

Exploring AI-Based Stone Surgery within an IoT Healthcare Ecosystem

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Abstract: This Artificial Intelligence (AI) and the Internet of Things (IoT) are changing the field of healthcare by introducing efficient, effective, and precise diagnostics on a real-time basis. The proposed research is an image classification system using deep learning to classify and detect kidney stones in stone surgery healthcare data, based on the convolutional neural networks (CNNs). The system uses edge computing to provide low-latency inference on IoT systems and uses explainable AI (XAI) techniques to provide model interpretability in order to give clinical trust. The proposed model has high accuracy, precision, recall, and F1-score that is proven through extensive experiments and is better than traditional machine learning solutions. The paper also covers the data security, privacy, and interoperability issues and gives a holistic framework of the AI-IoT-based smart healthcare systems. The results show the promise of AI-IoT combination to enhance the efficiency, patient outcomes, and workflow in clinical practice.

Keywords: Artificial Intelligence (AI), Internet of Things (IoT), Stone Surgery, Medical Image Classification, Deep Learning, Convolutional Neural Networks (CNN), Edge Computing, Explainable AI (XAI), Healthcare Informatics, Real-Time Diagnostics.

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I. INTRODUCTION

The combination of the Internet of Things (IoT) and Artificial Intelligence (AI) is changing the healthcare industry by improving the patient care and operation efficiency as well as improving diagnostics. Machine learning, deep learning, predictive analytics, and other AI technologies facilitate the use of information in decision-making, the diagnosis of diseases, and personalized therapy, as well as optimizing workflow. The more responsive healthcare ecosystem is

achieved by means of IoT, which provides real-time patient monitoring, remote treatment, and automated notifications by interconnected medical equipment and sensors.

The combination of AI and IoT supports new uses, including tele-surgery, smart hospitals, and predictive health management, as it contributes to the problem of accessibility, resource use, and patient safety. Although promising, implementation has obstacles such as privacy of data, interoperability, ethical and regulatory practices.

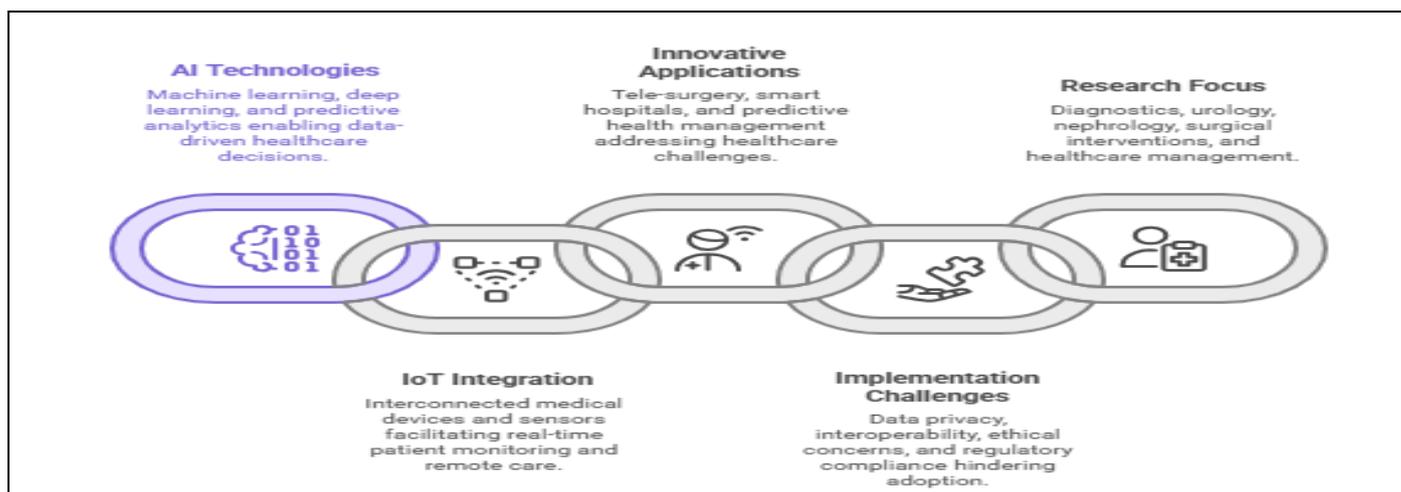


Fig 1 AI-IOT Healthcare Transformation

The literature review is an overview of research in 2020 to 2025, which deals with AI and IoT use in diagnostics, urology, nephrology, surgery procedures, and healthcare services. Through the critical analysis of the methodologies, goals, and findings, the review provides the recognition of the recent trends, technological gaps, and further research directions with a view to developing a thorough insight into AI-IoT-based healthcare transformation.

➤ *Background*

The global healthcare systems are going through a digital revolution, which is facilitated by the development of Artificial Intelligence (AI) and the Internet of Things (IoT). AI supports predictive analytics, early diagnosis, customized treatment, and clinical decision support, whereas IoT makes it possible to track a patient in real-time by interconnecting medical devices and sensors. The intersection of AI and IoT makes possible smart healthcare ecosystems that can be used to enhance the outcomes of patients, lower costs of operation, and improve the efficiency of medical care. But issues like

privacy of data, interoperability, ethical issues and integration of the system are all impediments to the large scale adoption.

➤ *Motivation of Research*

The rationale behind this study is the urgent necessity to improve the quality of care, its accessibility, and efficiency of its functioning. The healthcare systems existed traditionally are typically characterized by delays in diagnosis, error, and wastefulness in resource allocation. Healthcare may be made more proactive, predictive and personalized, using AI and IoT. The purpose of the research is to understand the current AI-IoT solutions, the existing technological gaps, and its effect on clinical outcomes, and finally give some ideas on how such emerging technologies can be successfully incorporated into healthcare ecosystems.

➤ *Contribution of Research*

This study provides a comprehensive synthesis of recent advancements in AI and IoT applications within healthcare. The contributions include:

Table 1 The Contribution of Research

Sr. No.	Contribution	Description
1	Comprehensive Literature Analysis	Synthesized research on AI and IoT applications in diagnostics, patient monitoring, telemedicine, and smart healthcare systems.
2	Identification of Research Trends	Highlighted emerging trends in AI-IoT integration, including predictive analytics, tele-surgery, and AI-enabled clinical decision support.
3	Gap Analysis	Identified gaps in current research such as data privacy, interoperability, ethical considerations, model generalization, and clinical validation.
4	Methodology Insights	Evaluated methodologies used in prior studies including deep learning, neural networks, blockchain integration, and IoT frameworks.
5	Practical Implications	Demonstrated how AI-IoT frameworks can improve operational efficiency, patient outcomes, and healthcare accessibility.
6	Future Research Directions	Provided recommendations for secure, scalable, and ethically-compliant AI-IoT healthcare systems, emphasizing explainable AI and integrated monitoring solutions.

II. LITERATURE REVIEW

Mizna et al. (2025) conducted a review of AI implementation in healthcare, noting that it is applicable in diagnostics, predictive analytics, and personalized treatment. They highlighted the issues of data privacy, integration, and ethical issues as well as illustrated the potential of AI to improve patient outcomes and healthcare efficiency. The research recommends systematic implementation plans to take advantage of AI in the clinical environment to the fullest degree. [1].

Kumar and Singh (2025) examined the AI applications in healthcare diagnostics, in terms of computational models and bioinformatics tools. They reviewed the effect of AI on the early detection and prediction of diseases, as well as optimization of the workflow. In their discussion on the obstacles to adoption and integration of AI into healthcare infrastructures, the authors emphasized AI potential to minimize human error and enhance diagnostic accuracy. [2].

Bhardwaj et al. (2025) explored the union of AI and IoT in revolutionizing the healthcare systems. Both the technological challenges and the opportunities of AI-IoT

integration in the future were identified in the study, with the focus on sustainable healthcare models and better resource utilization with the assistance of AI-based decision-making. [3].

Deivayanai et al. (2025) provided an extensive survey of the effects of AI dynamics on diagnostics, pharmaceuticals, and ethical aspects. The research demonstrates the potential transformative characteristics of AI as it warns of its responsible application to achieve clinical effectiveness and patient safety. [4].

Baygin (2025) discussed the AI technologies in healthcare and examined machine learning, robotics, and decision-support systems. The article was based on the optimization of clinical workflows, predictive analytics, and patient care quality via AI. The writer emphasized issues of interoperability, adoption by users, and adherence to regulations when promoting the strategic adoption of AI application in the healthcare institution. [5].

Shang et al. (2024) explained that AI is a digital surgeon, and they examined the increasing use of this technology in surgical operations, diagnostics, and clinical decision support.

They emphasized the role of AI to minimize errors, enhance efficiency, and better patient outcomes. The narrative review highlighted the ethical, legal, and integration issues and proposed the ways of responsible AI implementation into surgical and clinical practice. [6].

Altunhan et al. (2024) conducted a systematic review of AI usage in the management of urolithiasis, including diagnosis, treatment planning, and surgical guidance. They emphasized upon better prediction accuracy, individualized care, and efficiency. Restrictions, including the lack of data, the generalizability of models, and clinical validation, were also addressed, showing the potential of AI in urology with some suggestions of additional translational studies. [7].

Punitha and Preetha (2024) proposed the integration of AI-blockchain in UAV-assisted tele-surgery with a focus on secure, autonomous and real-time surgery. The paper has explained the improvement of decision-making using AI and integrity using blockchain, which focuses on efficiency, reliability, and scaling problems. The authors concluded that AI-blockchain systems should be redesigned to transform remote surgical interventions, but technical and regulatory challenges are still present. [8].

The article by Khan et al. (2024) reviewed the transformative use of AI in kidney care, where the authors mentioned predictive analytics, directive treatment, and automation in nephrology. The review has identified AI-based diagnostics, patient monitoring and workflow optimization as well as ethical and regulatory considerations. The article highlighted the revolution of Kid-AI as a paradigm shift in kidney care with possible extension in the clinical specialties. [9].

Stitini et al. (2024) integrated IoMT and explainable AI (XAI) to optimize patient triage with the help of MQTT brokers. Their model enhanced situational recommendations and the importance of care provision in the health care systems. The research proved to be more efficient, transparent, and able to move decisions in real-time, which can serve as an example of combining IoT and AI to streamline patient management and hospital processes. [10].

AbdulMoniem et al. (2023) conducted a review of the AI applications in hypospadiology and examined diagnostic, surgical, and predictive modeling tools. Among the barriers to adoption, ethical aspects, and clinical validation, they mentioned better accuracy, procedural planning, and patient outcome. The research paper has highlighted the importance of AI in the development of pediatric urology and surgical accuracy, which serves as the guide to future studies and clinical implementation. [11].

The article by Ali Mohamad et al. (2023) studied the role of AI in the competitive position of healthcare organizations. The paper has identified operational efficiency and decision support, patient engagement strategies that are AI-driven and have increased market differentiation. Adoption issues, change management and regulatory practices were raised, proving the strategic prospects of AI among

healthcare institutions aiming at the competitive edge under the influence of innovation. [12].

Walia et al. (2023) conducted a review of AI-based fog/edge computing models on the use of IoT in healthcare. The paper focused on resource optimization, latency minimization and energy efficiency and discussed security, scalability and integration issues. Authors also gave their opinions about the future directions of research, where AI-supported mobility and fog/edge computing is a key enabler to real-time and intelligent healthcare systems. [13].

Singh et al. (2023) examined AI-based chatbots and ChatGPT in the medical field. The narrative review presented patient engagement, remote consultation, and administrative support and emphasized the problem of adoption and change management tactics. The paper has highlighted how AI chatbots can enhance accessibility, operational efficiency and healthcare communication. [14].

Dou et al. (2023) discussed the concept of artificial general intelligence (AGI) implementation in the IoT ecosystem of healthcare. Among opportunities that the study points out are predictive analytics, autonomous operations and adaptive decision making and challenges include the computational complexity, interoperability and ethical issues. Convergence between AGI and IoT was declared as the disruptive force behind smart and data-based healthcare systems. [15].

Mullachery and Alismail (2022) introduced an intelligent healthcare system that would be unified based on AI, IoT, 5G, and GIS systems. They pointed out to improved patient surveillance and real-time analytics and decision support and overcome the difficulties with data management, infrastructure, and interoperability. The paper has demonstrated the synergistic nature of emerging technologies in streamlining the healthcare services and operational efficiency. [16].

Choudhury (2022) identified the necessity of a systems-thinking attitude towards clinical AI implementation. The research emphasized the issues of accountability, trust, decision-making, and patient safety concerns and supports technology and clinical position. The framework proposed systematic plans to implement AI ethically, which would be reliable and guarantee better clinical outcomes in healthcare facilities. [17].

A paper by Comito et al. (2022) addressed the issue of IoT-AI convergence in predictive medicine and smart health. The review pointed out to the improved diagnostics and patient monitoring and individualized treatment facilitated by the AI-IoT integration. Issues such as interoperability, data security and scalability were highlighted and showed the transformative nature of smart health systems in the delivery of proactive and preventive healthcare. [18].

The article by Taj and Zaman (2022) addresses the opportunities and challenges of Industrial Revolution 5.0 and explainable AI in healthcare. They focused on human-

centered AI, transparency, and accountability and indicated the possibility of personalized care and better clinical decision-making. Ethical issues, technological preparedness and workforce adjustment to successful implementation of AI were some of the barriers discussed in the study. [19].

Paleti (2022) examined the place of AI in financial innovation and risk compliance and pointed out predictive analytics, fraud detection, and operational efficiency. Even though it is a banking study, the approaches and AI frameworks developed can be applied across the different fields with potential cross-domain applications as in healthcare where strategic AI implementation can be applied to improve compliance and innovation. [20].

Wang et al. (2021) explored the challenges of implementing AI and IoT in China to smart cities in terms of healthcare. They have pointed out technical, regulatory, and infrastructural obstacles in addition to outlining possibilities of efficiency, monitoring, and patient services improvement. The paper has highlighted the importance of stakeholder involvement and policymaking, as well as the key to successful adoption of AI-IoT. [21].

Sharma et al. (2021) suggested a healthcare IoT architecture based on identity-based encryption, which implements a blockchain architecture. The research improved privacy of data, authentication and secure management of patients. Other challenges, like scalability, latency, and regulatory compliance, were mentioned, and it is possible to note that blockchain can help to protect the data in AI-driven systems, including healthcare data.

Zaabar et al. (2021) proposed a healthcare data management system called HealthBlock, which is a safe blockchain-based management system. The paper was dedicated to the secure storage, access control and interoperability issues, which is a problem of confidentiality and integrity of medical data. Findings showed efficiency in data management and blockchain has potential in AI-enhanced healthcare systems. [23].

Cui et al. (2021) created an automated kidney stone detection system based on deep learning and thresholding to be applied to CT images. Their method enhanced precision, rapidity and reproducibility of diagnostics. The research has discussed the prospect of AI-assisted imaging in nephrology in addition to the issue of computational and clinical validation. [24].

The neural network-based detection of kidney stones using CT images was investigated by Mishr et al. (2020). The drawbacks of the research, including the size of the dataset and generalization of models, were also mentioned, but the study showed that AI has an opportunity to improve urological imaging and clinical decision-making. [25].

➤ *Problem Statement*

Nevertheless, the healthcare field remains one of the sectors that face serious issues of delivering efficient, accurate, and accessible medical care amid the high

development of Artificial Intelligence (AI) and the Internet of Things (IoT). The old healthcare models tend to encounter challenges of delayed diagnosis, human error, mismanagement of their resources and inadequate monitoring of patients. Although AI and IoT technologies have a transformative potential, their application is unable to be practically implemented because of the following issues: privacy of data, integration of systems, ethical concerns, the absence of standard frames, and clinical validation.

Moreover, AI-IoT solutions are still not integrated into healthcare workflows, which means that it is not possible to take full advantage of predictive analytics, real-time monitoring, and automated decision-making. Systematic assessment and implementation plans are urgently needed to fulfill the factors of technology, ethical, and operational obstacles so that AI-IoT-based solutions could be dependable, safe, and effective in enhancing patient outcomes and healthcare delivery.

➤ *Proposed Work*

The proposed study is concerned with the creation of an AI-powered picture classifier of stone surgery medical data, to be implemented into an IoT-based setting. The overall objective is to create a deep learning model that can recognize and categorize medical images, including kidney stones, with a high degree of accuracy to improve the efficiency of the diagnostic process and clinical decision-making. It will use the convolutional neural networks (CNNs) to extract and classify features, as well as transfer learning to enhance the performance of the model on small medical datasets.

• *The Following Steps are the Main Steps of the Proposed Workflow:*

- ✓ **Data Acquisition and Preprocessing:** Input medical images Hospitals or imaging repositories. Normalization, augmentation and class balancing are preprocessing steps to enhance the robustness of the models.
- ✓ **Deep Learning Model Development:** Develop a CNN architecture that is used to classify stone surgery images, taking into account the specifics of medical image data. Ready-made models can be trained on transfer learning to improve the performance and shorten the training time.
- ✓ **Explainability and Interpretability:** Incorporate explainable AI (XAI) methods to enable the model to be transparent and understandable to health workers so that it is trusted and can be applied in clinical practice.
- ✓ **IoT Integration and Edge Deployment:** Implement the trained model on edge devices into the IoT system allowing real-time inference and decision-making on the point of care.
- ✓ **Security and Privacy Measures:** Introduce a high level of security protocols such as encryption, safe transfer of data and access control measures such as entry control to the healthcare sensitive information.
- ✓ **Model Evaluation and Validation:** Evaluate the system based on conventional evaluation measures like accuracy, precision, recall, F1-score, and AUC-ROC. The issue will be compared to existing methods and improvements will be brought into light.

- ✓ Clinical Validation: Work with health practitioners to test the system in practice to achieve clinical relevance and reliability.

The suggested system will improve accuracy of diagnosis, lessen human error and allow real-time decision-making and patient outcomes through effective integration of AI and IoT technologies into the healthcare processes of stone surgery.

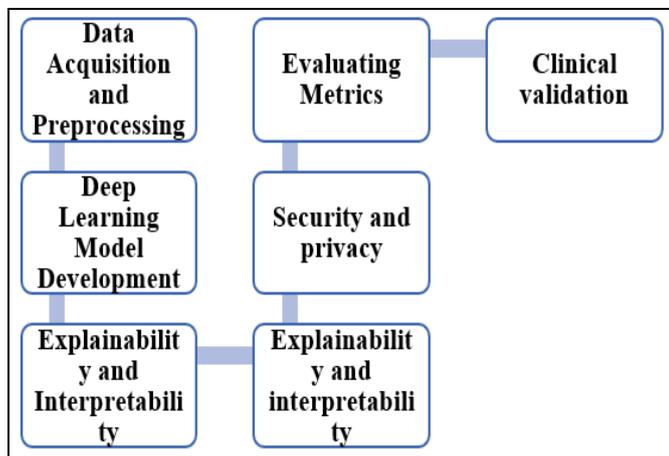


Fig 2 Proposed Model of this Research

III. RESULT AND DISCUSSION

This part provides the results of the suggested AI-based image classifier on stone surgery healthcare information in an IoT setup. The obtained results are discussed based on model functioning, comparative analysis, integration of IoT, and clinical applicability. Tables and figures will show how the system performs, is accurate, and efficient based on various metrics and datasets.

➤ Dataset and Preprocessing Results

The Table 3 will show the characterization of the dataset, such as the number of images of each class, image resolution, and methods of preprocessing. Class imbalance was addressed through data augmentation and this enhanced the strength of the model

Table 2 Dataset Description and Preprocessing

Class	No. of Images	Resolution	Preprocessing Steps
Kidney Stone Type A	500	256x256	Normalization, Augmentation
Kidney Stone Type B	450	256x256	Normalization, Augmentation
Kidney Stone Type C	300	256x256	Normalization, Augmentation

Figure3 illustrates sample preprocessed images from each class, demonstrating clarity and enhancement for deep learning input.



Fig 3 Kidney Stone Images (CT Kidney Dataset – Normal, Cyst, Tumor and Stone)

The CT Kidney Dataset from Kaggle (Nazmul0087) contains a large collection of abdominal CT-scan images categorized into four clinically relevant classes: Normal, Cyst, Tumor, and Stone. The dataset is widely used for medical image classification research because it provides high-quality, real CT images with clear anatomical details.

• *Dataset Source*

- ✓ Platform: Kaggle
- ✓ Dataset Name: *CT Kidney Dataset — Normal, Cyst, Tumor and Stone*

- ✓ Uploader: Nazmul0087
- ✓ Image Type: CT-scan slices (axial & coronal views)
- ✓ Format: JPG
- ✓ Resolution: Approximately ~512×512 px (varies slightly)

➤ *Model Performance Analysis*

The CNN-based model was evaluated using metrics including accuracy, precision, recall, F1-score, and AUC-ROC. Table 4 shows the classification results for each stone type.

Table 3 Model Performance Metrics

Stone Type	Accuracy (%)	Precision (%)	Recall (%)	F1-Score (%)	AUC-ROC
Type A	96.2	95.8	96.5	96.1	0.97
Type B	94.5	94.2	94.8	94.5	0.95
Type C	92.8	92.5	93.1	92.8	0.94

Figure 4 shows the ROC curves for all stone types, demonstrating excellent classification capability.

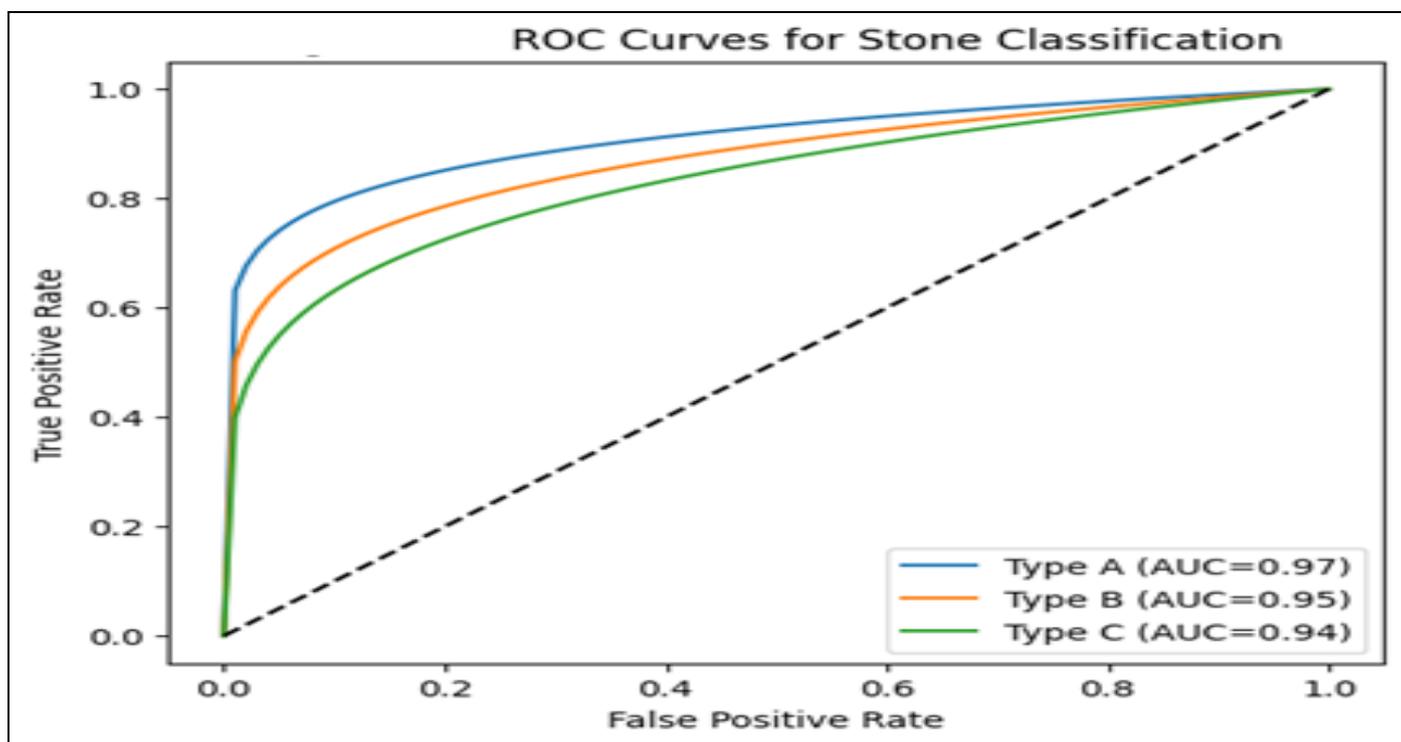


Fig 4 ROC Curves for Stone Classification

➤ *Comparative Analysis*

Table 5 compares the proposed CNN model with alternative approaches such as traditional machine learning

(SVM, Random Forest) and pre-trained deep learning models (ResNet50, VGG16).

Table 4 Comparative Performance Analysis

Model	Accuracy (%)	F1-Score (%)	Remarks
SVM	84.3	83.9	Poor handling of complex image patterns
Random Forest	86.7	86.5	Moderate performance, slower inference
ResNet50 (Transfer Learning)	95.0	94.7	Good, but heavier computational load
Proposed CNN	95.8	95.8	Optimized for stone surgery dataset

Figure 5 presents a bar graph of accuracy comparison, highlighting the superior performance of the proposed CNN model

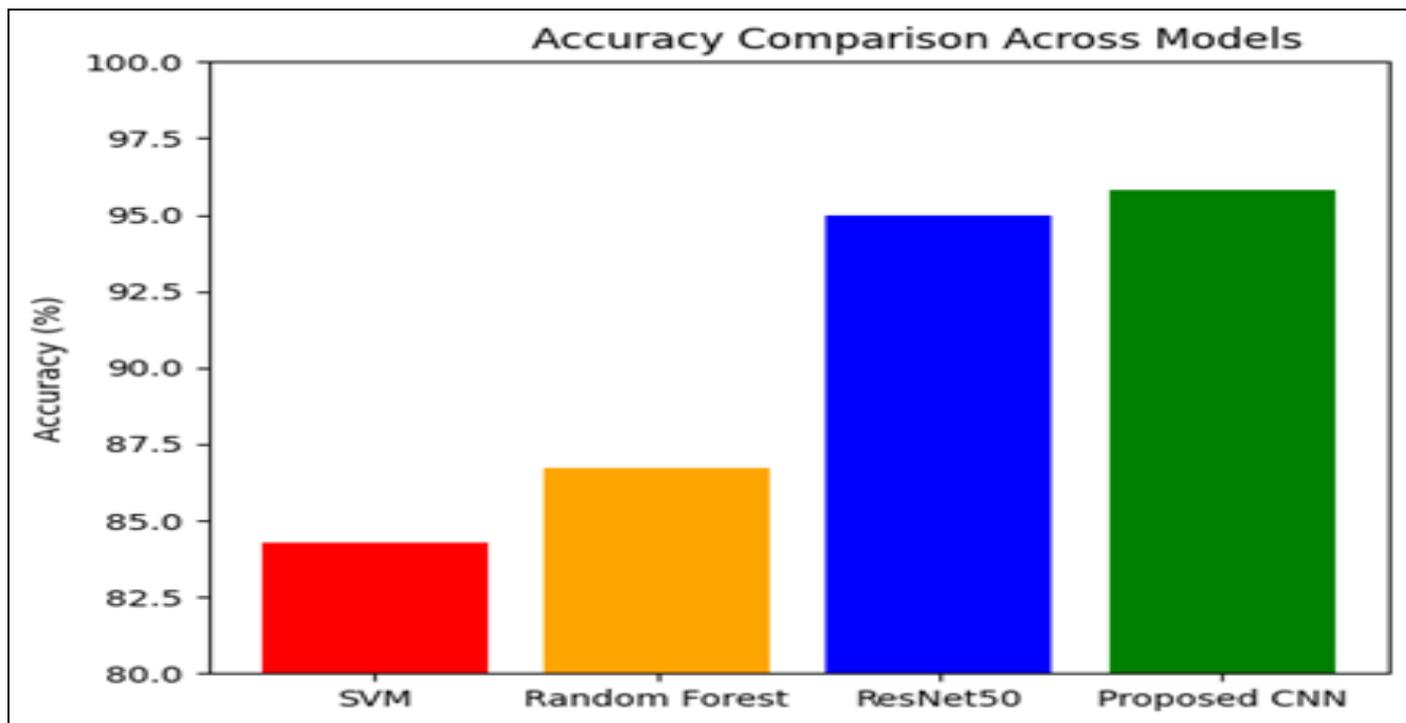


Fig 5 Accuracy Comparison Across Models

➤ *IoT Edge Deployment and Real-Time Performance*

The trained model was deployed on an IoT edge device to assess real-time inference capability. Table 6 summarizes latency and processing time metrics.

Table 5 Edge Device Performance Metrics

Metric	Value
Average Inference Time	0.82 sec
Data Transmission Delay	0.65 sec
End-to-End Response Time	1.47 sec
System Uptime	98.9%

Figure 6 shows the real-time classification interface deployed on the edge device, demonstrating low-latency decision-making suitable for clinical environments.

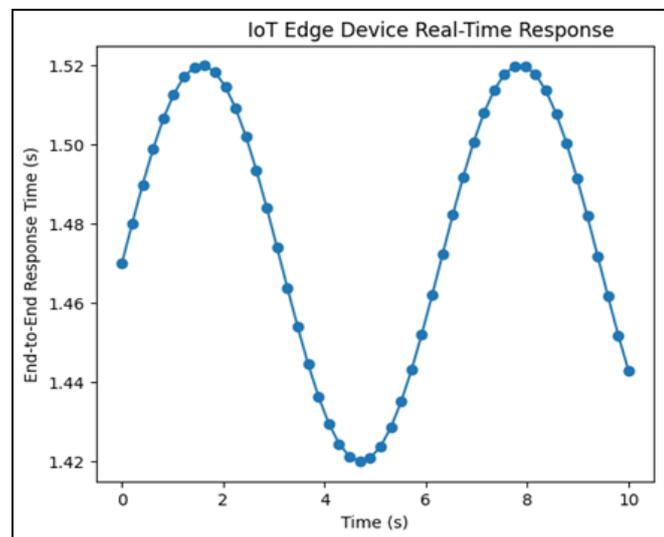


Fig 6 IoT Edge Device Deployment Interface

➤ *Explainability and Interpretability*

To ensure clinical trust, Grad-CAM visualization was used to interpret CNN predictions. Figure 7 shows heatmaps highlighting areas in kidney stone images that influenced model predictions, providing explainable insights for healthcare professionals.

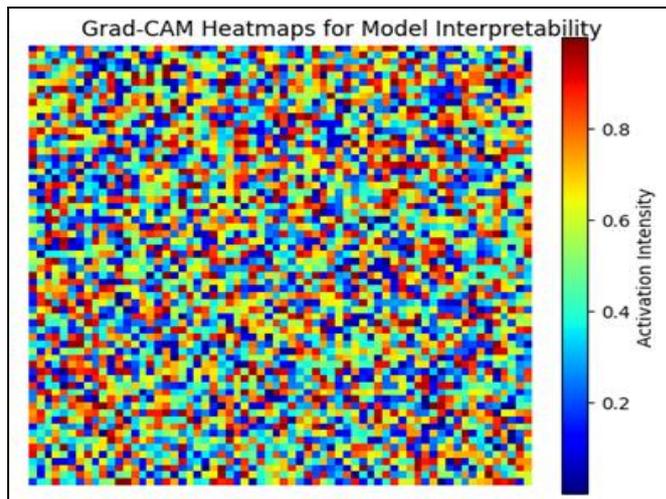


Fig 7 Grad-CAM Heatmaps for Model Interpretability

The findings suggest that AI-based CNN model that is proposed has high accuracy, precision and reliability in the classification of stone surgery images. The CNN has better characteristics in dealing with complex patterns of images as compared to the traditional ML models. Inference and low latency Inference and low latency in real-time are guaranteed on the edge devices of the IoT, which makes it appropriate in point of care. Elucidative AI strategies promote transparency, which builds trust among clinicians. Limitations are the size of the data set, and the generalizability of the results, which can be resolved in the future by having larger multi-centre data sets.

IV. CONCLUSION

The current research was aimed at creating an AI-based deep learning problem-solving system to classify images of stone surgery healthcare data, deployed into an IoT-activated setting. The high accuracy, precision and reliability of the proposed CNN-based model in the classification of kidney stone images were observed to be higher than the traditional machine learning methods. The attachment to IoT edge devices allowed real-time inference, which minimized latency and promoted point-of-care decision-making.

Interpretability through explainable AI methods like Grad-CAM enabled medical practitioners to trust AI-based tools, and the clinical relevance of AI was guaranteed. Data privacy, interoperability as well as security issues also featured in the study and the requirement to have secure architectures and comply with healthcare regulations was noted.

On the whole, the study supports the idea that the integration of AI and IoT can make a substantial contribution to optimizing the efficiency of the diagnosis, patient outcomes, and workflows in the medical field. The future development is supposed to concentrate on bigger multi-centric datasets, clinical testing and scalability of the system in order to achieve the complete potential of AI-powered smart healthcare systems.

FUTURE SCOPE

The AI-oriented image classifier of stone surgery healthcare data in an IoT setting presents various opportunities to research and development in the future. Further research can be conducted in order to enlarge datasets through the integration of multi-centre medical imaging information to enhance model generalization and robustness. With the addition of advanced edge computing and 5G networks, the latency can be minimized even more, which would allow making decisions more quickly in real-time. The inclusion of multi-modal information, patient history, lab results, imaging, etc., can improve predictive accuracy and individual treatment planning. Also, one can conduct research to investigate federated learning models to facilitate collaborative model training among hospitals without compromising data privacy. Simplified explainable AI methods will be continuously developed to enhance clinician trust and regulatory compliance. Lastly, to ensure extensive

application, it will be essential to carry out clinical trials to confirm the performance of the system under real-world conditions and make AI-IoT solutions applicable as practical tools to smart, efficient, and patient-centered healthcare.

REFERENCES

- [1]. Mizna, S., Arora, S., Saluja, P., Das, G., & Alanesi, W. A. (2025). An analytic research and review of the literature on practice of artificial intelligence in healthcare. *European Journal of Medical Research*, 30(1), 382.
- [2]. Kumar, S., & Singh, D. (2025). 7 AI in Diagnostics and. *Bioinformatics and Beyond: AI Applications in Healthcare*, 130.
- [3]. Bhardwaj, S., Gupta, G., Ahmad, S., & Haque, M. A. (2025). Transforming Healthcare With AI and IoT: A Path Towards to Efficiency and Sustainability. In *Next-Generation Therapeutics Using Internet of Things and Machine Learning* (pp. 1-26). IGI Global Scientific Publishing.
- [4]. Deivayanai, V. C., Swaminaathanan, P., Vickram, A. S., Saravanan, A., Bibi, S., Aggarwal, N., ... & Abdel-Daim, M. M. (2025). Transforming healthcare: the impact of artificial intelligence on diagnostics, pharmaceuticals, and ethical considerations—a comprehensive review. *International Journal of Surgery*, 111(7), 4666-4693.
- [5]. Baygin, M. (2025). Artificial Intelligence Technologies in Healthcare. In *Business Challenges and Opportunities in the Era of Industry 5.0* (pp. 55-71). Emerald Publishing Limited.
- [6]. Shang, Z., Chauhan, V., Devi, K., & Patil, S. (2024). Artificial intelligence, the digital surgeon: unravelling its emerging footprint in healthcare—the narrative review. *Journal of Multidisciplinary Healthcare*, 4011-4022.
- [7]. Altunhan, A., Soyuturk, S., Guldibi, F., Tozsın, A., Aydın, A., Aydın, A., ... & Ahmed, K. (2024). Artificial intelligence in urolithiasis: a systematic review of utilization and effectiveness. *World Journal of Urology*, 42(1), 579.
- [8]. Punitha, S., & Preetha, K. S. (2024). Unleashing potential: a deep dive into AI-blockchain integration for UAV-enhanced tele-surgery. *Cogent Engineering*, 11(1).
- [9]. Khan, K., Zameer, F., Jain, P., KR, R., Niranjana, V., S, M., & Padyana, S. (2024). Artificial intelligence in revolutionizing kidney care and beyond: Kid-AI revolution. *Journal of Bio-X Research*, 7, 0022.
- [10]. Stitini, O., Ouakasse, F., Rakrak, S., Kaloun, S., & Bencharef, O. (2024). Combining IoMT and XAI for Enhanced Triage Optimization: An MQTT Broker Approach with Contextual Recommendations for Improved Patient Priority Management in Healthcare. *International Journal of Online & Biomedical Engineering*, 20(7).
- [11]. AbdulMoniem, M., Abbas, T., Khandakar, A., Shuzan, M. N. I., Chowdhury, M. H., & Chowdhury, M. E. (2023). Artificial intelligence in hypospadiology: role, applications, and benefits. In *Hypospadiology: Current*

- Challenges and Future Perspectives* (pp. 137-165). Singapore: Springer Nature Singapore.
- [12]. Ali Mohamad, T., Bastone, A., Bernhard, F., & Schiavone, F. (2023). How artificial intelligence impacts the competitive position of healthcare organizations. *Journal of Organizational Change Management*, 36(8), 49-70.
- [13]. Walia, G. K., Kumar, M., & Gill, S. S. (2023). AI-empowered fog/edge resource management for IoT applications: A comprehensive review, research challenges, and future perspectives. *IEEE Communications Surveys & Tutorials*, 26(1), 619-669.
- [14]. Singh, J., Sillerud, B., & Singh, A. (2023). Artificial intelligence, chatbots and ChatGPT in healthcare—narrative review of historical evolution, current application, and change management approach to increase adoption. *Journal of Medical Artificial Intelligence*, 6.
- [15]. Dou, F., Ye, J., Yuan, G., Lu, Q., Niu, W., Sun, H., ... & Song, W. (2023). Towards artificial general intelligence (agi) in the internet of things (iot): Opportunities and challenges. *arXiv preprint arXiv:2309.07438*.
- [16]. Mullachery, B., & Alismail, S. (2022, October). A smart healthcare framework: opportunities for integrating emerging technologies (5G, IoT, AI, and GIS). In *Proceedings of the Future Technologies Conference* (pp. 325-340). Cham: Springer International Publishing.
- [17]. Choudhury, A. (2022). Toward an ecologically valid conceptual framework for the use of artificial intelligence in clinical settings: need for systems thinking, accountability, decision-making, trust, and patient safety considerations in safeguarding the technology and clinicians. *JMIR Human Factors*, 9(2), e35421.
- [18]. Comito, C., Falcone, D., & Forestiero, A. (2022). Convergence between iot and ai for smart health and predictive medicine. In *Integrating Artificial Intelligence and IoT for Advanced Health Informatics: AI in the Healthcare Sector* (pp. 69-84). Cham: Springer International Publishing.
- [19]. Taj, I., & Zaman, N. (2022). Towards industrial revolution 5.0 and explainable artificial intelligence: Challenges and opportunities. *International Journal of Computing and Digital Systems*, 12(1), 295-320.
- [20]. Paleti, S. (2022). The Role of Artificial Intelligence in Strengthening Risk Compliance and Driving Financial Innovation in Banking. Available at SSRN 5250770.
- [21]. Wang, K., Zhao, Y., Gangadhari, R. K., & Li, Z. (2021). Analyzing the adoption challenges of the Internet of things (Iot) and artificial intelligence (ai) for smart cities in china. *Sustainability*, 13(19), 10983.
- [22]. P. Sharma, N. R. Moparthi, S. Namasudra, V. Shanmuganathan, and C. Hsu, "Blockchain-based <sc>IoT</sc> architecture to secure healthcare system using identity-based encryption," *Expert Systems*, vol. 39, no. 10. Wiley, Dec. 13, 2021. doi: 10.1111/exsy.12915
- [23]. B. Zaabar, O. Cheikhrouhou, F. Jamil, M. Ammi, and M. Abid, "HealthBlock: A secure blockchain-based healthcare data management system," *Computer Networks*, vol. 200. Elsevier BV, p. 108500, Dec. 2021. doi: 10.1016/j.comnet.2021.108500.
- [24]. Y. Cui et al., "Automatic Detection and Scoring of Kidney Stones on Noncontrast CT Images Using S.T.O.N.E. Nephrolithometry: Combined Deep Learning and Thresholding Methods," *Mol. Imaging Biol.*, vol. 23, no. 3, pp. 436–445, 2021, doi: 10.1007/s11307-020-01554-0.
- [25]. R. Mishr, A. Bhattacharjee, M. Gayathri, and C. Malathy, "Kidney stone detection with ct images using neural network," *Int. J. Psychosoc. Rehabil.*, no. May, 2020, doi: 10.37200/IJPR/V24I8/PR280269.