THE IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE ON THE IOT FOR PURPOSE OF IMPROVING THE EFFICIENCY OF MEDICAL HEALTHCARE

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Abstract:

The research areas of the internet internet of things (IoT) and the field of artificial intelligence (AI), both of which are related, have a substantial impact on the creation and creation of better personalised healthcare systems. This study included a summary of AI for Internet and medical devices, which covers the use of AI technique in several healthcare fields. According to the literature study, four important areas of medicine—heart disease diagnostics, prediction methods, surgical robots, and personalised care—apply AI approaches. The top AI methods are k-nearest neighbours support vector machine, support vector regression, naive Bayes regression, linear regression tree, classification plant, and random forest. These methods are mostly used to analyse information about patients with the intention of improving

1. Introduction

The term "Internet of Things" (IoT) refers to the pervasiveness and ubiquity of cyber-physical systems with communications and sensing capabilities. The use with the Internet of Things, or IoT, to improve living conditions and advance health has benefitted agriculture [1-2], noise control [3–4], interior monitoring of quality [5–6], and many more fields. The Internet technology medical things (IoMT) is a brand-new paradigm that has emerged as a result of IoT, and it is most importantly changing hospital environments. Given that a great deal of people utilise wearable sensors for improved health and wellbeing that are directly related to eHealth and mHealth, IoMT offers a number of opportunities [7-8]. The rising use of these mobile sensors can be attributed to their accessibility, affordability, and availability. These personalised medical devices.

IoT, big data, and artificial intelligence (AI) are a few linked research areas that have an impact on the planning and creation of more specialised medical facilities [10]. Big Data-enabled wearable medical systems can provide ongoing tracking capabilities that can gather a significant amount of medical data, enabling practitioners to predict an individual's future state [12]. The process of data evaluation and knowledge extraction is challenging and necessitates further safety precautions [13–15].

2. Traditional Medical Heathcare

Traditionally in medical Heathcare most of the diseases were not recognized by the Docter Because of the insufficient technology but now most of the diseases were recognised before they are attacking for human body.

2.1.1 Operations and Surgeries: Before the AI comes into the world All Operations were done by the manually by the Docters so that takes so much time to do all the process but now it's all easy to do an operation just within minutes. We already the cases like the dockers forgetting the medical related equipment's inside the body of human while doing the operations and that leads a death also, so to avoid that as well AI and IOT is most useful.

2.1.2 Initial stage of finding is difficult: In traditional medical healthcare early finding of any diseases will be very difficult so that most of people will suffered at the last stage and leads to their deaths. After AI on IOT coming into the picture all these are finding earlier and most of the patients are cured in earlier stage itself. As shows in the figure1 all AI techniques will helps in the health care related works very efficiently.

2.1.3 Difficult in finding inner Tumers: Before AI it is very difficult to find inner Tumers inside the body of human like Brain and other sensitive organs but now by using AI on IOT the dockers will send machine inside the body of the human to take a picture of the Tumers and gives the best healthcare medicine to cure in bud stage.

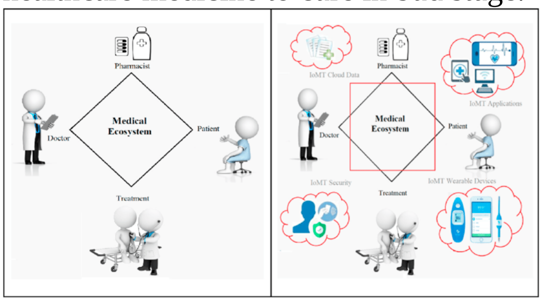

Fig1: Traditional vs advanced using AI

3. Role of AI on the internet of medical Things

IOMT gathers data from medical applications and devices with the goal of assisting healthcare systems. It uses a variety of sensors, including a visual sensor, an accelerometer sensor, a carbon dioxide sensor, a temperature sensor, a sensor for electrocardiograms (ECG), electroencephalograms, and electromyograms, a sensor for blood oxygen saturation, and a sensor for blood pressure [13]. These medical gadgets track the health status of the patients, gather clinical data, and transmit it to the clinicians via distant cloud data centres [14,15]. The biggest problem for IoMT, however, is how to manage clinical applications that produce a lot of medical data from connected devices. The utilisation of AI and IoMT for illness prediction, as well as are all included in this review.

3.1 Heart Disease Diagnosis

Many studies investigate the use of machine learning algorithms (MLA) in systems for diagnosing cardiac disease. MLA holds the most significant position in healthcare systems, particularly in the detection of cardiac disease [19]. Systems for diagnosing cardiac illness use support vector machines (SVM) and Naive Bayes (NB) machine learning techniques. A set of hyperplanes are created by the SVM in the infinite-dimensional space. In each training dataset. SVM has also been extensively employed in nonlinear regression and pattern analysis challenges. It does not, however, offer any compelling hypotheses on the data [14]. Different categorization processes all use the NB AI algorithm. The input data must be categorised for this machine learning technique to work properly.

Mobile Heart devices are also necessary to the detection of diseases. Those gadgets monitor the heartbeat in real time over a long period of time and aid in the arrhythmia diagnostic process. In addition, medical wearables and AI can be combined to create effective techniques for diagnosing cardiac disease via remote patient monitoring [14]. By analysing previous data and scanning data from previous patients, can recognise the signs of cardiac disease. Additionally, MLS can forecast the likelihood of a future heart attack occurring. Researchers used AI and ECG at the Mayo Clinic to study. Asymptomatic left ventricular dysfunction (ALVD) has been discovered using MLS, which analyses the electrical activity of the heart. Convolutional neural networks were used by these researchers.

3.2 Predicting Methods

In outpatient settings, NN is employed to enhance multi-dimensional prediction [5]. According to the findings of this field's testing on NN models, they are more effective for nonlinear important components in respiratory outpatients. IoMT and deep learning are combined to create NN models. IoMT currently permits the collecting of medical data through wearable sensors and gadgets including tomography, ultrasound pictures, and magnetic resonance. As a result, CNN makes it possible to anticipate a patient's future circumstances through analysis of the data gathered from sensors and other equipment [12]. A realistic method of developing CNN also uses stacked auto-encoders, recurrent neural networks, and deep belief networks (DBN, SAE). A machine learning model can set hypotheses at various stages based on the findings of dialysis using non-invasive techniques.

To process data, ML employs learners and labels with values for biomarkers. The students work on real-time MLA data processing [13]. One of the deadliest diseases in the world is chronic kidney disease (CKD), and it is crucial for patients to detect this condition early on. Healthcare services are currently attempting to leverage IoT to predict the future stage of CKD based on patient analysis data from the past and IoT is utilised, which includes ML techniques like NN and linear regression (LR). The CKD stage can be predicted by NN, while CKD-causing factors can be found via LR. The HIM trials demonstrate that the accuracy of CKD prediction is 97.8% [15].

In addition, diabetic illnesses can be predicted using a fuzzy neural classifier. To forecast patients' future states, it leverages a dataset from the UCI repository that contains recorded therapy data. To understand diabetes' future stage and potential issues, a fuzzy neural system that predicts and calculates patients' situations using Big Data from IoMT sensors has been developed [15].

3.3 Personalized Treatment

Personalised medicine is a popular area in contemporary medicine. It entails gathering and utilising Big Data, applying machine learning and data science methodologies, producing statistical analysis, and offering trustworthy outcomes. Particularly in recent years, when medical devices have begun incorporating some languages like Machine learning and big data and their development stages have nearly reached their final stages. Big Data and machine learning will be used in clinical practise for personalised treatment. Big Data and ML algorithms allow for more complicated when used for personalised treatment [20]. Recent study findings indicate that the field of personalised medicine has the potential to develop into one that is more dependable and long-lasting.

the incorporation and fusion of cutting-edge technology, and the production and analysis of large amounts of data. Particularly in data science and statistical analysis, AI methodology offers several opportunities for individualised care [14]. AI-based personalised medicine opens new avenues for the advancement of this medical discipline. Combining IoMT, Al, and ML enables.

3.4 Robotic Surgery

Robotic surgery has entered a new era in the twentieth century. Today, tremor filtration, 3D visions, and instrument stability are frequently performed with surgical robots. There are several advantages to using robots in surgery, including shorter hospital stays, a quicker recovery after surgery, less blood loss, and fewer adhesions. Recent studies have shown that surgeons who use endo-wristed devices on abdominal walls that are still intact get positive outcomes [18].

The larynx is a good place to use transoral robotic surgery (TORS) with newly developed retractors for tissue manipulation and visualisation. 37 patients with various conditions have undergone surgery using the TORS with Med robots' system. The outcomes of the tests confirm that TORS can be applied to papilloma, leucoplakias, polyps, and dysplasia and that it produces useful results in patients who don't experience issues [12].

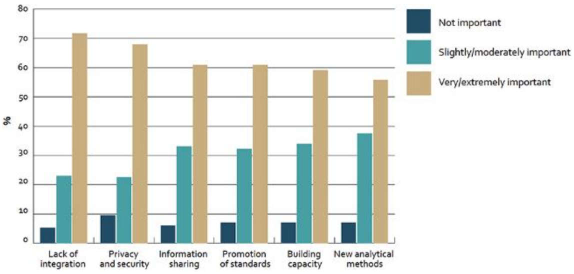

Fig2: AI used in HealthCare

4. Algorithm and Method

The clinical applications of AI and IoT are largely technical, focusing on things like activity identification, behavior recognition, anomaly detection, auxiliary decision-making, anonymization, and privacy protection. The following section provides a quick overview of the key methods and algorithms utilized in a range of technical fields.

4.1.1 Activity Recognition

Inertial sensors are mostly employed in clinical medicine to track patients' activities using activity recognition technologies. Preprocessing, segmentation, feature extraction, reduction, and classification are the key processing phases. To be correctly executed, each stage requires a different set of algorithms and techniques [9].

4.1.2 Preprocessing

To get rid of high-frequency noise in the sensor's data, preprocessing is first necessary. Nonlinear techniques, Other filter types include low-pass median, Laplace, and Gaussian. Although relevant information is preserved, the initial data has to be shown. Common methods for this include piecewise linear representations (PLR), Fourier transformations (FTs), which can maintain original information while also lowering data dimension, and The wavelet transform (WTs), which can more correctly characterize functions with discontinuity and spikes. One of these methods is the Continuous-WT (DWT), which uses distinct wavelet sampling to distinguish between various motions and eliminate noise when people are running or walking.

4.1.3 Segmentation

Continuous sensor data streams are challenging for ongoing activity detection since it is necessary to extract relevant information from them. Therefore, a technique for segmenting data from time series, such as top-down, internally and sliding the window or bottom-up, is crucial. The most popular alternative among them is the window that slides algorithm since it is simple to implement, intuitive, and readily available online. Starting with a small time series, fresh data points are added in this method until the corresponding fitting errors of the possible segments surpasses a user-defined threshold.

4.1.4 Feature Extraction

The fundamental feature groups that can be retrieved include the time domain features, frequency realm features, temporal-frequency sector features, heuristic attributes, domain-specific functions, etc. Among the many time domain characteristics that are directly extracted from a data segment are fundamental waveform features including signal statistics. The primary focus of frequency-domain features is the cyclic pattern of the electrical signal, that may be used to record the cyclical nature of velocity information in the period domain and can distinguish between inactive and vigorous activity. Wavelet technology is often used to study the time-frequency aspects of signals, and it is mostly used to detect changes in one activity from another.

4.1.5 Dimensionality Reduction

Dimensionality reduction frequently includes changing features and feature selection. Choosing features that will best assist the accuracy of the classifier and have the greatest capacity for recognition is the aim of feature selection. A subset of the current features will be provided by this procedure, which may be discovered via the use of support vector machine-based choice of features, clustering using k-means, forward-backward serial search, etc. By translating a high-dimensional space of features to a much lower dimension, feature transformation technology aims to reduce the total number of initially generated feature combinations. These include local discriminatory analysis (LDA), independent component evaluation (ICA), principal component evaluation (PCA), and principal component analyses (PCA).

4.1.6 Classification and Recognition

It is customary to use threshold-based techniques to distinguish between activities of differing intensities. In contrast, recognition of patterns technologies includes naive Bayes models (NB), supported vector machines (SVMs), Nearest Neighbour (NN), concealed Markov models (HMMs), Gaussian combination models (GMMs), and HMMs.

4.2 Behavior Recognition

The study of behavior recognition in computer vision has long been a hot area. Additionally, it is an essential technological element in therapeutic applications. In situations like acute care, rescue operations, rehabilitation, and others, it can monitor patient behavior through remote video recording.to efficiently identify patient movements and offer a basis for therapy and evaluation. Currently, recurrent neural networks (RNN) or convolution neural networks (CNN) are used as the primary methods of behavior recognition. The traditional CNNs, such as Alex Net and VGG16, may extract multiple features using various convolution, pooling, and fully connected layer combinations and permutations [4].

After obtaining a piece of sequence information as output and recursing according to the sequence's shifting direction, an RNN spins the unit in line with the chain connections [1-4]. Nowadays, a double-stream system, 3D CNN, and RNN are used to build the majority of deep learning-based behaviour recognition algorithms that are in use, especially short-term long-term memory (LSTM). Its double-stream network-based neural network behaviour recognition technique uses more video as the behaviour recognition object. This approach necessitates the inclusion of time-series information in addition to a single image. To obtain the recognition the end, the double-flow convolution networks first train the spatial flow and time flow features separately. This strategy compensates for the lack of time flow aspects in the prior approach.

4.3 abnormal detection

Finding data that deviates from expected trends or characteristics or that are inconsistent with other data is the aim of anomalous detection [49]. By assisting in the identification of abnormal behaviour, aberrant detection helps to increase the security associated with medical therapy. The main anomalous methods of detection can be categorised using supervised and unsupervised learning.

A support vector machines or similar classification is used with data labelled to create a training set in order to carry out supervised learning correctly. However, access to the tagged data needed for aberrant identification is sporadic, and it can be difficult to take into account every possible exception that might occur in a domain. As a result, unsupervised learning is commonly chosen as the approach to deal with difficulties involving aberrant detection.

A comparatively simple unsupervised method is to use the clustering technique to identify objects in tiny groups or objects which have not been assigned to any groupings. On the premise that exceptions happen in sparse neighbourhoods, some algorithms without supervision base their conclusion upon the distance of the particular case and its closest neighbour. Three of the most popular proximity algorithms include the approximate K-nearest The neighbours (AKNN) strategy, the reverse K-nearest neighbour (KNN), and the local outlier factor. Other typical methods include statistical and probabilistic analyses. The first two steps of the anomalous detection approach are outliers analysis, score distribution, and score transference [9, 10].

4.4 Auxiliary Decision-Making

The speed and precision of medical diagnosis are increased using auxiliary decision-making. It creates a classification models based on multidimensional medical data using mining technology then offers the appropriate diagnostic in accordance with newly discovered patient symptoms [1].

Predictive and descriptive tasks are the two categories into which auxiliary decision-making prediction tasks fall. The prediction job entails To deduce a function from an array of marked training samples, supervised learning is used to map data samples depending on both the input and the result. Examples of supervised learning methods include neural networks, trees, and support vector classify/regressions. Descriptive tasks, such as grouping and association methods, aim to infer untagged input data. They either identify some intriguing connections between database variables or organize things into clusters. These methods include frequent itemset rule extractor, hierarchical clustering, and k-means clustering. Clinical data categorization, which must be chosen The key in these strategies comes from group, decision trees, based on rules, Bayesian, and other approaches.

The fundamental objective of the A decision tree is built using the choice tree algorithm, a common classification technique, using examples and the accompanying data sets. Divide-and-conquer is the algorithm's chosen approach, and at each level it evaluates the entropy and information gain to determine which attribute will best segment the data set. Many data mining techniques are currently being utilized to diagnose a wide range of illnesses, such as lung cancer, diabetes, heart problems, etc. In SVMs, which KNNs, and neural networks, C4.5 exhibits the highest accuracy. In addition, J48 outperforms Bayesian networks in terms of performance accuracy. The decision tree classification approach is the most effective one for medical applications [3].

5. Proposed Methodology

5.1 Advantages

5.1.1 AI facilitates robot-assisted surgery:

Here by using AI robot surgery will going to produce best results than being done in manual way, it increases the frequency of the process in healthcare.

5.1.2. It is capable of triage and early symptom identification.

By using AI, we can detect the dangerous cancers and also most the diseases will be found out earlier and treatment will also start in early stage so that it can cure in early stage only.

5.1.3. It may help us in managing medications and patient care.

Medications and patient care are improved by using AI and IOT so that it is using an AI and IOT is the best option.

5.1.4. The use of an AI assistant to provide virtual care via online medical records can benefit and support patients.

It is very important that all virtual care via online spreads rapidly so that the patient in any place in entire world can be going to get a medical healthcare.

5.2 Disadvantages

5.2.1 Data Gathering Issues:

The first issue is the difficulty in obtaining pertinent data. For models using machine learning and deep learning to accurately identify or forecast an extensive variety of occupations, enormous datasets are necessary. The industries with easy access to vast datasets have seen the biggest improvements in ML's capacity to produce more precise and accurate algorithms. Information accessibility is a complicated problem for the healthcare industry [11].

5.2.2 Concerns with Algorithm Developments

Biases in the methods employed to gather the data needed to create the models could lead to potentially misleading results. For instance, the underrepresentation of minorities and a result of racial biases in the dataset construction may produce poor predictions.

5.2.3 Ethical Issues

Many people think of intelligent machines (AI) as a "black box," as it may be difficult to understand how an algorithm arrived at a particular decision, according to academics.

5.2.4 Social Issues

Humans have always been concerned that the use of intelligent machines (AI) in healthcare will result in job losses. Because they fear being replaced, some people are wary of and even antagonistic to AI-based ventures. This viewpoint, however, depends mainly on a misunderstanding of AI in all of its forms.

6. Discussion and Results

There are various artificial algorithms, frameworks, and methods, according to a review of the literature on heart disease diagnosis. Table 1 displays the distribution of research utilizing an AI technique to identify heart illness. The results of our review show that NB and deep learning are the methods most frequently used, whereas multilayer perceptron, RFRS, cluster analysis, and EDPDCS are the methods least frequently used in the study under consideration. Other AI strategies like SVM and NB are also used in [5]'s studies.

The majority of hazardous heart conditions will be treated in the early stages of the tumours by employing AI based on LOT. Heart diseases were subjected to MRIs in order to more quickly identify any blocks that may have developed in the heart.

According to the results, applying AI methodology enhances key medical fields like heart disease, surgical techniques, prediction methods, and personalised treatment. With AI, it is possible to quickly understand the conditions of a patient's bathroom. Its approach can identify the underlying causes of ailments and forecast a patient's future health. This will foretell the comparison of many writers from various study papers; let's see the comparison-based outcomes in Table 1.

Different genres of writers have written about various heart diagnosis techniques.

According to the results, utilizing AI approach advances key medical fields like heart disease, surgical techniques, prediction methods, and personalized treatment. With AI, it is possible to quickly understand the conditions of a patient's bathroom. Its approach can identify the underlying causes of ailments and forecast a patient's future health.

7.Conclusion

In conclusion, the integration of AI and IoT in medical healthcare presents a transformative opportunity to revolutionize the industry and improve patient outcomes significantly. The seamless combination of these cutting-edge technologies has the potential to enhance diagnostic accuracy, personalize treatment plans, and enable proactive patient monitoring. Through AI-powered algorithms, healthcare professionals can analyze vast amounts of patient data collected by IoT devices, leading to more informed decision-making and better healthcare delivery. Real-time insights and continuous patient monitoring provided by IoT devices enable timely interventions and can prevent adverse events, ultimately improving patient safety and care quality. Moreover, the implementation of AI and IoT in medical healthcare fosters the development of smart medical systems and devices that can autonomously adjust treatment parameters and provide real-time alerts for critical conditions. This not only increases efficiency but also reduces human errors, enhancing overall patient care and management.

8. Future scope

8.1 Remote Patient Monitoring: IoT devices can collect real-time data on patients' vital signs, activities, and behaviors. AI algorithms can analyze this data to detect patterns, identify anomalies, and provide personalized healthcare recommendations. Remote patient monitoring can help prevent hospital readmissions, enable early intervention, and improve overall patient care.

8.2 Predictive Analytics and Early Diagnosis: AI algorithms can analyze large amounts of medical data, including electronic health records, genomics, and wearable sensor data, to identify patterns and predict diseases. Early diagnosis of conditions such as cancer, cardiovascular diseases, and neurological disorders can significantly improve treatment outcomes and patient survival rates.

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