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Comparative analysis to understand the opportunities offered by Artificial Intelligence in enhancing the innovation in Medical Image Processing

S.K.UmaMaheswaran[1,*], S.Saravana Kumar[2], S.Vijayashaarathi[3], Gopal Ramchandra Kulkarni[4], Andhe Srinivas[5]

[1]Professor, Department of Mathematics, Sri Sai Ram Engineering College, Chennai, TN, India.
[2]Assistant Professor, Department of Computer Science, Karpagam Academy of Higher Education, Coimbatore, India.
[3]Assistant Professor, Department of ECE, Sona College of Technology, Salem.
[4]Principal, Merchant Engineering College, Basna Gujarat, India.
[5]Lecturer, Department of Computer Science, SRR Govt. Arts & Science College, Karimnagar
*Email : umamaheswaran.maths@sairam.edu.in

ABSTRACT

Modern-day medical science has experienced a vast utilization of artificial intelligence benefits for providing better patient-care services. With the advent of AI in medical science, critical disease detection, medical image recognition, and prediction of proper treatment procedures have become easier than before. Physicians and scientists have witnessed a lot of potential challenges regarding accurate medical image processing for better healthcare decisions over the decades. Due to the implantation of artificial intelligence techniques in healthcare sectors in recent times, all the clinical image processing issues have been resolved with enhanced opportunities for AI-based innovations. In order to investigate the particular topic, researchers in this research paper have conducted a primary data collection method by quantitative approach. Through conducting three surveys and a probability sampling method, they have collected opinions of around 60 participants regarding the survey topic. All the research findings show that 55% of the people have strongly supported the use of artificial intelligence in medical image processing for better healthcare progress. Besides, almost 25% of the participants have agreed that artificial intelligence can help in more accurate medical image generation for conducting improved decision making and disease prediction approaches. On the contrary, around 20% of the people have placed their negative opinion over the error mitigation rate in medical image recognition by applying artificial intelligence. Researchers, for this reason, are showing genuine curiosity in order to explain the significance of applying AI advantages for better patient-care services in the sustainable future.

Keywords: *Artificial Intelligence, researchers, healthcare services, survey, medical image processing, innovation, and participants*

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INTRODUCTION

The modern-day healthcare industry has witnessed a huge application of artificial intelligence towards offering a better patient-care service. From the past few years, the healthcare industry around the world has experienced several issues while detecting critical diseases and predicting proper medical treatments. With the advent of machine learning and artificial intelligence, the process has become easier than before [1]. Medical image recognition and innovation have moved their way from the conventional process of disease detection to detecting critical diseases by the use of AI-based machine learning approaches. However, artificial intelligence at once provides utter benefits to the world physicians while conducting numerous medical image identification and innovation processes for a sustainable future [2]. In order to understand the scopes provided by Artificial Intelligence, researchers have focused much on investigating the factors behind increasing the innovation in clinical image processing. With the help of AI, physicians can get clear images related to patients' conditions for analysis as well as to detect reasons and symptoms regarding critical stages of diseases.

Today, it has been observed by the researchers that, around ***87%*** of the global physicians and scientists strongly support the use of artificial intelligence in recognizing as well as modifying unique clinical image materials [3]. With the advent of AI, clinical computer technology has experienced relevant changes

regarding a shift in two-dimensional image innovation to three-dimensional image recognition. The applied process reflected important benefits to the UK-based physicians while detecting critical diseases or predicting decision-making approaches [4]. From numerous researches and surveys, researchers have identified the applications of remote sensing for medical image recognition and innovation that can offer relevant benefits towards human development [5]. Researchers for that reason in the research study have shown genuine approaches towards investigating the opportunities of using AI for innovating and processing effective medical images.

LITERATURE REVIEW

Today, growing demand in using artificial intelligence for more accurate medical image recognition and innovation has been highlighted by the researchers to some extent. After conducting relevant primary surveys, researchers came to know that it was not an easy job for the previous healthcare practitioners to detect and predict diseases properly. Nowadays, the problem has been solved so far by the appearance of AI-based ML and TL approaches for clearer and better medical image recognition [6]. On the other hand, the implementation of AI-based methods has redacted overall industrial costs by ***34.23%*** while increasing its profit percentages by ***76.35%*** annually. Besides helping in medical image recognition, AI can also evaluate big databases containing patients' medical history [7].

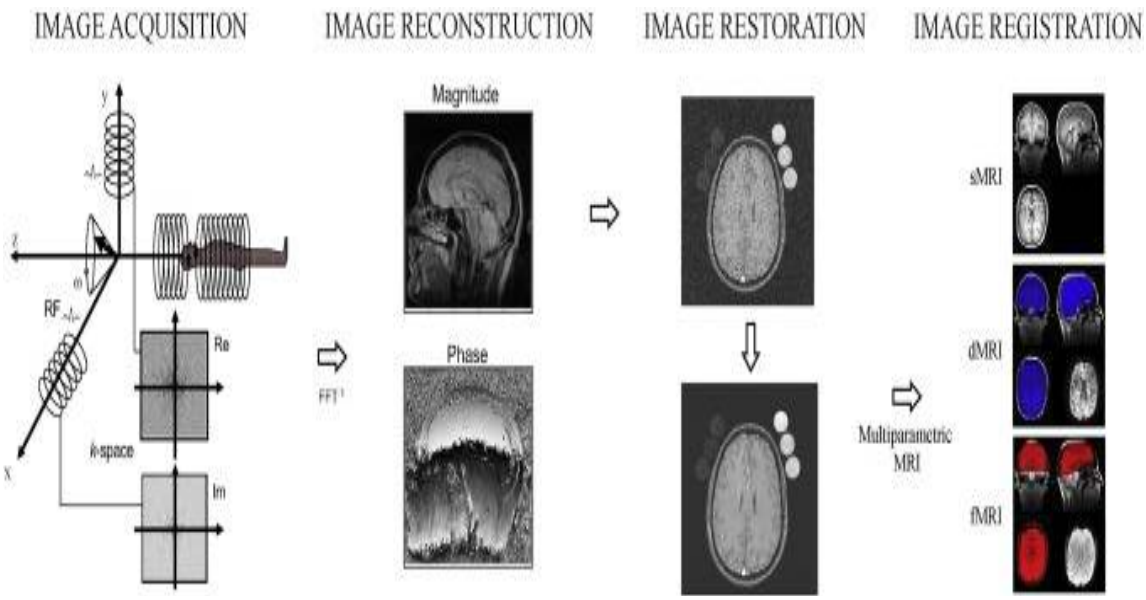
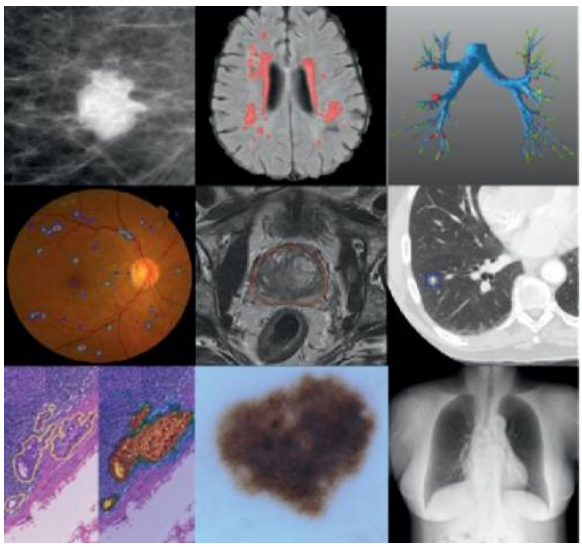


Figure 1: Importance of Artificial Intelligence in medical imaging[7]

Over the decades, scientists and researchers are experimenting together on inventing more opportunities after using artificial intelligence for healthcare services. For example, physicians have to arrange an x-ray film in order to recognize and understand relevant symptoms of diseases from the medical images [8]. As a result, previously, the process was more time-consuming and costly. Further, the accuracy level and error reduction rates were also not satisfying to healthcare practitioners in those days. However, doctors and scientists have experienced relevant benefits in recognizing and innovating clinical images by integrating AI-based machine learning approaches. The process has become much easier than before because, in recent times, the x-ray outcomes are examined through artificial intelligence techniques [9]. After using machine learning methods, accurate diagnosis can be also carried out easily automatically in order to provide better healthcare advantages for the sustainable future [10]. This is highly essential to be well informed about the actual causes and symptoms of diseases in a host's body to determine the level of his life risk. The entire process needs to be completed without a delay by applying proper detection and innovation to AI-based approaches [11]. This is highly significant in healthcare sectors to process and develop the neural, chest as well as brain images in order to mitigate critical time threats.



Collage of some medical imaging applications in which deep learning has achieved state-of-the-art results.

From top-left to bottom-right:

1. mammographic mass classification
2. segmentation of lesions in the brain,
3. leak detection in airway tree segmentation,
4. diabetic retinopathy classification
5. prostate segmentation,
6. nodule classification,
7. breast cancer metastases detection,
8. skin lesion classification
9. bone suppression

Figure 2: Use of AI-based machine learning in detecting medical images[11]

Modern-day medical science has thrown a relevant light on applying various scopes of artificial intelligence for developing the process of more accurate and useful patient-oriented images [12]. It has been observed from various conducted reports and surveys that physicians of the UK-based healthcare sectors highly utilize around ***73.25%*** of the overall wearable technology by incorporating AI facilities to serve patients in a better way [13].

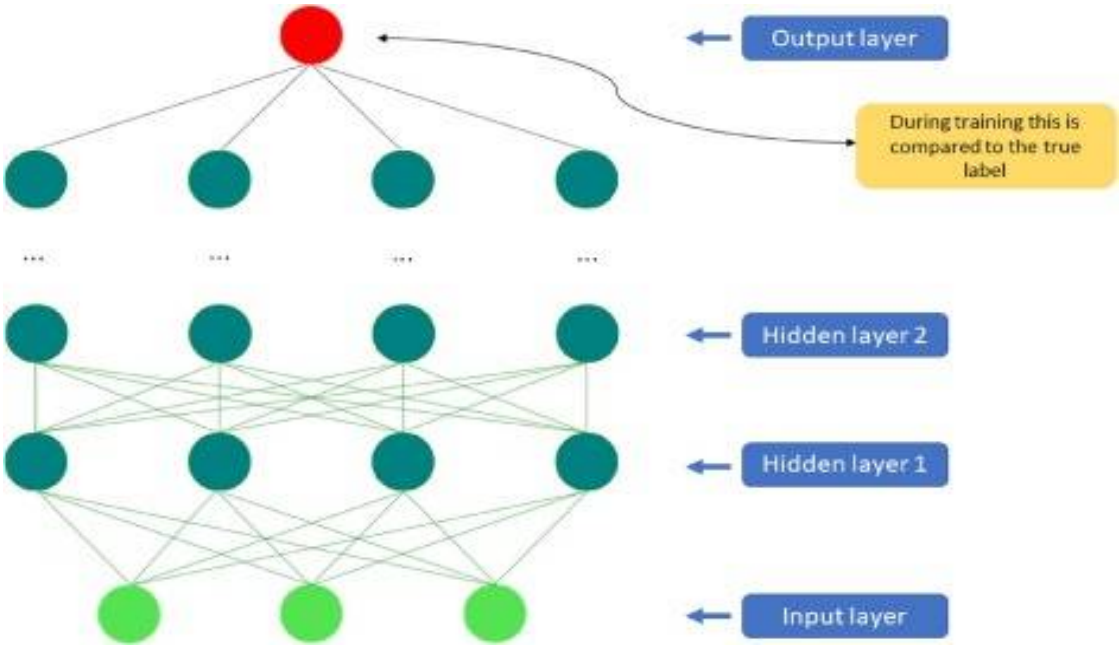


Figure 3: Applications of AI in detecting anomalies in medical images through ML approach[13]

Researchers have identified that AI techniques can be highly essential in relevant clinical practices such as treatment procedures, diagnosis protocol, development of clinical image, and improving patient-care monitoring activities [14]. After recognizing and classifying medical images, artificial intelligence can offer doctors the necessary medical decision support for developing the patient care service to some extent. With accurate medical image processing, ML algorithms can aid physicians to select as well as obtain relevant features from those images for creating new modifications and innovations worldwide [15]. In order to comprehend various anthropogenic changes in the patients' bodies and detect all the symptoms of diseases properly, AI approaches have undergone several changes in modern medical science.

MATERIAL AND METHODS

The overall research methodology of this study mainly focuses on the evaluation as well as interpretation of gathered clinical resources from different *primary sources*. Researchers have conducted ***a quantitative*** data collection approach to perform relevant survey analysis for understanding the role of artificial intelligence in medical image recognition and innovation more clearly. Through quantitative research techniques, researchers can at once consider proper ways to gather and investigate relevant medical data. However, through processing effective survey techniques, researchers in this research paper mainly used a positivism research philosophy while gathering authentic clinical data to carry out the specific research project. Researchers also focused much on applying a deductive approach for the particular study to collect desirable healthcare information to evaluate the specific research topic. On the contrary, the involvement of a descriptive design would be highly beneficial for the researchers in resolving different challenges during analyzing the overall research study.

In order to comprehend the beneficial opportunities provided by AI approaches in healthcare sectors, effective surveys have been conducted online due to the COVID-19 pandemic [16]. Researchers have also undertaken various research methodologies and approaches for investigating the research topic related to the contributions of AI in the healthcare industry. After collecting valid opinions from physicians, medical practitioners, healthcare professionals, hospital staff, and nurses, the research at once underwent different stages for evaluating the significance of using AI for more accurate medical image processing [17]. However, after analyzing three relevant survey questionnaires, researchers reflect a serious interest in examining all the participants' perspectives and choices while managing and performing the entire study. Around 60 participants have placed their views over the beneficial scopes of AI applications in the future development of the healthcare industry through virtual mediums.

Three important survey questions have been formed and outlined by the researchers while conducting a detailed evaluation regarding all the virtual binary options. Apart from this, the research also focuses on investigating their accuracy as well as relevance related to the utilization of the AI approaches in clinical aspects in recent times. After collecting all the choices and options from those 60 directly linked participants, researchers are going to analyze a comparative study regarding the beneficial opportunities offered by the AI techniques towards increasing the innovation levels in clinical image processing. On the other hand, by considering a probability sampling technique, researchers can easily gather relevant perspectives of those healthcare-based people through random sampling methods of survey. Necessary outcomes of the three survey questions reflect that participants related to the healthcare industry do not possess relevant knowledge and understanding about the advantages of using AI. Researchers thus are genuinely involved in comprehending the effective utilization of AI techniques for increasing the innovative approaches in clinical image processing and further development. Moreover, by analyzing all the survey results, researchers have emphasized obtaining various healthcare decision-making approaches in providing better patient-care scopes for sustainable medical progress in the future.

RESULTS

It has been identified that researchers need to process *probability techniques for data sampling* in order to understand the significance of gathered responses from the healthcare participants more efficiently. They have conducted *primary data collection procedures* for analyzing further *10000-20000 medical images* as well. Among 60 random participants, the survey questionnaires have been presented by the researchers to collect their viewpoints from an effective angle related to the topic of the study. Researchers have also framed two valid research questions regarding the survey analysis, that include-

- How can the rate of accuracy be enhanced while innovating medical image processing by applying artificial intelligence in healthcare sectors?
- How do AI opportunities and their implementations offer advantages in escalating the healthcare business operations for offering better patient-care service in the sustainable future?

Relevant Survey Questionnaires:

Q1. Will AI approaches be utilized in the healthcare model to increase the efficiency as well as innovation of medical image processing for future healthcare service improvement?

TABLE I. INCREASED EFFICIENCY MEASUREMENT RATE CALCULATION OF MEDICAL IMAGE PROCESSING BY USING ARTIFICIAL INTELLIGENCE

Participants' Options	Total Participants	Response Gathered	Percentage
Agreed Strongly	60	21	35
Supported	60	13	21.67
Neutral	60	9	15
Disagreed	60	7	4.2
Disagreed Strongly	60	10	6

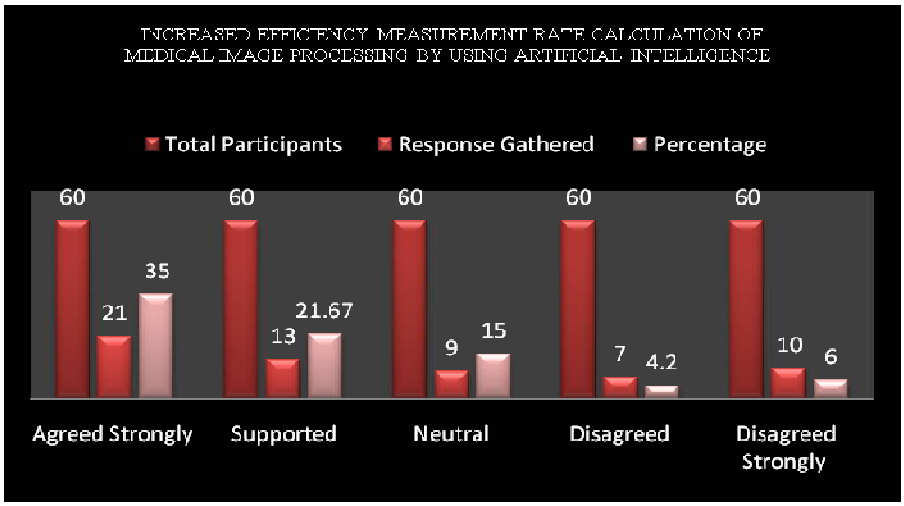


Figure 4: Increased efficiency measurement rate calculation graph by applying medical AI in image processing

Researchers have identified from the above graph that around ***35%*** of the participants have strongly agreed with the applications of artificial intelligence in healthcare practices. However, it has also been traced that around ***21.67%*** of the people have agreed with the survey question. On the other hand, among ***60 participants***, around ***15%*** of the participants did not provide their opinions about the beneficial opportunities of using AI in medical image recognition and innovation. In contrast to that, researchers have spotted almost ***4.2%*** of the people who disagreed with the survey question. Apart from this, around ***6%*** of the participants have strongly avoided the relevancy of the first survey question. Moreover, numerous major calculation gaps and rate percentage differences also have been analyzed from an effective perspective from the first survey question analysis table.

Q2. Do you support that the effective use of AI applications can provide high opportunities in innovating more accurate medical image processing for future scopes?

TABLE II. HIGH OPPORTUNITY RATE CALCULATION IN CLINICAL PROCESSING OF IMAGES BY APPLYING AI TECHNIQUES

Options provided to Participants'	Overall Participants	Collected Response	Percentage
Strongly Agreed	60	27	45
Supported	60	15	9
Remained Neutral	60	3	5
Did not supported	60	6	3.6
Disagreed Strongly	60	9	15

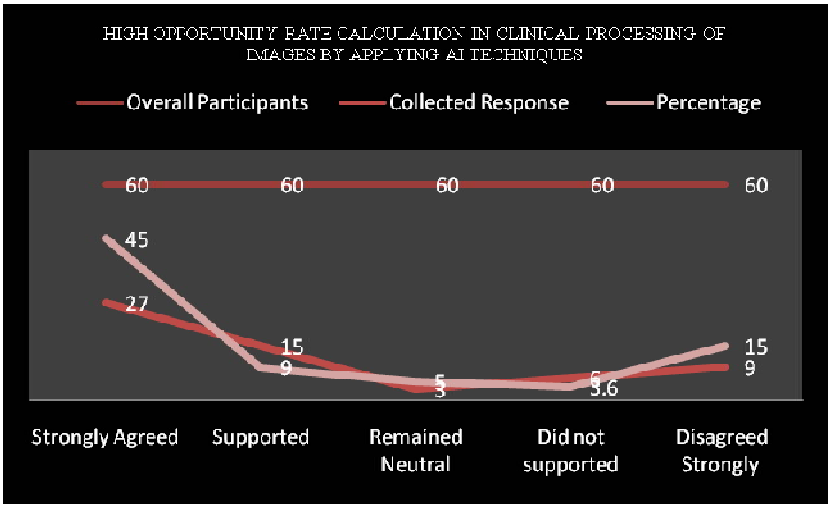


Figure 5: High scopes rate calculation graph in healthcare due to AI implications in medical image processing

After collecting opinions from 60 participants, researchers have evaluated all the opinions positively from the above calculation table. However, in the table, it has been observed that around *45%* of the people have placed their strong opinion on using AI for further medical applications in image processing. On the other hand, from the above graph, researchers can identify around *9%* of the participants who support the second survey question related to the particular research topic. In contrast to that, only *5%* of the people remained silent and provided no positive or negative thoughts about the applications of AI in managing better healthcare procedures. Besides, researchers have also spotted around 3.6% of the participants who disagreed with the second survey questionnaire. Apart from this, from the above table and graph, it is evident that almost *15%* of people strongly disagreed with the survey topic and did not support the beneficial usage of artificial intelligence in the future. Moreover, relevant differences among percentages at once help researchers to analyze the validity and relevance of the particular research question.

Q3. Do you prefer the use of artificial intelligence in more accurate medical image recognition and disease prediction by mitigating errors and life risks to a great extent in the future?

TABLE III. IMPROVED MEDICAL IMAGING PROCESSING RATE MEASUREMENT THROUGH CALCULATING AI-BASED CLINICAL PRACTISES IN HEALTHCARE

Options of the Participants'	**The number of Participants**	**Overall gathered Response**	**Percentage**
Supported Strongly	60	12	20
Agreed	60	8	4.8
Stayed Neutral	60	2	1.2
Disagreed	60	24	40
Did not support strongly	60	14	23.33

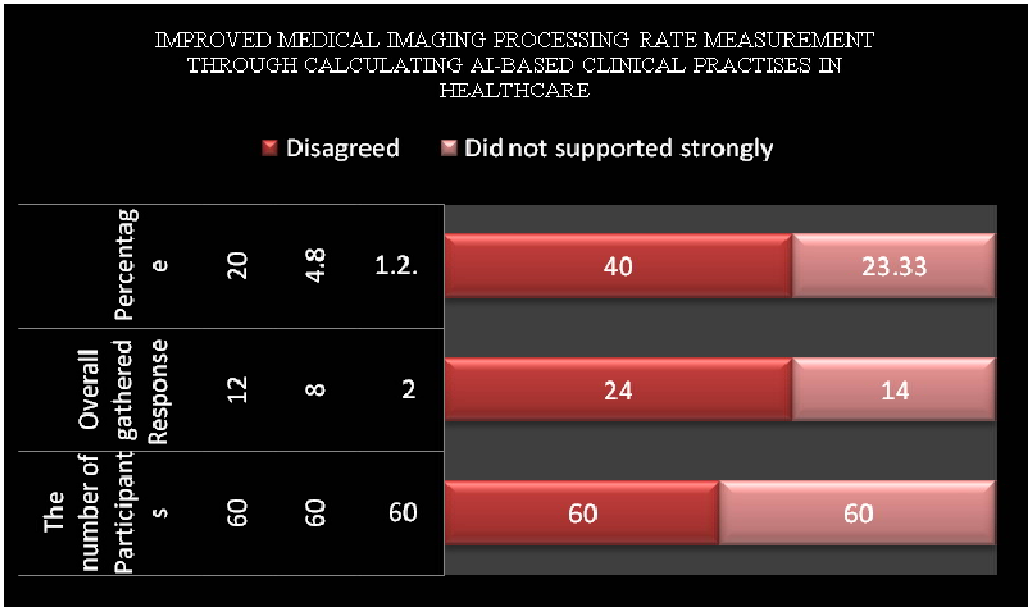


Figure 6: Enhanced rate measurement calculation graph of medical image processing through AI techniques

The particular third survey question has shifted its view from positive support to negative support at its high. The evaluation of the survey outcomes helps researchers in analyzing that participant have no clear view regarding the applications of AI in clinical image recognition and innovation. As per the strong view of around ***20%*** of people, error mitigation rates can be increased by using artificial intelligence in more accurate medical image classification and disease prediction. While on the other hand, ***4.8%*** of the participants have supported the validity of the question after analyzing current medical practices. However, it has been found from the above graph that, among overall ***60 people***, only ***1.2%*** of the people did not answer positively or negatively of the survey topic and remained neutral. In contrast to that, researchers have analyzed almost ***40%*** of the people's opinions that reflect they did not support the implications of AI for reducing human efforts. Further, around ***23.33%*** of the people have strongly disliked the question and its relevance to the authenticity of current medical science. Moreover, all the percentage rate changes from strongly supported to strongly disagree opinions have been fruitfully investigated by the researchers from the above graph and table.

DISCUSSION

After analyzing all the survey outcomes, researchers have effectively pointed out relevant opinions of around 60 participants. Participants have various thoughts and viewpoints about the beneficial use of artificial intelligence in the progress of the healthcare industry. However, for analyzing all the opportunities and potential advantages of artificial intelligence in medical image processing, researchers have highly concentrated on the investigation of the first survey-related question. From the first survey result, it has been identified that around ***55%*** of participants are in support of the effective use of AI in increasing innovation for medical image recognition. The useful applications of AI-based techniques can pull together all the healthcare staff and patients' insights towards conducting a fruitful predictive treatment analysis [18]. Quickly processing and recognizing a patient's past medical history can at once aid the healthcare professionals to discover the major sections of patient care that demands more improvement.

In order to measure the validity and relevance of the second survey-related question, researchers again threw some effective light on the evaluation of the second survey question. Around ***25%*** of the participants have strongly supported the validity of utilizing effective AI approaches for offering high opportunities in generating more accurate clinical images for future treatment prediction. The UK-based healthcare sectors have witnessed several successful implications of artificial intelligence and its vast opportunities for medical image innovation in recent times. With the help of neural networks, scientists can control the entire recognition and image processing stages from a remote section [19]. Besides recognizing medical images accurately, an image innovation facility system must be also incorporated properly to classify those important clinical images. Researchers in the research study thus showed extreme enthusiasm towards investigating the applications of ML-based artificial intelligence in order to provide better patient-care facilities in the sustainable future.

TABLE IV: SURVEY OUTCOMES REGARDING THE UTILISATION OF AI METHODS IN VARIOUS HEALTHCARE ASPECTS

Topic of Discussion	*Supported*	*Neutral*	*Disagree*
(a) AI approaches are providing high opportunities and values to disease detection, medical image recognition, radiology, pathology, and further treatment predictions	55%	11%	34%
(b) AI techniques are providing future scopes for innovating the process of medical image recognition and classification while monitoring patients	25%	19%	56%
(c) Artificial intelligence is reducing errors and providing merits to efficiency enhancement of the overall healthcare industry.	11%	9%	80%

The third question analysis at once reflects the high change in people's opinion from positive to negative reading the use of artificial intelligence in error mitigation practices. It has been traced that around 80% of the participants strongly disliked the application of AI by replacing the conventional method of patient care in recent times. However, studies across the healthcare industry of the UK showed that over ***90.89%*** of the clinical data is extracted from accurate clinical imaging in modern times. On the contrary, researchers have also traced that more than ***98.73%*** of those medical images cannot be analyzed accurately without the help of AI-based machine learning approaches [20]. Moreover, the entire research and survey analysis reflect the significance of bringing AI to medical image recognition for the sustainable growth and innovation of the overall patient-care industry in the future.

CONCLUSION

Medical image innovation by remote sensing has become a trend nowadays. From a remote area, physicians can easily recognize various materials by the use of AI approaches. Previously, utilizing facilities of remote sensing was not being highly used. However, the topic has witnessed a sparkling shift from the conventional to technological by which the applications and benefits of remote sensing have become next to accurate. Medical scientists and doctors have experienced various potential benefits of utilizing AI for mitigating further delays while identifying and detecting abnormal clinical images.

Researchers have focused much on conducting a quantitative data gathering approach in the research paper, by evaluating relevant online survey options related to the specific topic. They have gathered all the important clinical data and opinions from 60 healthcare professionals, medical practitioners, and random people from a positive perspective. All three survey outcomes help in analyzing other valid opinions collected from patients, their family members, hospital employees, and medical scientists regarding various clinical records and resources. In order to comprehend the effective opportunities

provided by medical artificial intelligence in clinical image recognition, all the perspectives of participants have been carefully handled during the survey. Researchers thus focused much on investigating the actual opportunities provided by artificial intelligence towards developing medical image processing and innovating for the sustainable growth of the healthcare sector.

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