HealthSquare: A Survey of Deep Learning Based Healthcare Platform

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***ABSTRACT*— The multi-health diagnosis web application HealthSquare represents a pioneering endeavor in healthcare technology by integrating advanced AI models for comprehensive healthanalysis. The system comprises multiple components, including two image processing modelsfor fracture detection from X-ray reports and brain tumor identification from MRI scans. Additionally, GCP's Vertex AI is leveraged for blood & thyroid report analysis to predict & provide descriptive diagnosis. Moreover, the platform enables users to create accounts for secure storage of medical reports, akin to a specialized digital locker tailored specifically for healthcare documents. Furthermore, an AI-driven chat bot offers real-time health- related guidanceand recommendations to users based on their queries. The integration of these components aims to redefine healthcare diagnostics by providing users with accessible, accurate, and personalized health analysis tools. Utilizing advanced image processing techniques, AI-driven analyses, and secure user accounts, the project strives to revolutionize healthcare by offering a comprehensive and user-centric approach to medical diagnosis and health management.**

Keywords: AI Integration, Fracture Detection, Brain Tumor Identification, Thyroid Detection, Blood Analysis, Secure Medical Report Storage, AI Chat Bot.

I. INTRODUCTION

In an era marked by rapid technological progress, AI integration has brought transformative changes, particularly in healthcare. This convergence has led to innovations promising to revolutionize medical practices and patientcare. Healthcare faces challenges in timely diagnostics and personalized interventions, driving the need for AI-driven solutions. Our project aims to address these challenges through a comprehensive health diagnosis web application, merging AI models and user-centric features.

Healthcare's evolution has shifted from traditionalmethods to AI-powered solutions, ensuring accuracy and efficiency. AI's integration has enhanced diagnostic capabilities, especially in imaging and medical data analysis. Our project exemplifies AI's potential in diagnostics, utilizing image processing techniques for swift and accurate assessments. Moreover, Vertex AI expands diagnostic capabilities to predict predispositions to blood- related diseases, enhancing the application's functionalities.

Apart from diagnostic proficiency, our project emphasizes auser-centric approach, offering personalized healthcare experiences. Users can securely store and access medical reports within the application. Additionally, an AI-driven chatbot provides real-time health guidance, empowering users with actionable insights. The project's vision extends beyond technological innovation to democratize healthcare access and redefine diagnostic standards.

In summary, AI integration in healthcare herald's transformative changes, promising enhanced diagnostics and personalized care. Our project embodies thisconvergence, offering a comprehensive health diagnosis platform. By leveraging AI capabilities, including Vertex AI for blood report analysis, we aim to revolutionize healthcare accessibility and patient care, setting a new standard for precision and personalized diagnostics.

II. LITERATURE REVIEW

In [1], survey explores Concept Based Document Management in Cloud Storage, focusing on efficient information retrieval and storage optimization. The authors introduce a novel Document Retrieval Algorithm to handle large datasets in cloud computing. They emphasize the urgency of swiftly accessing data due to its exponential growth in cloud environments, proposing a content search approach using Named Entity Recognition and Universal Word Lists with Term frequency. Additionally, they advocate for storing file metadata instead of entire files to manage distributed storage space. The paper concludes by discussing the algorithm's potential applications and benefits in real-world scenarios, comparing it to ontology-based systems for content search. Overall, it provides insights into information management challenges in cloud computing and offers a promising new approachto address them.

In [2], This paper presents various ML techniques for prediction of various diseases like heart disease, breast cancer, diabetic disease, and thyroid disease. From the earlier study, it is recognized that naive Bayesprovides 86% of accuracy for the diagnosis of heart disease. SVM gives 96.40% of accuracy for the breast cancer diagnosis, and CART provides 79% of accuracy for the detection of diabetic disease. In future, we are trying to improve the accuracy of breast cancer prediction by using different machine learning algorithms.

In [3], The research presented focuses on the detection of blood- related diseases using image processing techniques. The proposed method aims to provide an automated and efficient means of diagnosing diseases such as Malaria, Leishmaniasis, and Acute Leukemia, reducing the reliance on skilled expertise and minimizinghuman error. The research compares different image processing techniques, including Sobeledge detection, Harris corner detection, k- means clustering, and feature extraction, to identify infected cells and determine the stage of the malarial parasite in red blood cells.

In [4], The efficient outcome of the research on blood diseases detection using classical machine learning algorithms was the achievement of high prediction accuracy. The study tested several classifiers and achieved an accuracy of up to 98.16%,fulfilling the research objective of helping physicians predict blood diseases based on general blood test results, [object Object]. This high accuracy demonstrates the potential of machine learning algorithms in effectively identifying and predicting blood diseases, thereby contributing to improved medical decision-making and patient care.

In [5], The research paper "Chatbot for Healthcare System Using Artificial Intelligence" presents a system architecture for a healthcare chatbot application. The outcome of the research paper includes the development of a chatbot that utilizes natural language processing techniques such as tokenization, stop words removal, n-gram, TF-IDF, and cosine similarity for processing user queries and providing relevant answers. The chatbot is designed to store data in a knowledge database and uses an expert system to handle queries that are not understood or present in the database. Overall, the research paper provides valuable insights into the development of a healthcare chatbot using artificialintelligence, natural language processing techniques, and database management to improve user interaction and provide relevant healthcare information.

In [6], The research paper provides essential insights into online cloud storage implementation, focusing on key considerations for robust system functionality. It highlights the paramount importance of data reliability in cloud storagesystems accessed by multiple users simultaneously.
Additionally, it emphasizes the role of RAID technology in ensuring data stability and protection against disk failures. The paper delves into the necessity of deploying multiple servers and implementing load balancing for efficient service allocation. Addressing growing concerns, it stressesthe significance of considering privacy and data reliability in personal cloud storage solutions. Moreover, the paper offers a comprehensive overview of various cloud storage providers, shedding light on the competitive landscape of this evolving technological domain, presenting valuable knowledge for researchers, developers, and organizations involved in the development and management of online cloud storage systems.

In [7], The paper discusses the use of AI algorithms, including fuzzy logic, machine learning, and deep learning,for the diagnosis of various diseases. It emphasizes the potential of AI methods in the diagnosis of diseases and highlights the effectiveness of machine learning algorithms in detecting the early stages of diseases. The authors also discuss the use of classification and regression treealgorithms for predicting arthritis as well as the early detection of Parkinson's disease using deep learning and machine learning. Furthermore, the paper provides insights into the systematic review process, indicating that 80 academic research papers from 30 international scientific journals and 10 conference proceedings were thoroughly reviewed to identify articles that applied fuzzy logic, machine learning, and deep learning for disease diagnosis. This demonstrates the rigorous approach taken by the authors to gather relevant information for their study. Overall, the paper offers valuable technical insights into the application of AI algorithms in medical diagnostics,highlighting. their potential in early disease detection and the importance of a structured review process to gatherrelevant literature.

In [8], From this research paper, we can gain the following technical knowledge: The use of computer- aided diagnosis (CAD) can reduce the burden on orthopedic surgeons and improve the accuracy of fracture detection in X-rays. The proposed techniquecombines conservative filtering, canny edge detection, and texture feature extraction to enhance the efficiency of fracture detection. Neural networks, such as backpropagation neural networks (BPNN), can be used to train the system to accurately detect fractures in X- rays. The accuracy of fracture detection can be improvedby using gray-scale images and canny edge detection, as opposed to other filtering techniques. Texture features, such as mean and median, can be extracted from segmented images and used as input for neural networks. The proposed technique has a high accuracy rate of 91% and outperforms traditional methods, suchas SVM and ANN. Limitations and challenges of implementing this approach in real-world medical settings include the need for a large dataset of X-ray images and the potential for false positives or false negatives.

In [9], The efficient final technical outcome of the research on brain tumor detection from MRI imagesusing deep learning techniques includes the development and application of a Convolutional Neural Network (CNN) model. The CNN model demonstrated a high accuracy of 89% when applied to testing data, outperforming other techniques such as Artificial Neural Networks (ANN). The CNN model effectively reduced the dimension of the images at each layer without losing the necessary information for training, showcasing its ability to process and analyze the MRI dataset efficiently. Additionally, the CNN model exhibited maximum precision, further supporting its effectiveness in detecting the presence of brain tumors. Furthermore, the researchleveraged 2D convolutional neural networks for the classification of different types of brain tumors fromMRI image slices. Techniques such as data acquisition, data pre-processing, pre-modeling, model optimization, and hyperparameter tuning were applied, culminating in the development of a robust and accurate deep learning model for brain tumor detection. Overall, the efficient final technical outcome of this research is the successful implementation of a CNN model for brain tumor detection from MRI images, which demonstrated high accuracy, precision, and efficiency in analyzing the image dataset.

In [10], The paper discusses different machine learning algorithms used to predict thyroid disease, including Decision Tree, Support Vector Machine, ArtificialNeural Network, k-Nearer-Neighbor algorithm, and Logistic Regression. Based on the analysis of the accuracy of these algorithms, Logistic Regression turned out to be the best classifier. In another study, Decision Tree algorithm was implemented and 92.3% accuracy score was obtained. Therefore, Logistic Regression seems to be the most beneficial algorithm forpredicting thyroid disease.

In [11], The study conducted experiments using three different CNN architectures, namely Inception-V3, VGG- 16, and VGG- 19, to automatically classify brain tumors based on MRI images. The authors also applied transfer learning and fine-tuning to improve the accuracy of the models. The results indicated that the use of transfer learning in conjunction with deep learning- based CNNs provided more robust automatic and reliable segmentation methods. Specifically, the VGG-19 architecture achieved the highest accuracy of 97%, followed by VGG-16 with 96% accuracy, outperforming Inception-V3, which achieved 89% accuracy. Furthermore, the study found that fine- tuning, when used in conjunction with transfer learning, resulted in higher accuracy compared to using transfer learning alone. Therefore, the most beneficial solution was the application of transfer learning in combination with the VGG-19 architecture, which yielded the highest accuracy for brain tumor detection in MRI images.

In [12], The review covers a wide range of diseases, including Alzheimer's disease, mild cognitive impairment, heart disease, anemia, liver diseases, skin cancer, Parkinson's disease, breast cancer, diabetes, and COVID-
19. The application of Machine Learning and Deep Learning techniques in diagnosing these diseases is discussed, along with the potential benefits and challenges associated with these approaches. This is a comprehensive review on the use of Machine Learning and Deep Learning for disease diagnosis. The review includes a systematicarticle selection procedure, bibliometric analysis, and a list of common datasets utilized in the reference literature. The review also discusses performance evaluations, co- occurrence networks, and publications by year, journal, and citations. The authors highlight the potential of Machine Learning and Deep Learning in disease diagnosis, but also note limitations and challenges, such as the need for ethicalconsiderations and model interpretability.

In [13], Early detection of brain tumors is crucial for reducing global mortality rates. However, accurately detecting brain tumors remains challenging due to their varying forms, sizes, and structures. MRI image classification plays a vital role in clinical diagnosis and treatment decision-making for brain tumor patients. While early identification of brain tumors through MRI and tumor segmentation methods shows promise, precise localization and categorization of tumors are still difficult to achieve. In our study, we utilized a diverse set of MRI brain tumor images to enhance early detection. Deep learning models, particularly convolutional neural networks (CNNs), significantly influence the classification and detection process. We proposed a CNN model for early brain tumor detection, achieving promising results with a large dataset of MR images. Various metrics were employed to evaluate the efficiency of our machine learning models. Alongside our proposed model, we also tested several other ML models to validate our findings.

Regarding the limitations of our research, the CNN's multiple layers and the lack of a powerful GPU resulted in a lengthy training process. Training time increased significantly with larger datasets, such as those containing a thousand images. By upgrading our GPU system, we were able to reduce the training duration. Future work could focus on accurately identifying brain cancers by incorporating individual patient information from various sources.

In [14], In the proposed work 500 images which are normal and 400 are abnormal. Here from 500 normal, 300 are taken for testing and 200 for training and from 400 abnormal images, 200 for testing, and 200 for training. Results are compared using 3 kinds of classifiers, like ANN, BPNN, and SVM in which BPNN gives a better classification of 86% when compared to
the other 2 classifiers as it has better combination of filtering technique. Future Scope of the proposed work is, this work can be extended for detecting the fractures in a curvedbone also.

Sr No.	Paper Name (Year)	Author Name	Methods / Techniques	Advantage	Future Scope
1.	Concept Based Document Management in Cloud Storage (2013)	M.R.Sumalatha, E.Pugazhendi, D.J.Archana	Cloud Storage, Keyword Combination Algorithm	In-time and proper search operation performance.	Boost work by inputting images, extracting related documents, or relevant visual data.
2.	Machine Learning in Healthcare: A Review (2018)	K.Shailaja, B.Seetharamulu, M.A. Jabbar	Support Vector Machine, Naïve Bayes Classification, Decision Tree, Random Forest, Fuzzy Logic	Enhanced disease prediction, narrowed research gap, improved patient outcomes.	Continuously enhance disease prediction and diagnosis effectiveness.
3.	Detection of diseasesvia blood analysis using Image processing Techniques (2018)	Kajal Jewani, Krishna Boddu, Pratik Gurnani, Kiran Solapure	K-Means Clustering Algorithm.	Efficient clustering, improved segmentation, and automated diagnosis offer accuracy and efficiency.	Real-time diagnosis, clinical validation, expand diseases, optimize efficiency.
4.	Blood Diseases Detection using Classical Machine Learning Algorithms (2019)	Fahad Kamal Alsheref, Wael Hassan Gomaa	Support Vector Machine.	Blood disease detection with precise identification, quality datasets.	IoT data collection, NLP in textual.
5.	Chatbot for Healthcare SystemUsing Artificial Intelligence (2020)	Lekha Athota, Vinod Kumar Shukla, Nitin Pandey, Ajay Rana	RNN, NLP, voice recognition, SVM.	Cost reduction, knowledge base, NLP, interactive framework for medical chatbot development.	Advanced Machine Learningalgorithmsto enhance the chatbot's diagnostic capabilities for a wider range of medical conditions.
6.	Research on online cloud storage technology (2020)	ZOU Shan-hua, FANG Ning-sheng, GAO Wei- jie	RAID Technology, Cloud Storage Providers.	Data Protection, Improved Performance, Simplified Information Management.	Enhanced Security Measures, Scalability and Performance Improvements.
7.	Medical Diagnostic Systems Using Artificial Intelligence (AI)Algorithms: Principles and Perspectives (2020)	Simarjeet Kaur, Jimmysingla, Lewis Nkenyereye,Sudan Jha, Deepak Prashar, Gyanendra Prasad Joshi, Shaker El-Sappagh, MD. Saiful Islam, S. M. Riazulislam	Fuzzy logic.	Auto diagnosis and reduced detection errorscompared to exclusive human expertise.	Addressing major issues in AI-based diagnostic systemsto obtain the maximum potential of AI for mining novel insights from medical data.

8.	Detection of Bone Fractures Automatically with Enhanced Performance with Better Combination of Filtering and Neural Networks(2020)	Syed Karimunnisa, Pradeep Raj Savarapu, Ram Kumar Madupu, C.M.A.K Zeelan Basha, P. Neelakanteswara	Back Propagation Neural Network (BPNN), Canny Edge Detection.	Improved Accuracy, Reduced Dependency on Orthopedicians, Comparative Analysis.	Extending the detection of Fractures in curved bones, indicating it's potential for broader applications in orthopedic diagnostics
9.	Brain tumor detectionfrom MRI images using deep learning techniques(2021)	P. Gokila Brindha, M. Kavinraj, P. Manivasakam, P. Prasanth	CNN-based Approach, 10-fold Cross Validation, Hough Voting and Segmentation, Voxel-wise Classification.	Achieving higher precision values compared to Artificial Neural Network (ANN) by using CNN.	Adoption of optimization techniques to improve model performance like determining the ideal number of layers and filters inthe model.
10.	THYROID DETECTION USING MACHINE LEARNING (2021)	Chandan R, Chetan Vasan, Chethan MS, Devikarani H S	SVM, KNN, logistic regression, anddecision tree.	Ability to predict all possible typesof thyroid diseases with theusage of a minimum number of parameters.	Leveraging Image processingtechniques on ultrasonic thyroid scans to predict nodules and cancer, which cannotbe identified through blood test reports.
11.	Brain Tumor Detection Using Transfer Learning in Deep Learning(2022)	Sri Sai Meghana Alla, Kavitha Athota	VGG-19, VGG-16, CNN architecture.	High accuracy with transfer learning, robust segmentation, knowledge transfer, efficientoptimizer, data availability for brain tumor detection.	Apply transfer learning for tumor size and stage determination, and explore augmentation techniques for enhanced brain tumor detection.
12.	MACHINE LEARNING BASED DISEASE DIAGNOSIS: A COMPREHENSIVE REVIEW (2022)	Md Manjurul Ahsan, Zahed Siddique	Decision Tree, Support Vector Machine, KNN, CNN, Linear Regression, ANN.		Increased interest,efficient use, widespread application in disease diagnosis with ML and DL techniques across medical fields.

13	A Deep Analysis of Brain Tumor Detection from MRI Images Using Deep Learning Networks(2023)	Md Ishtyaq Mahmud, Muntasir Mamun, Ahmed Abdelgawad	VGG16, ResNet-50, Inception V3.	Large dataset (3264 MRI scans), cost-efficient transfer learning (VGG16, ResNet-50, Inception V3), time and resource-saving pre-trained models.	Enhance CNN for early tumor detection, minimizetraining time.
14.	Detection of bone fracture based on machine learning techniques (2023)	Kosrat Dilshad Ahmed, Roojwan Hawezi	Canny edge detection, Naïve Bayes, Decision Tree, Nearest Neighbors, Random Forest, SVM.	GLCM for textural features,Adaptive histogram equalization for local contrast, Canny edge detection for structural information.	Implement ML and image processing inreal-time clinical settings, explore integration with other imaging modalities (CT,MRI), develop automated diagnostic tools for improved fracture detection.

Parameters	VGG16 without BN	VGG16 with BN	VGG19 withoutBN	VGG19 with BN
Model Type	Convolutional Neural Network (CNN)	Convolutional Neural Network (CNN)	Convolutional Neural Network (CNN)	Convolutional Neural Network (CNN)
Pre-trained model	ImageNet	ImageNet	ImageNet	ImageNet
Number of trainable layers	16	16	19	19
Image input size	224x224	224x224	224x224	224x224
Optimizer	Adam	Adam	Adam	Adam
Learning rate	0.1 to 0.001	0.1 to 0.001	0.1 to 0.001	0.1 to 0.001
Loss function	Cross-entropy	Cross-entropy	Cross-entropy	Cross-entropy
Training data source	Mura (Fracture dataset), Brain radiographic images (Tumor dataset)	Mura (Fracture dataset), Brain radiographic images (Tumor dataset)	Mura (Fracture dataset), Brain radiographic images (Tumor dataset)	Mura (Fracture dataset), Brain radiographic images (Tumor dataset)
Validation data source	Independent subset of Mura (Fracture dataset), Independent subset of Brain radiographic images (Tumor dataset)	Independent subset of Mura (Fracture dataset), Independent subset of Brain radiographic images (Tumor dataset)	Independent subset of Mura (Fracture dataset), Independent subset of Brain radiographic images (Tumor dataset)	Independent subset of Mura (Fracture dataset), Independent subset of Brain radiographic images (Tumor dataset)
Test data source	Mura (Fracture dataset), Brain radiographic images (Tumor dataset)	Mura (Fracture dataset), Brain radiographic images (Tumor dataset)	Mura (Fracture dataset), Brain radiographic images (Tumor dataset)	Mura (Fracture dataset), Brain radiographic images (Tumor dataset)
Performance metrics	Test accuracy, Validation accuracy, Precision, Recall,F1-Score	Test accuracy, Validation accuracy, Precision, Recall,F1-Score	Test accuracy, Validation accuracy, Precision, Recall,F1-Score	Test accuracy, Validation accuracy, Precision, Recall,F1-Score
Training time	Moderate	Longer	Moderate	Longer
Memory footprint	Longer (Fracture) Tumor (Moderate)	Longer (Fracture) Tumor (Moderate)	Longer (Fracture) Tumor (Moderate)	Longer (Fracture) Tumor (Moderate)
Accuracy score	70%	85%	75%	92%

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