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A Systematic Review of AI-Powered Patient Triage and Diagnosis Support Systems

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Abstract - The field of healthcare is rapidly evolving with the introduction of the concept of Artificial Intelligence (AI) that has improved the quality, efficiency, and accessibility of clinical services. The current paper has provided a clear explanation of the AI-powered patient triage and diagnostic assistance system, its functionality, and its usage, and its contribution to healthcare. The present paper uses a systematic review of literature to investigate the state-of-the-art in machine learning (ML), deep learning (DL), and natural language processing (NLP) in medical decision support systems.

Triaging systems that use AI can be used to prioritize patients based on their symptoms and any other patient data, thus reducing the waiting time of patients and effectively managing patients at the hospital. Equally, AI-based diagnostic support systems help physicians to diagnose a disease based on medical images, electronic medical record (EMR), and lab findings and results, which results in better diagnostic accuracy and timely diagnosis. The results show that the systems are capable of performing similar to human beings in certain areas especially in image-based diagnoses.

Nevertheless, numerous problems are linked to the use of AI in healthcare, such as the quality of data, bias in algorithms, the absence of explainability and ethical implications such as privacy and responsibility. The paper addresses these limitations and emphasizes the significance of the hybrid of AI and human expertise to safe and reliable health care.

1.INTRODUCTION

Health care has been rapidly evolving along with Artificial Intelligence (AI) technologies. Machine learning (ML), deep learning (DL) and natural language processing (NLP) are some of the AI technologies being integrated into the clinical practice to enhance speed, precision and aid clinical decision-making. They provide the possibility to interpret great volumes of information, discover intricate trends and assist health care providers in their decision making, which can contribute to better patient outcomes and higher efficiency of health care [1], [2].

Triage and diagnosis of patients is a very important aspect of health care especially in primary and emergency health care. Triage is the categorization of the patients based on the urgency of the disease to be diagnosed and treated and diagnosis is the process of making the diagnosis based on the information provided by the patient. Historically, such processes are very dependent on the judgement of health care professionals. Nevertheless, the process of the triage and diagnosis can be slowed down, uneven and subject to errors because of the growing number of patients, resource shortages, and time limitations [3]. It has made it significant to have smart systems to assist doctors to provide superior and faster services.

To solve these issues, one of the solutions would be the development of smart triage and diagnostic systems to respond to them with AI. Natural language processing (NLP) and machine learning can be used to have AI triage systems (including symptom checkers and chatbots) make sensible recommendations to patients based on the symptoms they provide and prescribe them proper care. Likewise, the identification of diseases at an early stage and prediction of risks could also be done with the assistance of AI diagnostic systems that process electronic health records (EHRs), images, and other medical data with the help of smart algorithms [4], [5]. These systems can be equal (or even better) to such human experts in health care as image recognition and pattern matching.

The defamations are the absence of transparency, biases, ethical concerns, and the impossibility to incorporate AI systems with the existing health care systems. As an example, they may cause health care disparities among different individuals due to the biases in the data that they are trained on and lead to the question of equity and fairness [6]. Beyond that, the privacy, accountability and trust of the AI recommendations should be emphasized to make sure that the majority of the health care professionals and patients will embrace AI.

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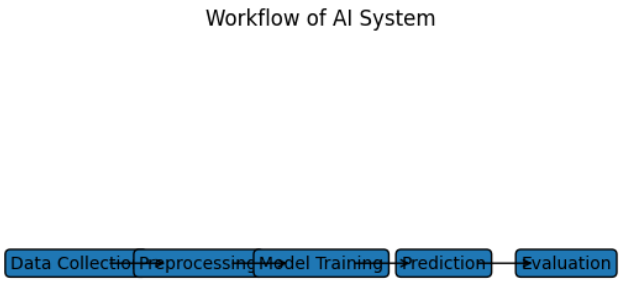
The technologies, applications and tools will be a part of the research and also outline the benefits, constraints and issues in the real world. This paper will also describe the system architecture and will discuss the considerable research and future studies on how to come up with effective and ethical AI-based health care solutions.

2. METHODOLOGY

This paper will adopt a Systematic Literature Review (SLR) to investigate the literature on AI-based systems for triage and diagnosis support in detail. The PRISMA (Preferred Reporting Items to Systematic Reviews and Meta-Analyses) is adopted to ensure transparency, reproducibility and rigor in this study. The systematic literature review methodology is shown in Fig. 1.

Figure 1: The workflow of AI-Based Patient Triage and Diagnosis System



2.1 Blueprint

The review aims to locate, appraise and synthesise the evidence on the application of Artificial Intelligence (AI) technologies including Machine Learning (ML), Deep Learning (DL) and Natural Language Processing (NLP), in triage and diagnostic systems in health.

The approach is as follows.:

- Literature search
- Study selection
- Data extraction
- Data synthesis and analysis.

2.2 Data Sources

The following data bases were searched to get relevant publications:

- Electronic library IEEE Xplore.
- PubMed
- ScienceDirect
- Google Scholar

These search engines were chosen as they have access to a plethora of multidisciplinary research on artificial intelligence, medical systems and medical informatics.

2.3 Search Strategy

- Digital symptom checker
- Computer aided detection
- AI in Medical field
- Deep learning in medical Systems

We conducted the search from the past 10 years (2015-2024).

2.4 Selection Criteria

Inclusion Criteria

- Publications from 2015–2024
- Studies on AI in:

AI Driven algorithms

o Clinical supporting systems

- English language articles

Exclusion Criteria

- Publications before 2015
- Unpeer-reviewed articles (blogs, editorials)
- Research not related to health care AI
- Duplicate records
- No information about experiments or methods

2.5 PRISMA-based Study Selection

Our study selection follows the PRISMA guide:

Identification

A total of 1,250 papers were identified from all databases.

Screening

These were de-duplicated (300), the remaining 950 articles, titles and abstracts were screened, and 420 selected.

Eligibility

The full text of these papers were analysed. 310 of these were excluded because:

- Not related to health care
- Insufficient methodological detail

Inclusion

We examined 110 studies.

Study selection (PRISMA) process is presented in Fig. 2.

Figure 2: PRISMA Flow Diagram for Study Selection

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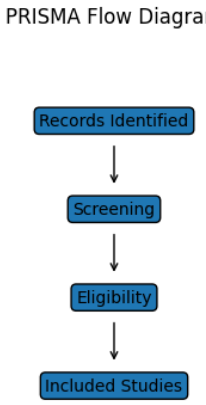

2.6 Study process

1. Literature search
2. Data cleaning (deduplication and screening)
3. Relevance assessment
4. Full-text eligibility assessment
5. Data extraction
6. Comparative and thematic analysis

2.7 Data Extraction

- Author(s) and year
- AI techniques (ML, DL, NL)
- Use case (triage or diagnosis)
- Dataset type
- Performance metrics (accuracy, precision,)
- Key findings
- Limitations

2.8 Data Analysis

We used three approaches to analyse the data:

2.8.1 Qualitative Analysis

- Patterns, trends and themes
- Considers system efficiency, usability and ethical considerations

2.8.2 Quantitative Analysis

- Assesses model performance via:
  - Accuracy
  - Precision
  - Recall
  - Specificity

2.8.3 Comparative Analysis

- Compares various AI techniques with respect to:
  - Performance
  - Data requirements
  - Implementation complexity
  - Clinical applicability

2.9 Research Gaps Identified

There were some gaps identified through the systematic review.:

•Very little implementation in the clinical environment.

•Absence of diverse and unbiased data.

•Integration with the current health care system.

These limitations reveal the need for more research into the development of safe and effective AI-based solutions for the healthcare industry.

2.10 Limitations of the study

The study has some limitations and has been conducted in a systematic manner.:

Based on secondary data (no experimentation)

Inclusion of only relevant studies in the databases.

•Data variability and measures.

•Rapid advancement with AI technologies.

3. OVERVIEW OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE

Artificial Intelligence (AI) is a disruptive technology when it comes to contemporary healthcare systems because it provides an opportunity to increase their efficiency, accuracy, and scalability of clinical processes. Artificial intelligence is a human thinking that people have idealized in computers with the capability to learn, reason, and make decisions. AI systems in healthcare are primarily driven by machine learning (ML), deep learning (DL), and natural language processing (NLP), which allow processing and analysing various complex medical information [1], [2]. The advent of AI in healthcare has served to develop intelligent tools that can aid clinicians in the diagnosis, treatment planning and patient management. They can analyse large amounts of data (big data) in both structured data and unstructured data like medical imagery, electronic health records (EHRs), laboratory records, and patient history. AI can augment clinical decision making by identifying latent patterns and improvements by identifying patterns and correlations [2].

3.1 Key AI Technologies in Healthcare

3.1 Key AI Technologies in Healthcare

Technology	Description	Applications in Healthcare
Machine Learning (ML)	Learns patterns from data for prediction and classification	Disease prediction, risk assessment
Deep Learning (DL)	Multi-layer neural networks for complex data analysis	Medical imaging, cancer detection

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Technology	Description	Applications in Healthcare
Natural Language Processing (NLP)	Processes and understands human language	Clinical notes analysis, chatbots
Computer Vision	Image and video analysis using AI	Radiology, pathology

3.1.1 Machine Learning (ML)

Machine learning is a subdivision of AI that enables systems to learn through data and become more efficient without any particular programming. ML algorithms are utilized in the healthcare sector to conduct predictive analytics, disease risk analysis and predict patient outcome. Such supervised learning algorithms as decision trees and support vector machine are popular to classify patient conditions, predict patient diagnosis based on past data [1].

3.1.2 Deep Learning (DL)

Deep learning is a subfield of ML that involves artificial neural networks with more than one layer in order to process challenging data. DL has demonstrated excellent performance in medical image analysis, such as radiology, dermatology, and pathology. Specifically, CNNs are useful in identifying anomalies in medical images, and have been shown to perform similarly to human experts in some diagnostic tasks [4].

3.1.3 Natural Language Processing (NLP)

NLP makes machines to perceive and comprehend human language. NLP is applied to clinical notes, patient reports and doctor-patient dialogues in healthcare. It is an important part of AI-based triage systems, where patient symptoms are handled through textual or conversational input to create recommendations on care [5].

3.2 Applications of AI in Healthcare

AI is used in numerous fields in healthcare to enhance the service provision and patient outcomes. It has been applied in some of the applications below:

- **Clinical Decision Support Systems (CDSS)**
  AI assists clinicians by providing **evidence-based recommendations** for diagnosis and treatment, improving the accuracy of medical decisions.

- **Medical Imaging Analysis**
  AI applications are used to analyse radiological images (X-rays and MRIs) to identify diseases such as cancer and cardiovascular diseases with high accuracy.

- **Predictive Analytics**
  The use of AI predicts the development of diseases, hospital readmission, and individual patient risks, which enables proactive care.

- **Remote Monitoring and Telemedicine**
  AI facilitates the real-time tracking of patients using wearables and remote health services, which provides a link between patients and healthcare providers.

Application Area	Description	Example Use Case
Clinical decision support	Assist doctors with recommendation	Treatment planning
Medical Imaging	Analyses images for disease detection	Tumour detection in MRI/CT scans
Predictive Analytics	Forecasts disease risks and outcomes	Early detection of heart disease
Telemedicine	Enables remote healthcare services	AI-based consultation systems
Patient Monitoring	Tracks patient health in real time	Wearable device monitoring

3.3 Benefits of AI in Healthcare Systems

Implementation of AI in healthcare has a number of important benefits:

•Improved Accuracy

The instances of the mistakes in the diagnosis can be minimised with the help of AI systems that will examine a vast amount of data and extract very minor details that can go unnoticed by a human being.

•Enhanced Efficiency

Healthcare professionals can also be able to devote more time to patient care because they can automate their daily tasks and decrease the number of administration that healthcare professionals possess.

•Early Disease Detection

Early detection of diseases can be done using AI, and this is required to offer early interventions and much better patient outcomes.

•Scalability

The AI systems can handle a pertinent number of patients at once and it is an invaluable remedy in delivering quality care within the resource-limited setting.

Such benefits serve to improve quality and access of health care particularly in places where there are inadequate medical centers.

Benefit	Description
Improved Accuracy	Reduces human errors in diagnosis
Faster Processing	Speeds up clinical decision-making

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Benefit	Description
Early Detection	Identifies diseases at early stages
Resource Optimization	Efficient use of healthcare resources
Scalability	Handles large patient volumes

3.4 Challenges in AI Adoption

Despite a few benefits, AI in healthcare is associated with a variety of challenges:

Data Availability and Quality.

AIs demand big data, high data quality, which is not always easily available because of strict privacy regulations, security and high fragmentation of data in different systems.

•Bias and Fairness

When the datasets used to train AI models are biased, they may offer unequal results regarding the way different groups of patients are treated and this will only serve to augment the existing differences in healthcare.

•Integration Issues

Introducing AI systems into the current healthcare system is a multifaceted and expensive process and may necessitate colossal technical improvements and employee training.

Technique	Strengths	Limitations	Best Use case
ML	Simple, interpretable	Limited for complex data	Prediction models
DL	High accuracy for large datasets	Requires high computational power	Image-based diagnosis
NLP	Handles unstructured text	Language ambiguity	Chatbots, symptom analysis

Ethical and Legal Issues.

The unethical challenges of data privacy, accountability and transparency should be firmly addressed to ensure that clinical trust and regulatory adherence are upheld in the AI systems.

These issues underscore the necessity to develop, control and assess AI technologies in the health care sector.

Challenge	Description
Data Quality Problems	Incomplete or inconsistent data.
Discrimination in AI Models	Discrimination with biased training data.
Integration Problems	Lack of integration with the existing systems.
Privacy Issues	Risks of breach of patient data.
Ethical Problems	Problems of accountability and transparency.

3.5 Summary

Already in the modern world, AI has become an indispensable part of the healthcare system, which promises vast possibilities to enhance the diagnosis and treatment, monitoring of a patient. Machine learning, deep learning, and natural language processing are some of the technologies that can be exploited to create intelligent systems capable of analysing sophisticated medical data and assist clinicians to make clinical decisions. The positive impact of AI is equally prominent; however, one has to tackle the issues of data quality, ethics, and system integration to guarantee the effective implementation of AI. According to this, the triage and diagnostic support systems based on AI are discussed in the following sections.

4. AI-BASED PATIENT TRIAGE SYSTEMS

Patient triage is a significant procedure in a healthcare system especially within the emergency department whereby the patients are ranked in respect of the severity of their illnesses. Conventional methods of triage presuppose clinical judgment and manual evaluation that are time-consuming and susceptible to error.Automated and intelligent triage systems are becoming more and more needed with the rising volumes of patients and limited resources of healthcare. AI has become a potential solution to improving the efficiency, accuracy, and consistency of the triage processes [3].

Triage systems based on AI use sophisticated computational methods to interpret the symptoms of patients, their medical history, and other pertinent data to establish the urgency of care. The purpose of these systems is to minimize waiting duration, allocate limited resources in the most effective way and to make critically ill patients a priority. With the combination of machine learning (ML), natural language processing (NLP), and rule-based algorithms, triage systems based on AI can make real-time suggestions and aid in clinical decision-making [5].

4.1 Architecture of AI-Based Triage Systems

The triage systems implemented by AI usually adhere to the multi-layered design that includes data input, processing, and output modules. The input layer gathers the data of the patient such as the symptoms, demographic and medical history. The processing layer uses AI algorithms to process the data, and the output layer gives triage decisions, including the urgency levels or care recommendations. The overall architecture of

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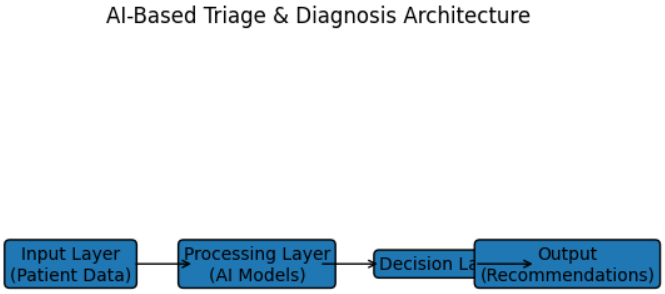
the proposed AI-based patient triage and diagnosis system is illustrated in Fig. 3.

Figure 3: Architecture of AI-Based Patient Triage and Diagnosis System



Architecture Components of AI-Based Triage Systems

Component	Description
Input Layer	Patient symptoms, medical history, demographic data
Processing Layer	AI models (ML, NLP, rule-based systems)
Output Layer	Triage level, recommendations, care pathway
Feedback Layer	Continuous learning and model improvement

4.2 Techniques Used in AI-Based Triage

Triage systems based on AI utilise different computational methods to interpret patient information and produce recommendations.

4.2.1 Machine Learning Approaches

Historical data is used to classify patient conditions using machine learning models. Decision trees, random forests, and support vector machines are the algorithms that are usually used to make predictions related to triage categories and patient risk levels.

4.2.2 Natural Language Processing (NLP)

NLP is essential in the context of unstructured inputs of patients, including the description of the symptoms via chatbots or mobile apps. It allows the system to make sense of user queries and derive meaningful clinical information [5].

4.2.3 Rule-Based Systems

Rule-based systems have pre-established clinical guidelines and decision rules to allocate the triage levels. They are not as flexible as ML models and offer transparency and are simpler to validate in clinical practice.

AI Techniques in Triage Systems

Technique	Description	Advantages	Limitations
ML Models	Data-driven prediction models	High accuracy	Requires large datasets
NLP	Processes textual symptom input	Handles unstructured data	Language ambiguity
Rule-Based	Uses predefined clinical rules	Transparent decisions	Limited adaptability

4.3 Existing AI-Based Triage Systems

A number of AI-based triage systems have been designed and implemented in practice in healthcare settings. Such systems are usually deployed in the form of a web-based or mobile app that communicates with patients and offers care recommendations.

Among them, the most prominent ones are symptom checker websites that evaluate the condition of patients and provide corresponding recommendations, including self-treatment and emergency treatment. Such systems use AI algorithms to enhance access to healthcare services and to decrease the pressure on emergency departments [5].

Examples of AI-Based Triage Systems

System Name	Key Features	Functionality
Ada Health	Symptom checker, personalized advice	Recommends care level
Babylon Health	AI chatbot, virtual consultation	Provides triage and diagnosis
Buoy Health	Interactive symptom analysis	Suggests treatment options

4.4 Performance Evaluation of Triage Systems

The efficiency of AI-based triage systems is measured in terms of a range of performance measures such as accuracy, sensitivity, specificity and response time. Research has demonstrated that AI systems are able to deliver performance similar to that of healthcare professionals in some triage conditions, especially on high-risk patients [3].

Performance Metrics for AI Triage Systems

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Metric	Description
Accuracy	Correct classification of patient conditions
Sensitivity	Ability to identify critical cases
Specificity	Ability to identify non-critical cases
Response Time	Speed of generating recommendations

4.5 Advantages of AI-Based Triage Systems

AI-based triage systems have a number of benefits over conventional approaches:

•**Less Waiting Time**: Quicker patient evaluation and prioritization.

•**Better Consistency:** Uniform decision-making process.

•**Improved Accessibility**: Can be accessed on mobile and online platforms.

•**Efficient Resource Allocation**: maximizes utilization of healthcare resources.

The benefits aid in improved patient care and efficiency of the healthcare systems.

4.6 Challenges and Limitations

Despite its promise, AI-based triage systems are faced with several challenges:

•**Bias and Fairness Issues**: Risk of unequal treatment outcome [6].

•**Absence of Transparency**: Inability to understand AI judgments.

4.7 Summary

A development in the sphere of healthcare is the use of patient triage systems that are based on AI that can prioritize patients more efficiently and faster. These systems are efficient and support clinical decision-making with the assistance of machine learning, natural language processing, and rule-based solutions. However, the problems in relation to data quality, integration and bias between systems must be addressed in such a way that they can be successfully realized.

5. AI-BASED DIAGNOSIS SUPPORT SYSTEMS

Detection of diseases is a crucial part of good healthcare service delivery. The conventional methods of diagnosis are based on clinical judgment, testing, and patient history that at times can cause delays or errors by humans because of the growing workload and complexity. The concept of Artificial Intelligence (AI) has become a potent resource to aid and facilitate diagnostic decision-making processes, as it analyses vast amounts of medical data at a high level of accuracy and speed [2].

AI-driven diagnosis support systems are structured to provide support to the medical worker by giving data-driven information, finding patterns of diseases, and giving potential diagnoses. These systems take advantage of the latest and innovative methods that include machine learning (ML), deep learning (DL) and data mining to process both structured and unstructured healthcare data, like medical images, electronic health records (EHRs) and laboratory outcomes [1], [2].

5.1 Architecture of AI-Based Diagnosis Systems

Usually, AI-based diagnostic systems have a layered structure that allows the effective processing of data and decision-making.

Architecture of AI-Based Diagnosis Systems

Component	Description
Data Input Layer	Medical images, EHRs, lab reports, patient history
Preprocessing Layer	Data cleaning, normalization, feature extraction
Processing Layer	AI models (ML/DL algorithms)
Decision Layer	Diagnosis prediction and risk assessment
Output Layer	Reports, recommendations, and alerts

5.2 Techniques Used in Diagnosis Support

5.2.1 Machine Learning Models

Disease prediction and classification are common applications of machine learning algorithms. These models are used to study historical data of patients and come up with trends and correlations which can be used in diagnosis. The most common are logistic regression, decision tree and support vector machines [1].

5.2.2 Deep Learning Approaches

Convolutional Neural Networks (CNNs) are the most effective deep learning models to analyse medical images. These models have the ability to identify abnormalities including tumours, lesions, organ irregularities, among others, with high precision. Deep learning has demonstrated itself as able to perform similarly to human experts in dermatology and radiology [4].

5.2.3 Data Mining and Predictive Analytics

Data mining involves deriving valuable information out of large medical data. Predictive analytics are applicable to

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detect the risk of the disease and its progression patterns in order to diagnose and prevent in advance.

AI Techniques in Diagnosis Systems

Technique	Description	Strengths	Limitations
ML Models	Statistical learning from structured data	Interpretable, efficient	Limited for complex data
DL Models	Neural networks for complex data	High accuracy in imaging	Requires large datasets
Data Mining	Pattern extraction from large datasets	Useful for prediction	Data quality dependent

5.3 Applications of AI in Diagnosis

The use of AI-based diagnostic systems is implemented in various fields of medicine to enhance the detection of diseases and the planning of treatment.

Applications of AI in Diagnosis

Medical Field	Application	Example Use Case
Radiology	Image analysis	Tumour detection in CT/MRI scans
Dermatology	Skin disease classification	Skin cancer detection
Cardiology	Heart disease prediction	ECG analysis
Ophthalmology	Eye disease detection	Diabetic retinopathy screening
Pathology	Tissue analysis	Cancer diagnosis

The AI systems have shown good results in these aspects by enhancing the accuracy of the diagnosis and the time taken to analyse the data.

5.4 Performance Evaluation of Diagnosis Systems

To ascertain the reliability and clinical effectiveness of AI-based diagnostic systems, the performance of the systems is assessed through different measures.

Performance Metrics for Diagnosis Systems

Metric	Description
Accuracy	Correct diagnosis rate
Precision	Correct positive predictions
Recall	Ability to detect actual positive cases
Specificity	Ability to identify negative cases
F1-Score	Balance between precision and recall

Research has shown that AI-based systems are capable of attaining high accuracy rates, and in some cases, they are more accurate than conventional diagnostic procedures, particularly in image-based analysis [4].

5.5 Advantages of AI-Based Diagnosis Systems

There are several advantages of AI-based diagnostic systems:

•**High Accuracy**: Better disease detection by data analysis.

•**Early Diagnosis**: Facilitates the diagnosis of the diseases at an early stage.

•**Less workload**: Helps healthcare professionals in decision making.

•**Consistency**: Delivers comparable diagnosis findings.

•**Scalability**: Processes large amounts of patient data effectively.

These advantages result in improved patient outcomes and health care performance.

5.6 Challenges and Limitations

In spite of the advantages of the use of AI-based diagnostic systems, they have numerous issues:

•**Data Dependency**:

Trains on big and heterogeneous data.

In that, model interpretability: The lack of explanability of AI decisions.

Ethical concerns:

Data security and privacy.

•**Integration Issues**:

Issues with implementation of AI systems in hospitals.

All these need to be addressed to help offer a safe and effective use of AI in clinical practice.

5.7 Summary

Diagnosis support systems based on AI have contributed to a great deal in helping healthcare providers to diagnose and treat diseases effectively. These systems increase the

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diagnostic accuracy and decrease clinical workload through the use of machine learning, deep learning, and data analytics. Nevertheless, the issues of quality of data, interpretability, and integration of systems will have to be resolved to achieve their full potential in healthcare settings.

6. DISCUSSION

The use of Artificial Intelligence (AI) in patient triage and diagnostic support systems has already been a promising phenomenon in transforming the existing health care. The reviewed literature suggests that AI technologies, such as machine learning (ML), deep learning (DL) and natural language processing (NLP), have been quite effective in enhancing the diagnostic performance, reducing the time of response and patient management [1], [2].

Perhaps the most important outcome of the study is that AI-integrated systems can process large volumes of patient data in real time, and therefore make faster and more consistent decisions than conventional systems. AI in triage systems improves the prioritization of patients by identifying the critical and non-critical patients, and reducing the number of patients going to the hospital. Similarly, in the diagnostic systems, AI enhances early disease detection, particularly in areas such as radiology, dermatology and pattern recognition [4].

6.1 Comparative Analysis: AI vs Traditional Systems

An overview of the traditional healthcare methods versus AI-based systems compares the merits and demerits of each on an equal footing.

Comparison of AI-Based and Traditional Systems

Aspect	Traditional Systems	AI-Based Systems
Decision Making	Manual, experience-based	Automated, data-driven
Speed	Slower	Faster
Accuracy	Subject to human error	High accuracy (data-dependent)
Scalability	Limited	Highly scalable
Consistency	Variable	Consistent outputs

This analogy shows that AI systems are faster, more scalable, and consistent than the traditional ones. Nevertheless, human knowledge is still needed to provide contextual knowledge and ethical judgment.

6.2 Impact on Healthcare Delivery

The AI-based triage and diagnosis systems are associated with the substantial enhancement of the healthcare delivery:

•Reduction in ED Overcrowding.

Triage systems based on AI can be utilized to classify patients based on their urgency so that the most urgent cases can be given medical attention as soon as possible and patients can be sorted effectively.

The Improved Clinical Decision Support.

Clinicians are also beneficiaries of the AI because it offers evidence-based advice and real-time data analysis that greatly minimises the diagnostic uncertainty and variability of treatments.

•Enhanced Accessibility

AIs can be added to systems, including mobile health applications, which can offer the necessary care to areas with limited access and populations in distant locations and eliminate geographical health care barriers.

•Operational Efficiency

The process of documentation, time schedule, etc. can be automated, and this will enable the medical staff to spend more time and mental capacity on the complex clinical cases.

6.3 Key Challenges Identified

No matter the advantages, a number of important issues still exist:

Key Challenges in AI-Based Healthcare Systems

Challenge	Impact on System Performance
Data Bias	Leads to unfair or inaccurate predictions
Data Privacy	Risk of sensitive patient data exposure
Model Interpretability	Difficulty in explaining AI decisions
System Integration	Compatibility issues with existing infrastructure
Regulatory Compliance	Delays in adoption due to strict regulations

Of them, the issues of data bias and interpretability are especially critical, as they directly influence the level of trust and reliability in AI systems [6].

6.4 Role of Human-AI Collaboration

A major conclusion that has emerged from the analysis is that AI is not to replace health care professionals but to assist them. AI can learn from data and identify patterns, while clinicians can make judgements, exercise ethical decision making and provide patient-centred care.

The key idea of human-AI collaboration ensures that:

- AI handles data-intensive tasks
- Clinicians make final decisions
- Patient safety and trust are maintained

This hybrid approach is essential for achieving optimal outcomes in healthcare systems.

6.5 Future Trends and Research Opportunities

The findings of this research highlight the emergence of a range of new trends and challenges for future research:

•Explainable AI (XAI)

Focuses on development of more explainable models to improve trustworthiness and interpretability, enabling

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medical professionals to understand and explain the AI-driven results.

•Integration with IoT Devices

For real-time monitoring of patients using AI algorithms in conjunction with Internet of Things (IoT) devices for data collection and medical alarms.

•Personalized Medicine

And applies AI knowledge to develop treatment plans for specific patients based on their genetic, lifestyle and medical history information.

•Real-Time Triage Systems

Artificial Intelligence can help doctors and nurses to decide who to treat first in an emergency situation. So, Artificial Intelligence can look at the patients and decide which patient needs to see a doctor. Artificial Intelligence can do this by seeing how the patients are injured or ill. And then it lets the doctors and nurses know, so they can use the hospital resources, such as beds and equipment to help the sickest people the most. Then the hospital can help the patients who are really sick or hurt the most, as quickly as possible. Artificial Intelligence is very helpful for this because it can analyse a lot of data, about all the patients really quickly.

•Federated Learning

This is a new method for training AI models that respects privacy, using data from different places. This will allow different institutions to collaborate on research while keeping patient data private.

These advances will make AI in health care even better, and address issues we currently have.

6.6 Summary

The discussion demonstrates that AI triage and diagnosis systems are faster, more accurate and scalable than conventional healthcare approaches. However, there are issues with data quality, ethics and interoperability that must be addressed. The key to the future of care is for AI and human specialists to collaborate to offer effective, efficient, and personalised care.

7. CONCLUSION

Artificial Intelligence (AI) is emerging in a new dimension in the health sector in medical triage and diagnostic support. This review has discussed the implementation of AI techniques such as machine learning, deep learning and natural language processing to improve decision-making, improve the accuracy of diagnosis and better manage patient care. This review can suggest that AI-based systems can shorten the time, streamline the process and assist the health care provider to do the right thing at the right time.

AI-based triage systems have been demonstrated to be effective in-patient prioritisation, emergency room congestion and optimising the utilisation of medical resources. Likewise, AI-based diagnostic systems are highly accurate in the diagnosis of diseases, particularly in the field of imaging (radiology and dermatology). Such developments demonstrate the capacity of AI to tackle the biggest challenges of the healthcare system, which are the growing patient and shortage of medical facilities.

While these have these advantages, there are several limitations to their widespread adoption. Data accuracy, the bias in the algorithm, the lack of transparency and the integration difficulty are not resolved. In addition, aspects of privacy, data security and accountability have to be carefully addressed to ensure trustworthy practice. Conflicts in terms of data and evaluation criteria in various studies also point to the need for a standardised validation protocol.

The paper highlights that AI can be a tool and not a replacement to health-care professionals. Collaboration between medical professionals and AI is the key to integration and to produce safe, ethical and patient-focused outcomes. Human decisions are still needed for crucial interpretations, empathy and final decisions.

Future research should focus on the development of interpretable AI models, quality and diversity of data and seamless integration with existing clinical systems. Use of emerging technologies like IoT devices, wearables and federated learning may also help to build AI-based applications.

In summary, triage and diagnostic systems based on AI have the potential to transform the delivery of health services to be more efficient, accurate and accessible. Responsible deployment and innovation of AI can help build an accessible and efficient health-care system.

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