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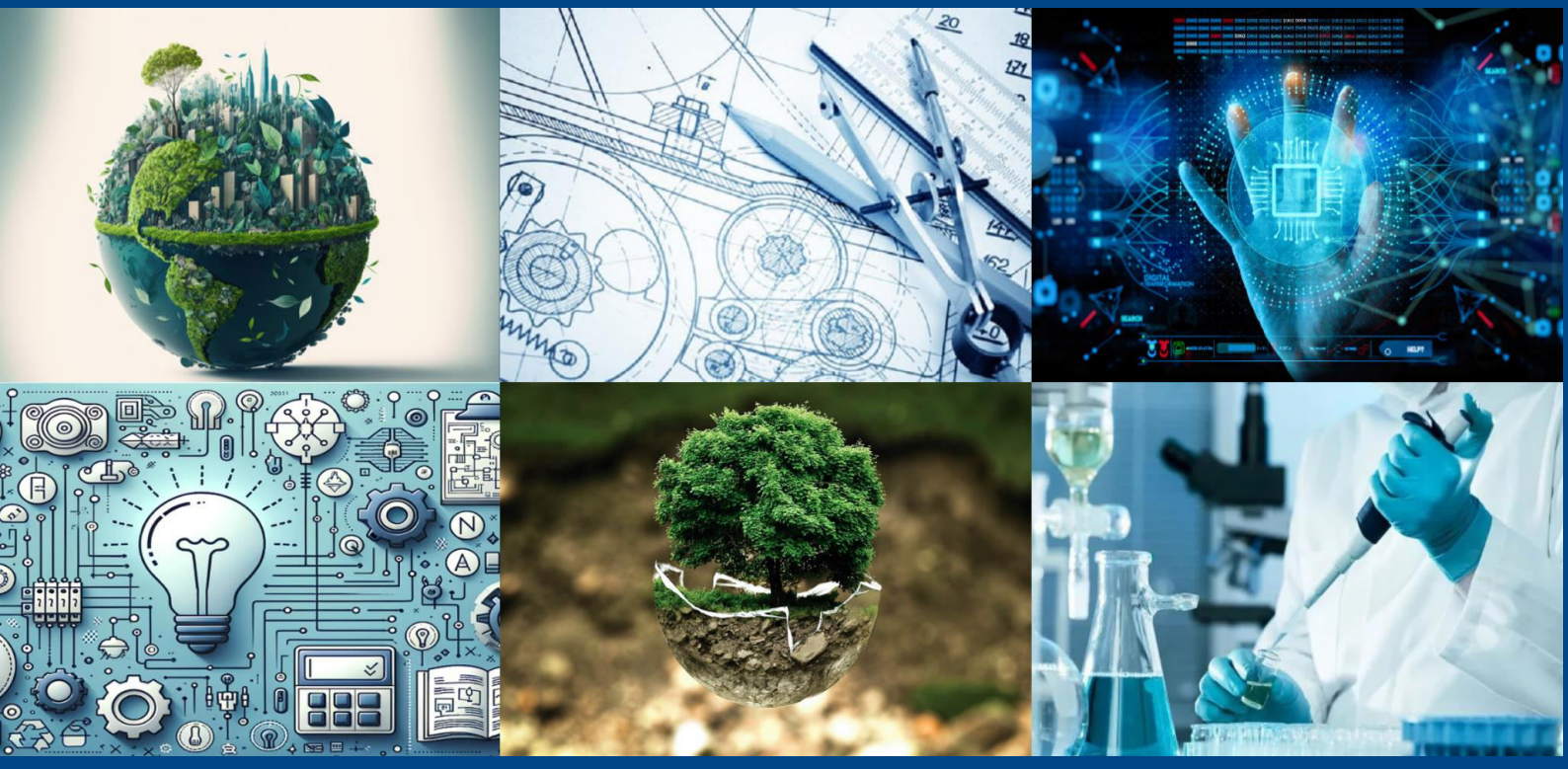

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Design and Develop Novel Approach to Detect Cardiac Problem in Child's using Machine Learning Approaches

Dr.D.J. Samatha Naidu, S. Jabeer Basha

Professor, Dept. of MCA APGCCS, New Boyanapalli, Rajampet, AP, India

PG Student, Dept. of MCA APGCCS, New Boyanapalli, Rajampet, AP, India

ABSTRACT: Cardiac arrest in newborn babies is an alarming yet typical medical emergency. Early detection is critical for providing these babies with the best care and treatment. Recent research has focused on identifying the potential indicators and biomarkers of cardiac arrest in newborn babies and developing accurate and efficient diagnostic tools for early detection. An array of imaging techniques, such as echocardiography and computed tomography may help provide early detection of cardiac arrest. This research aims to develop a Cardiac Machine Learning model (CMLM) using statistical models for the early detection of cardiac arrest in newborn babies in the Cardiac Intensive Care Unit (CICU). The cardiac arrest events were identified using a combination of the neonate's physiological parameters. Statistical modeling techniques, such as logistic regression and support vector machines, were used to construct predictive models for cardiac arrest. The proposed model will be used in the CICU to enable early detection of cardiac arrest in newborn babies. In a training (Tr) comparison region, the proposed CMLA reached 0.912 delta-p value, 0.894 False discovery rate (FDR) value, 0.076 False omission rate (FOR) value, 0.859 prevalence threshold value and 0.842 CSI value. In a testing (Ts) comparison region, the proposed CMLA reached 0.896 delta-p values, 0.878 FDR value, 0.061 FOR value, 0.844 prevalence threshold values and 0.827 CSI value. It will help reduce the mortality and morbidity of newborn babies due to cardiac arrest in the CICU.

I. INTRODUCTION

Cardiac arrest in newborn babies is an alarming yet typical medical emergency. Early detection is critical for providing these babies with the best care and treatment. Recent research has focused on identifying the potential indicators and biomarkers of cardiac arrest in newborn babies and developing accurate and efficient diagnostic tools for early detection. An array of imaging techniques, such as echocardiography and computed tomography may help provide early detection of cardiac arrest. This research aims to develop a Cardiac Machine Learning model (CMLM) using statistical models for the early detection of cardiac arrest in newborn babies in the Cardiac Intensive Care Unit (CICU). The cardiac arrest events were identified using a combination of the neonate's physiological parameters. Statistical modeling techniques, such as logistic regression and support vector machines, were used to construct predictive models for cardiac arrest. The proposed model will be used in the CICU to enable early detection of cardiac arrest in newborn babies. In a training (Tr) comparison region, the proposed CMLA reached 0.912 delta-p value, 0.894 False discovery rate (FDR) value, 0.076 False omission rate (FOR) value, 0.859 prevalence threshold value and 0.842 CSI value. In a testing (Ts) comparison region, the proposed CMLA reached 0.896 delta-p values, 0.878 FDR value, 0.061 FOR value, 0.844 prevalence threshold values and 0.827 CSI value. It will help reduce the mortality and morbidity of newborn babies due to cardiac arrest in the CICU.

The existing system for liver disease detection has employed various machine learning techniques such as decision trees, naive Bayes, random forests, and ensemble learning. Several studies have analyzed and compared different classifiers to determine their effectiveness in diagnosing liver diseases. Decision tree techniques like LMT, J48, Hoeffding Tree, Decision Stump, and Random Tree have been used, with Decision Stump yielding the highest accuracy. Medical data mining (MDM) has also been utilized to predict liver diseases in their early stages, helping to assess disease complexity. Classification models have been applied to distinguish between different liver conditions, including cirrhosis, hepatitis, liver cancer, and cases with no disorder, with Naive Bayes emerging as a strong performer. Additionally, feature selection methods such as Stability Selection combined with Random Forest have been employed to enhance model performance.

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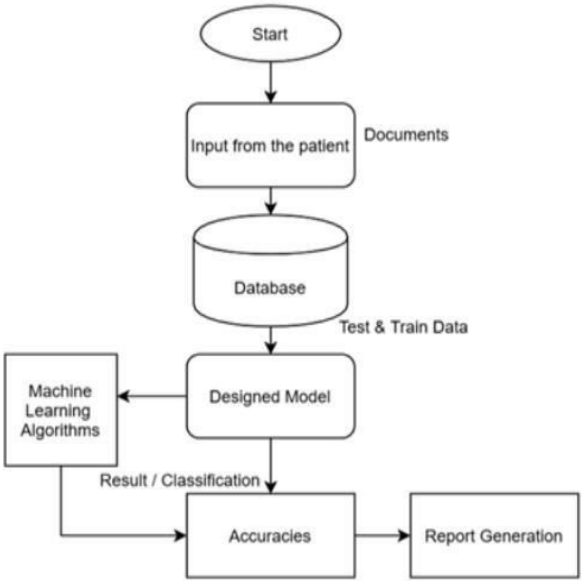

Figure 1: System Architecture

The machine learning is revolutionizing the early detection of cardiac arrest in newborns. By analysing large amounts of complex data, machine learning algorithms can detect signs of cardiac arrest and identify newborns at an increased risk of the condition. This technology could save lives and reduce the damage caused by cardiac arrest in newborns. The critical contribution of machine learning models used for the Early Detection of Cardiac Arrest in Newborn Babies is that these models can detect subtle changes in vital signs such as heart rate, respiratory rate, and oxygen saturation that are difficult to detect with the naked eye. This early detection can help to identify newborns at risk of cardiac arrest and allow for timely intervention and treatment. Additionally, machine learning models can be used to analyze patient data to provide personalized advice and care to patients, enabling better longterm management of their condition. Decision tree classifiers are widely applied across various domains due to their ability to capture descriptive decision-making knowledge from provided data. One of their most notable features is their capability to be generated from training sets. The process for generating decision trees based on a set of objects (S), each belonging to one of the classes C1, C2, …, Ck, unfolds as follows:

Step 1: If all objects in S belong to the same class (e.g., Ci), the decision tree for S comprises a leaf labelled with this class.
Step 2: Otherwise, select a test (T) with potential outcomes (O1, O2,…, On). Each object in S has a specific outcome for test T, thus partitioning S into subsets (S1, S2, Sn), where each object in Si corresponds to outcome Oi for test T. Test T becomes the root of the

II. LITERATURE REVIEW

1. Romuere Silva, "Helmet Detection on Motorcyclists Using Image Descriptors and Classifiers", 27th SIBGRAPI Conference on Graphics, Patterns and Images.IEEE, 2014.
Motorcycle accidents have been rapidly growing throughout the years in many countries. Due to various social and economic factors, this type of vehicle is becoming increasingly popular. The helmet is the main safety equipment of motorcyclists; however, many drivers do not use it. The main goal of helmet is to protect the drivers head in case of accident. In case of accident, if the motorcyclist does not use can be fatal. This paper aims to propose a system for detection of motorcyclist without helmet. For this, we have applied the circular Hough transform and the Histogram of Oriented Gradients descriptor to extract the image attributes. Then, the Multilayer Perceptron classifier was used and the obtained results were compared with others algorithms. Traffic images were captured by cameras from public roads and constitute a database of 255 images. Indeed, the algorithm step regarding the helmet detection accomplished an accuracy rate of 91.37%

2. ThepnimitMarayatr, PinitKumhom, "Motorcyclist"s Helmet Wearing Detection Using Image Processing", Advanced Materials Research Vol 931- 932, pp. 588-592, May-2014.
In traffic accidents, motorcycle accidents are the main cause of casualties, especially in developing countries. The main cause of fatal injuries in motorcycle accidents is that motorcycle riders or passengers do not wear helmets. In this paper, an automatic helmet detection of motorcyclist's method based on deep learning is presented. The method consists of two steps. The first step uses the improved YOLOv5 detector to detect motorcycles (including motorcyclists) from video surveillance. The second step takes the motorcycles detected in the previous step as input and continues to use the improved YOLOv5 detector to detect whether the motorcyclists wear helmets. The improvement of the YOLOv5 detector includes the fusion of triplet attention and the use of soft- NMS instead of NMS. A new motorcycle helmet dataset (HFUT-MH) is being proposed, which is larger and more comprehensive than the existing dataset derived from multiple traffic monitoring in Chinese cities. Finally, the proposed method is verified by experiments and compared with other state-of-the-art methods. Our method achieves map of 97.7%, F1-score of 92.7% and frames per second (FPS) of 63, which outperforms other state-of-the-art detection methods.

3. Amir Mukhtar, Tong Boon Tang, "Vision Based Motorcycle Detection using HOG features", IEEE International Conference on Signal and Image Processing Applications (ICSIPA). IEEE, 2015.
we present a motorcycle detection system in static images leading to its application in crash avoidance systems. Motorcycles are common mode of transport in ASEAN countries and contribute more road crashes than any other mode of transport. In our proposed system, motorbikes are detected based on the helmet and tyre color characteristics. This method involves the fusion of shape, color and corner features to hypothesize motorcycle locations in a video frame. The hypothesized locations are then classified using a support vector machine (SVM) classifier trained on histogram of oriented gradients (HOG) features of motorcycle database. The proposed technique was successfully designed and implemented on a standard PC. It was able to detect single and multiple motorcycles in videos with 96% detection rate.

III. RELEVANCE TO CURRENT RESEARCH

To ensures a systematic, data-driven, and experimental approach to mitigating cyber threats in power distribution systems. By leveraging machine learning and decentralized intelligence, the system aims to improve real-time threat detection and automated response mechanisms for securing critical infrastructure.

K-Nearest Neighbours (KNN)
K-Nearest Neighbors (KNN) is a straightforward yet highly effective classification algorithm that operates based on a similarity measure. It is non-parametric and employs lazy learning, meaning it does not "learn" until presented with a test example. Whenever there is a new data point to classify, KNN identifies its K-nearest neighbors from the training data and determines its classification based on their majority vote or weighted vote.

Logistic regression
Logistic regression analysis explores the relationship between a categorical dependent variable and a set of independent variables. The term "logistic regression" is applied when the dependent variable has only two values, such as 0 and 1, or Yes and No. On the other hand, "multinomial logistic regression" is used when the dependent variable has three or more unique values, like Married, Single, Divorced, or Widowed. While the nature of data for the dependent variable differs from that of multiple regressions, the practical application of the procedure remains similar.
Logistic regression serves as a competitor to discriminant analysis in analyzing categorical-response variables. Many statisticians favor logistic regression due to its versatility and suitability for modeling various situations compared to discriminant analysis. This preference arises from logistic regression's ability to not assume that the independent variables follow a normal distribution, unlike discriminant analysis.

Naive Bayes
The naive Bayes approach is a supervised learning method founded on a simple assumption: it presumes that the presence or absence of one feature of a class is independent of the presence or absence of any other feature. Despite its simplicity, it demonstrates robustness and efficiency comparable to other supervised learning techniques. One explanation often highlighted in the literature is based on representation bias.
The naive Bayes classifier operates as a linear classifier, akin to linear discriminant analysis, logistic regression, or

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linear support vector machines (SVMs). However, the distinction lies in the method used to estimate the classifier's parameters, known as the learning bias. Although the naive Bayes classifier finds extensive use in the research community due to its ease of programming, parameter estimation simplicity, rapid learning even with large datasets, and reasonably good accuracy compared to other methods, it remains less popular among practitioners seeking practical results. Researchers appreciate its simplicity and efficacy. However, practitioners often struggle with its interpretability and deployment, as they may not grasp its relevance or utility.

IV. CONCLUSION AND FUTURE WORK

The proposed machine learning-based statistical model is essential for the early detection of cardiac arrest in newborn babies in the Cardiac Intensive Care Unit (CICU) because they enable the efficient and accurate identification of infants at high risk of cardiac arrest. Machine learning models can accurately identify subtle changes in vital signs, such as heart and respiration rates, that may indicate an impending cardiac arrest. In a training (Tr) comparison region, the proposed CMLA reached 0.912 delta- p value, 0.894 FDR value, 0.076 FOR value, 0.859 prevalence threshold value and 0.842 CSI value. In a testing (Ts) comparison region, the proposed CMLA reached 0.896 delta-p values, 0.878 FDR value, 0.061 FOR value, 0.844 prevalence threshold values and 0.827 CSI value. The proposed cardiac machine learning model to identify at-risk infants, healthcare providers can provide early intervention that may help to avert a tragic outcome. Early detection of cardiac arrest can also reduce the amount of time an infant spends in the CICU, helping to reduce costs and improve outcomes. Future enhancements of the proposed model will focus on using real-time data to identify critical indicators of cardiac arrest. It can involve collecting various data types such as heart rate, breathing rate, temperature, and other physiological measures. The cardiac machine learning algorithms can then be used to analyse this data to develop models that can accurately predict the likelihood of cardiac arrest. The proposed model can then be used to alert medical staff in order to allow for earlier and more effective interventions.

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