovations in the fields of AI-aided image analysis. AI is also implemented for lesion determination, healthcare management, and various other healthcare approaches. AI makes a major contribution in the fields of visualized medicine, AI-aided treatments, and clinical meta-data analysis. These are some of the prominent scales in the preclinical and clinical uses, which serve more in the future perspectives of AI-based clinical decision-making [15]. Concurrently, AI has also been implemented in nuclear medicine, which is used to represent a disruptive technology and is significant for clinical decision support systems. These are especially used by radiologists, where the opportunities of nuclear medicine tend to enhance the seamless integration of transformative technology without any displacement of human resources [16].

AI has been used to predict strokes in individuals by making use of real-time Extracellular Matrix (ECM) signals. Patients with stroke are prone to have abnormal Electrocardiogram (ECG) signals. Correspondingly, Computed Tomography (CT) and Multi-resistant Organism (MRO) are less effective for an appropriate real-time diagnosis of stroke diseases; AI has been used for the analysis of real-time ECG signals examination and predicting the cases of stroke. This is done by combining the Random Forests (RF) and LSTM for the case prediction, achieving an overall accuracy rate of 90.3% [17]. Several studies have been implemented with ANN for stroke diagnosis and prediction [18]. DL techniques such as Decision Tree (DT), RF, and Logistic Regression (LR) have been combined for the stroke disease rate prediction, and the consistency of the disease prediction has been improved in their accuracy rates [19]. Whereas a DL-based model has been implemented for the examination and in the prediction of the Hemorrhagic Transformation (HT) after the onset of stroke. Convolutional Neural Networks (CNN) have been comparatively used more in aspects of providing predictive information before the onset of therapy for the assistance of the pre-procedural management of patients with thrombectomy in the endovascular system (EVT) [20].

CNN has also been adapted as a suggested approach for the prediction and detection of penumbral tissue in acute ischemic stroke (AIS). 3D images of Pseudo-Continuous Arterial Spin Labeling (pCASL) data have been collected from 137 patients, where DL and 6 various ML algorithms have been adapted with 10-fold cross-validation [21]. Patients with hypertension (HT) tend to have an expansion over hemorrhage. The corresponding risk was examined using the radiomic score prediction, which was done on 104 patients. Both Synthetic Minority Oversampling Technique (SMOTE) techniques have been applied to the original data collected. One of the prominent techniques, Least Absolute Shrinkage And Selection Operator (LASSO) regression, has been applied for the identification of random features and in constructing a radiomic score [22].

4. SIGNIFICANCE OF EARLY DETECTION AND PREDICTION OF ILLNESS

There has been a notable increase in the field of study that is used in investigating the application of computational intelligence for the enhancement of diagnostics and the prognostics of diseases. AI-empowered solutions have been able to transform many sectors of healthcare [23]. AI approaches such as ML have been involved in making inferences with information by detecting the patterns that are hidden in the observations. For instance, heart-related abnormalities are one of the prominent fatal diseases among other diseases globally. Early and effective detection of heart disease is one of the most highly investigated and researched issues [24]. Moreover, many such fascinating trends have been used in the early identification and detection of numerous severe illness-causing diseases. Whereby Diabetes is one of the hazardous diseases, leading to several organ failures such as kidney, heart, and nerve damage to an individual [25].

Chronic Kidney Disease (CKD) is one of the most prevalent and fatal forms of disease resulting in influencing people on a large scale. It is a dormant and irreversible form of damage to an individual kidney. Followed by the progression of CKD can result in various complications, such as increased rates of disorders such as anemia, nerve damage, and further pregnancy complications. Million number of people die due to the complication every year [26]. Concurrently, the diagnosis and prognosis of CVD, known as Cardio Vascular Disease, is one of the crucial medical tasks involved in effectual classicist ion of risks, which can aid in providing a productive and proper form of treatment to patients. The applications of ML have been involved in the medical niche to reduce misdiagnosis and reduce fatality rates due to cardiovascular disease (CVD) [27]. Similarly, manual diagnostic procedures such as CT and Magnetic Resonance Imaging (MRI) have been less crucial in the effectual diagnosis of CVD, where these procedures are comparatively costly and impractical, resulting in about 17 million people's death [28].

Understanding the timely developmental milestones of the typical and clinical populations facilitates the intervention planning early detection and preventing the risk for further co-occurring conditions [29]. The early diagnosis is one of the necessary aspects for the timely inclusion of effective preventive measures and for presenting a clear manifestation of the disease in children. Moreover, the hereditary predisposition of the disease can be addressed individually. Minimal forms of manifestations are not diagnosed with pathological conditions, which are interpreted as a predisposition to a particular disease [30].

5. POTENTIALS OF AI IN ADDRESSING HEALTH ISSUES AMONG INFANTS

AI approaches for the management of patients and the data available can be used in making computer-guided interventions. However, AI approaches are liable for mitigating healthcare disparities by applying a reliable and appropriate form of approaches to reduce the adversities of diseases [31]. Some of the productive considerations and methods encompassing DL and ML approaches in infant disease prediction have been discussed in the following section.

5.1 Machine Learning in Infant Healthcare Monitoring

The suggested model involves making an effective diagnosis and the prediction of sepsis in neonates, which is one of the deadly and morbidity-causing diseases. Early diagnosis of the key disease is a complicated task due to their non-specific signs. Heart rate, respiration ranges, and O2 saturation levels have been evaluated for the prediction of sepsis. The prediction has been made using Naïve Bayes with a framework of 24 hours before the clinical sepsis mistrust. About 20 positive cases of sepsis have been discovered using the analysis of the combination of symptoms. The overall Receiver Operating Characteristic (ROC) curve of the approach has been in the range of 0.82 with an increase of 150-fold [32].

Similarly, the rise of ML has had significant implications for pediatrics. Long-term conditions such as disease heterogeneity comprising long portions of the disease prediction and intervention have been easily established by the ML models in clinical practices. ML models have been able to handle complex and high-dimensional data, which has been extensively common in healthcare approaches. The suggested model has been used in determining pediatric Inflammatory Bowel syndrome (IBS) and preterm nutrition [33].

Digital health and ML technologies have been used in the examination of Gestational Diabetes Mellitus (GDM), which is one of the subtypes of Diabetes that occurs during the maternity period. The blood glucose monitoring and the ML model have been fused for the monitoring of gestational Diabetes in both clinical and commercial settings. The data is collected from various sensors, such as activity tracking, quantification of food intake, and blood glucose monitoring. These can aid in the further management of GDM [34]. Figure.3. represents the ailment recognition model from [35].

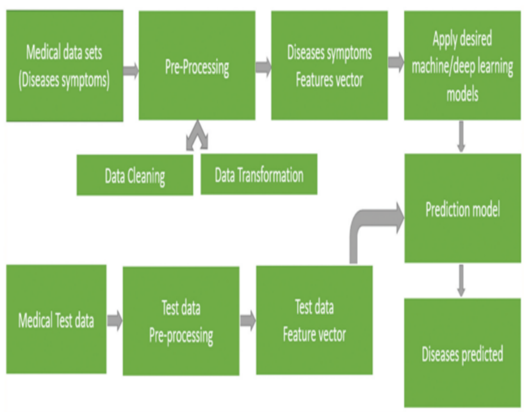

Fig.3: *Ailment prediction using ML model [35].*

The diagnosis of Respiratory Syncytial (RSV) infection in the first year of infants has been used in the suggested model; the supportive clinical decisions are used in providing timely data for effectual public health surveillance. The data from 2015-2020 have been collected from the Polymerase Chain Reaction (PCR) labs to confirm the RSV infection. Blood tests and clinical systems have also been used in algorithm development. The Light Gradient Boosting Machine (GBM) model was used to estimate the dataset of about 599 children. The recall and the F1-scores of the model were 0.72. ML-based clinical tools can be developed to make effective clinical support systems that create a large and accurate form of tools for clinical support and public health surveillance [36].

Cardiotocograms have been used in assessing fetal health and in preventing child mortality. The suggested study has been involved in developing an ML-based model for predicting fetal health based on the features extracted from Cardiotocography (CTG). Both SMOTE and univariate forms of feature selection approaches have been used to predict fetal health. K-Nearest Neighbour (KNN), Support Vector Machine (SVM), DT, and ANN with Multilayer Perceptron (MLP) have been employed in the task across various metrics for the performance evaluation. The RF has achieved a higher accuracy rate of 95.77%, whereas other models have also identified effectual fetal health predictions. Both the trend and histogram tendency over time have emerged as significant predictors for capturing the patterns associated with potential complications [37].

5.2 Deep Learning in Infant Healthcare Monitoring

The suggested approach makes use of a DL approach for cry detection among infants. These have been examined in the household setting. Cry, being a primitive form of communication for infants, requires continuous supervision. These can be an effective approach for monitoring infants. A stacked form of classifier has been used in the detection of infant cries, encompassing the CNN-Stacked Classifier Network (CNN–SCNet) model. The overall model has achieved a precision rate of 98.7% and an overall F1 score at a rate of 98.3% [38].

Concurrently, the Electroencephalogram (EEG) has been crucial in infant monitoring for effectual neurocritical care used in the facilitation of early therapeutic decisions and positive outcome predictions. Though the use of EEG is on a large scale, implementation and interpretation are needed for productive and spontaneous cortical activity. The classification of the EEG signals from the infants was monitored while infants were recovering from asphyxia and stroke. Unsupervised learning models have been used to explore the latent EEG characteristics, which can be guided by the DL-based classifier. The cortical brain function and the brain state of the infant were monitored using the suggested approach of using the EEG background classifier. The overall results have shown that 39 infants, on an observation period of 2561 hrs, had a post-natal period of 0-7 days. Both external validations were also done using 31 infants during an examination period of 105 hours. The overall accuracy rate of the model is 0.92. The ranges of Bachelor of Science in Nursing (BSN) have been closely related to EEG activity and the sleep-wake cycle [39].

Early identification of Cerebral Palsy (CP) is one of the crucial tasks in early intervention of preventing injuries occurring in the brain. This is one of the common physical disability in children, resulting in functional limitations and co-occurring impairments. These CP are diagnosed among the ages of 12-24 months, whereas milder forms of CP can be diagnosed in later childhood. Early identification of CP is needed to prohibit the high risks of CP for targeted interventions and infancy when the rate of neuroplasticity is comparatively high. The age group of 12-89 month children and infant data have been collected and are examined for perinatal brain injury from 13 various hospitals. The fidgety movements were assessed using the General Movement Assessment model, known as GMA, and both CPs with their sun types were assessed [40].

The suggested study [41] has been effectuated for accurate detection of the mechanical forms of ventilation requirements in neonatal patients using their respective healthcare records. Data from 1394 patients comprising 505 and 899 patients with and without Mechanical Ventilation (MV) have been chosen, and data are loaded to the FC layers followed by the Bidirectional Long Short-Term Memory (BI-LSTM) layer model. The AUROC ranges of the suggested model for the Intermittent Mandatory Ventilation (IMV) support have achieved an overall accuracy rate of 0.95. ROC is a graph presentation of the performance of classification methods at every classification threshold, and the Area under the Curve (AUC) is the ability measure of a binary classifier to differentiate among classes, and this is utilized as a summary of the ROC curve.

These DL approaches have been effective in standardizing the prediction of Intermittent Mandatory Ventilation (IMV) usage among neonatal patients and facilitating neonatal care. However, the suggested model is limited to the range of data, which affects its generalization. Data pertaining to the application of IMV are immature and critical. Moreover, the outborn patients did not have sufficient information regarding their maternal history and the other essential critical factors affecting neonatal lung disease.

6. TABULAR ANALYSIS

The corresponding section presents the tabular analysis for the ML—and DL-based approaches involved in disease prediction and detection in infants.

Table 1: *Tabular Analysis of ML and DL approaches in disease detection.*

Study	Aim of the approach	Dataset	Methodology	Outcome	advantage	Reference
Idris Oladele Muniru & Lizelle Van Wyk. Early prediction of IVH	Early detection and prevention of IVH among pre-term neonates have been examined using the Noninvasive Cardiac Output Monitoring (NICOM) parameters.	NICOM dataset, which has multi-variate time series data comprising hemodynamic parameters, has been used.	LSTM with AI has been used in the NICOM pattern prediction	A significant outcome towards a non-invasive and accurate form of the timely method has been used in preventing IVH in pre-term neonates	The model can also be adapted for low-resource settings. The model has achieved an overall accuracy rate of 0.71 and a precision rate of 0.70.	[10]
Chenxi Liu1, Dian Jiao1, and Zhe Liu1. AI-aided desease prediction.	Implementing the AI approaches in nuclear medicine has been carried out.	Single-photon emission Computed Tomography (SPECT) and Positron Emission Tomography (PET) datasets have been implemented.	Both ANN and the CNN have been implanted for the emergence and initiation of nuclear medicine.	AI will equip nuclear medicine professionals with the principles and applications needed to assimilate AI into workplaces that are similar in manner and reshape roles.	AI intends to create efficiencies and increase the Perceived value of human resources.	[15]
MS Azam, M Habibullah and HK Rana. Usage of ML methods in prediction of stroke risk and examination of their process.	The aim is to develop and validate an effective DL-based model based on the MRI results of HT present in Androgen AIS patients.	The acute ranges of infraction and hypo-perfusion are labeled manually.	Models based on single and multiple parameters have been developed to predict HT in AIS patients.	This model has achieved an AUC rate of 0.93 and an accuracy of 0.84. The multi-modal parameter has been with an AUC rate of 0.88 and an accuracy of 0.81.	The suggested model has a great potential for assisting the pre-procedural forms of management and in the early prediction of HT among patients with Endovascular Thrombectomy (EVT).	[19]
L Jiang, L Zhou, W Yong, J Cui, W Geng, J Zou, Y Chen, and X Yin. Prediction of hemorrhagic transformation after stroke	The selection of suitable patients having an AIS prone to an endovascular treatment, which is based on 3F pCASL, has been estimated	137 patients with AIS have been estimated and are included in the NN training.	The trained algorithm is further applied to 12 3D pCASL datasets from 1.5T and 3T electric MR systems without any fine-tuning.	The contrast defined hypo perfusion region in the pCASL with a voxel-wise area of 0.958.	The model's eligibility for a retrospective determination for a subject-level treatment has been improved. This assists in making an effectual decision for EVT having AIS.	[20]

K Wang, Q Shou, SJ Ma, D Liebeskind, XJ Qiao, J Saver, N Salamon, and H Kim. Detecting pCASL in stroke	The prediction of radiomic score has been developed for predicting the hemorrhage expansion after HT has ischemic stroke	104 patients with HT have been reported for Non-Enhanced Computed Tomography (NECT), comprising the brain images for assessing the brain images.	The SMOTE method was applied to the data with LASSO regression to identify the candidate radiomic features.	Among 104 patients, 17 were prone to HT after the onset of HT. 154 candidate predictors have been extracted from optimal features, with 0.91 specificity for train data and 0.87 for test data.	The current perceived score of NECT is viable for making an exact prediction of reperfusion treatment with HT.	[21]
J Yu, S Park, SH Kwon, Pyo and H CMB Ho, CS Lee. Predicting stroke disease through bio-signals with AI.	Evaluation of five various for the ML models prediction of CVD risk among the patients.	Cardiovascular Health Study (CHS) dataset.	DT with C4.5 is used in the process of feature selection, Patient-Controlled Analgesia (PCA) for dimension reduction, and ANN with SVM is used for classification.	DT, PCA, and the ANN are optimized and capable of producing optimal outcomes.	Early prediction and detection of stroke at an early stage can aid in reducing the severe rates of complexity and mortality rates.	[17]
SA Suha and TF Sanam. Employing AI-based applications in the clinical decision-making domain.	AI has been involved and is estimated for the enhancement of clinical knowledge and the treatment diagnosis	35 various opinions from experts in Bangladesh have been collected and are made for quantitative data plots.	Clustering approaches such as agglomerative clustering have been used in aspects of categorization	Among 3 various clusters, one of the clusters having six indicators is of relatively higher importance with less opinion case divergence, ensuring the rates of sustainability.	Healthcare practitioners are able to have a deeper perspective and opinion among the strategies and can focus on the most critical indicators in healthcare decision-making.	[13]
R Sawhney, A Malik, S Sharma and V Narayan. Early prediction and evaluation of CVD	Early prediction of CVD for reducing the fatality and mortality rates has been discussed	70,000 real-time datasets from kaggle have been used	K-mode clustering with Huang is used to improve the accuracy of classification. RF, DT, Extreme Gradient Boosting (XG-Boost), and MLP have been used and are validated	Upon comparison of models taking up with and without cross-validation. The MLP model has achieved a higher accuracy for classification with 87.2%	Unique characteristics and the progression of heart disease risk rate are also determined using the variations in gender to provide effectual prediction results.	[26]

SR Kobiljonova, NN Jalolov and SA Sharipova. Diagnosing Chronic Limb-Threatening Ischemia (CLTI) prognosis occurrence.	CLTI prognosis occurring due to peripheral artery defect is examined and diagnosed	CLTI patient data have been collected and are used for evaluation	AI and subsequent ML models have been used and are evaluated for the mitigation of CLTI	Effectual ML models have been applied to address the potential healthcare disparities in CLTI occurring in patients with peripheral arterial disease (PAD).	The outcomes obtained can be used in making effectual computer-guided interventions.	[30]
RR Dixit. Forecasting fetal health based on features extracted from CTG examinations.	Neurocritical care among the newborns has been carried out using EEG monitoring.	EEG reports from infants recovering from stroke and asphyxia are used	Cross-validation and external validation of the dataset have been conducted and are used to predict the BSN and the cortical function.	BSN is examined by identifying the sleep-wake cycle and continuous cortical activity, which is compared with the visual interpretation of the raw forms of EEG signals.	The trend of BSN can be implemented for bedside patients and in monitoring the EEG interpretation, which is intuitive, transparent, and clinically explainable.	[37]

7. CHALLENGES IN EARLY DISEASE PREDICTION AND DETECTION USING AI

AI approaches such as ML and DL have been some of the reputed applications in clinical cancer research where cancer prediction has reached new heights. Over a few decades, developments in statistics and computer engineering have encouraged many such research works to apply computational approaches such as multi-variate analysis to diagnose and prognosis the disease. Though AI approaches in breast cancer prediction, solid and non-solid tumor diagnosis, and several AI applications in cancer medical imaging have been facing a number of challenges, which are listed from [42].

1. ML, among the clinical diagnosis and disease prognostics, faces the risk of overfitting the training data, resulting in a degraded and brittle state of performance in certain aspects.
2. ML often involves a trade-off between accuracy and intelligibility.
3. Some of the ML models, such as the Naïve Bayes, single DT, LR, and RF, are less negligible to produce effectual positive outcomes and are comparatively with poor accuracy rates.

Moreover, the AI implemented for diabetic disease prediction has been prone to several challenges, where diabetic classification is one of the crucial tasks due to the non-linearity and complexity of the data. Besides, the Pima Indians Diabetes Database (PIMA) dataset used in the diabetes classification and prediction has more null entities, which results in degrading the model performance [43]. Whereas, considering the AI-based models for the prediction and the prognosis of AI in Coronavirus (COVID) infection outbreaks are encompassed with several challenges such as from [44],

- Increased infrastructure for data digitization among healthcare data is needed for effectual prediction and outcome rates using AI.
- The determination of legal liabilities associated with adverse outcomes is controversial in patient care. The obligations among AI-driven protocols and clinical care providers are less applicable. The use of tools such as the DL is limited to their generalization ranges, concerns regarding privacy, and explainability.
- High rates of false positives are obtained due to the model and data incompleteness at some point in the model classification.

Concurrently, AI has adopted Remote Patient Monitoring (RPM), which has been used to assist healthcare professionals in monitoring patients prone to acute and chronic forms of illness. The patient-centric RPM ranges from the classification of chronic diseases to monitoring the vital signs of emergency cases. The Federated form of learning (FL), which is used in learning human behavior patterns, has been implemented. Most black-box models are less viable for deliberating the effects and the relationships between the predictor and the target variables [45]. Both the AI and the ML models can be adapted only when the cases of interpretable structures are provided, and the results are provided. The sensitivity rates of the model can result in fewer prediction effects for a trained neural network [46].

8. DISCUSSION

Numerous ML and DL approaches have attempted to accomplish better accuracy and precision outcomes in the prediction of infant health problems. LSTM with AE has been used in the NICOM pattern prediction and has attained 0.71% accuracy [10]; likewise [20], for predicting hemorrhagic transformation, the pCASL dataset from 1.5T is utilized, and a voxel-wise area of 0.958 has attained. Both the ANN and the CNN have been employed [15] for implementing AI techniques in nuclear medicine and, additionally, to evaluate the effectiveness of DL-founded models based on MRI to predict the HT in AIS patients [19], likewise, the SMOTE model has been employed to predict HT along with finding the identifying the candidate radiomic features and has shown 0.91 specificity for train data then 0.87 for test data. Then, early prediction of CVD for decreasing the fatality and mortality rates was discussed using K-model clustering along with the hunang, which is utilized to enhance the classification's accuracy by 87.2% [26]. Different studies utilizing AI techniques, including both the DL and ML methods for the prediction and classification of infant health issues, have been one of the main domains that transformed AI in healthcare.

9. CLINICAL IMPLICATIONS

There is a notable rate of AI upon the application of AI in neonatal medicine and healthcare [47]. This is followed by the automated form of interpretation of the normal states of chest radiographs, which are used to alleviate the workloads of the radiologists. AI is applied for several radiological impacts, especially for chest radiographs, which are autonomously reported and are applied for the detection of abnormal chest radiograph reports [48]. Moreover, pain assessment among infants has been procured using AI practices, especially in infants. The mobile-health forms of pain assessment tools have been utilized for addressing the challenges of analyzing pain in infants [49].

Whereas, the application and the effectual diagnostic nature of the AI in the hip dysplasia in infants have been carried out in the suggested approach. Hip arthritis, in the absence of treatment, results in hip dysplasia in 1-2% of births occurring worldwide. This resulted in a feasible point-of-care where ultrasound was used in the AI as a primitive screening tool for infants with hip dysplasia. Beyond the detection and the screening affected by the AI approaches, the method is widely accepted by patients for fee-for–free services from providers with a history of innovation [50]. The application of AI in neonatal medicine has been complex and with a continuous form of recorded data. AI has the potential to connect the vast range of data and information tools to make them productive for clinical decision-making and in affirming personalized care and precise diagnosis of diseases. Current AI approaches have been employed in

- Risk stratification
- Patient and clinical safety approaches
- Diagnostics support
- Image recognition techniques
- Appropriate external validation of the clinical impacts has also been achieved [51].

Correspondingly, AI has been implemented to improve the effectual health outcomes in the NICU and the Pediatric Intensive Care Unit (PICU) systems. AI technologies have been highly implanted in pediatrics and have the potential to aid inpatient physicians in providing effective and high-quality care for significantly ill children. AI is primarily used in neonatal healthcare to benefit pediatric healthcare. AI has been involved in influencing patient outcomes indirectly [52].

10. CONCLUSION

The Integration of AI in infant healthcare and cases of disease prediction makes a significant promise for enhancing early detection and intervention of pediatric health. AI algorithms and approaches demonstrated a great ability to analyze and evaluate vast amounts of data, pattern identification and in providing accurate predictions. This, in turn, enabled the healthcare professionals to provide an effectual and informed decision, which initiated personalized care toward infants. Moreover, upon leveraging AI technology, healthcare systems can hypothetically reduce the afflictions among infant mortality and morbidity rates by early detection of diseases and by implementing timely, precise interventions. Several studies implementing the AI approach, encompassing the ML and the DL approaches for the prediction and classification of infant diseases, have been significant domains that have transformed AI in healthcare. Diverse applications of AI in the healthcare domain, including drug discovery, clinical text analysis, and pharmacovigilance, are some of the other vital aspects of implementing AI in the healthcare domains that are primarily used and applied. Despite this prediction, both the adoption and application of AI are likely to present unique and significant challenges in the healthcare domain. The AI systems from the review apply AI techniques to infant disease prediction and healthcare. Though there are several AI models adapted for disease and abnormality prediction in infants, some of the common AI models, such as the

RF, DT, and MLP, are commonly used models for precise disease prediction and diagnosis. More than ML models, DL models and approaches have been effective in infant disease prediction and prognosis with effectual accuracy rates. In aspects of making an effective theoretical and practical form of implementation, the AI approaches can be endeavored to disease diagnosis and in predicting the risk rates at the stages of maternity itself. This in, in turn, reduces the severity of the effectual treatment procedures. Moreover, the generalization of the ML and DL models can be made for an effectual and probabilistic means of detecting diseases in infants.

DECLARATION

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