iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** V **Month of publication:** May 2025

DOI: https://doi.org/10.22214/ijraset.2025.71396

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue V May 2025- Available at www.ijraset.com

Beatcancer : AI Powered Platform For Personalized Cancer Care and Treatment Planning

Aryan Chaturvedi[1], Ms Deepika Tyagi[2], Abhay Singh Patel[3], Abhay Singh[4]
Department of Computer Science and Engineering JSS Academy of Technical Education Noida, India

Abstract: ***This paper introduces an AI platform designed to improve personalized cancer care and treatment planning. The platform employs advanced machine learning algorithms to analyze patient information, including genetic data, medical history, and clinical results, to generate tailored treatment recommendations. By integrating diverse data sources, the system enables oncologists to take more accurate and information-based decisions on the treatment pathway while optimizing the process, minimizing risks, and side effects.It integrates well with the existing systems of healthcare, using predictive analytics to forecast treatment responses and adapt plans as the disease progresses, whereas the AI platform continually learns from new data, making better recommendations over time, and ensuring that ongoing treatment stays updated with current research as well as the individual patient's needs. The platform strives to revolutionize oncology by delivering personal, accurate, and data-informed treatment plans. It has the potential to improve clinical outcomes while reducing the burden on patients, thereby streamlining cancer care and, ultimately, enhancing the quality of the treatment process.***

Keywords: AI Powered Platform , Deep Learning , HealthCare, Personalized Cancer Care, Treatment Planning.

I. INTRODUCTION

Cancer is still one of the leading causes of death around the world, and treatment strategies often vary significantly depending on the type, stage, and genetic characteristics of the disease. Traditional approaches to cancer treatment, though effective in some cases, often fail to provide personalized care tailored to the unique needs of individual patients. This gap in personalized treatment is a significant challenge, as what works for one patient may not work for another, even with the same diagnosis. Therefore, there is a growing need for innovative solutions that integrate cutting-edge technology to personalize cancer care, making it more precise and effective.

AI-powered platforms are emerging as a powerful tool to bridge this gap by leveraging vast amounts of patient data to generate personalized treatment plans. By analyzing clinical data, genetic information, imaging results, and medical histories, AI algorithms can identify patterns that might otherwise go unnoticed. Through integration into health systems that already exist, AI will aid oncologists in decision-making that is informed by data in real time. This capability of AI to continuously learn ensures that these platforms evolve as new data becomes available, making them more accurate and relevant over time. This novel approach to cancer care is bound to transform the oncology landscape by offering better, patient-centered treatment plans that are personalized, precise, and adaptable, advancing the standard of care in cancer treatment overall.

II. LITERATURE REVIEW

1) P. Singh and R. Gupta's paper "Real-Time Patient Monitoring for Cancer Care with Wearable Devices" (2021) in IEEE Transactions on Biomedical Engineering probably explains how wearable devices improve care in cancer, focusing primarily on the real-time monitoring of a patient. The use of wearable technology can significantly enhance personalized cancer treatment by providing continuous data on vital signs, symptoms, and even response to treatments, which can be used to adjust care plans promptly. [1]

2) "AI-based decision support systems in cancer care: opportunities and challenges," paper by R. Wilson and T. Lee (2022) from Artificial Intelligence in Medicine discusses the use of AI in decision-making processes in care for cancer-diagnosed patients. An effort is here taken to explain how AIbased DSS can be applied in assisting healthcare professionals to take even mo re accurate and timely treatment decisions by leveraging large volumes ofpatientdata like history, genetic information, or clinica l test results. This paper discusses the advantages of Artificial Intelligence on clinical outcome, reduced human error, and optimu mtreatment in an individualized manner.[2]

3) S. Johnson and M. Smith of Journal of Cancer Research and Therapy presented the paper "A Machine Learning Framework for P ersonalized Cancer Treatment." (2019)It reports that the machine learning framework is optimized for personal cancer treatment. Theframework of several machine learning algorithmsanalyzes gigantic data that contains geneticprofiles ofthe patients, clinical history, and response of thetreatment to customize the treatment. This framework predicts patient specific treatment responses, is predictive of the reduction in side effects, and enhancement of outcomes while aiming at increasing theeffectiveness and accurac y in cancer therapy.[3]

4) The paper "Predictive Analytics for Oncology: An AI-Driven Approach" by H. Brown and J. Turner, published in the Journal of Clinical Oncology(2019) , talks about how AI and predictive analytics are changing oncology by providing better predictions of cancer progression and treatment responses. Analyzing large datasets, including patient histories, genetic information, and clinical outcomes, AI-driven models can predict the likely success of various treatment options, personalize therapy plans, and optimize clinical decisions.[4]

5) M. Stevens and L. Harris discuss in the Journal of Medical Systems the potential of blockchain technology to secure healthcare datasharinginoncology by improving the privacy and security ofsuch sharing. Blockchain technology, based on a decentralized a nd immutable ledger, presents a solution for the challenges of data privacy and security that ensure the protection of sensitive patient information while remaining accessible for personalized cancer care.[5]

6) A paper on "AI-based Personalized Treatment Recommendation for Cancer Patients" by J. DeFrank and A. Luiz (2022), which was publishedintheJournal of Carcinogenesis, aimed at using artificialintelligence in generating personalized treatment recomme ndation for cancer patients. A high degree ofpatient information analysis would allow the AIalgorithms to determine suitable cust omized treatment options based on a patient's requirements.[6]

7) This paper, "AI-powered Personalized Treatment Recommendation Framework for Improved Healthcare Outcomes," by I. Rahman in Journal of Computational Social Dynamics, discusses the AI-based framework designed for personalized treatment recommendations in health care. It uses algorithms from machine learning to predict the most appropriate treatment response based on the patient-specific data that may include his or her medical history, genetics, and treatment response (2023).[7]

8) The paper "AI-powered Healthcare Revolution: An Extensive Examination of Innovative Methods in Cancer Treatment" by M. Khan, A. Shiwlani, M. U. Qayyum, A. M. K. Sherani, and H. K. Hussain, (2024)published in Journal Multi discipline Ilmu, explores the role of AI in revolutionizing cancer treatment. It explores a range of new AI approaches, including machine learning, deep learning, and data analytics, that are increasingly being used in oncology to detect cancer earlier, personalize treatment, and predict outcomes. The paper demonstrates how AI is revolutionizing precision medicine, so that treatments are more effective for patients with cancer and with fewer side effects, by tailoring therapies to each patient's needs.[8]

9) H. Shimizu and Nakayama K.I."Artificial Intelligence in Oncology" .Published by Cancer Science, isdevoted to the growing role of AI in oncology but particularly from the viewpoint of its applications in diagnosing, planning treatment for and caring for patients. For the authors, AI technological changes,such as the development of machine learning, deeplearning, and further transf ormations, are changingdramatically the discovery, classification, andtreatment of cancers. With the help of AI applications of in terpreting medical images, genetics information, and patient history allows treatment planning, predicting outcomes and early diagnosis. (2020)[9]

10) The paper "Application of Artificial Intelligence for Improving Early Detection and Prediction of Therapeutic Outcomes for Gastric Cancer in the Era of Precision Oncology" by Z. Wang, Y. Liu, and X. Niu, published in Seminars in Cancer Biology, discusses the application of artificial intelligence in the early detection and prediction of therapeutic outcomes for gastric cancer. In terms of how AI, including the two most popular sub-areas, machine learning and deep learning models, has been applied to analyze many types of data sources from medical images to genomics and clinical histories, the AI models should increase the accuracy of the early diagnosis, personalize the strategies of treatment, predict responses to therapies, and then increase the outcomes in precision oncology.(2023)[10]

Table1: Literature Review

S.No.	Proposed Work	Gap
1.	P. Singh and R. Gupta's (2021), Explores how these devices can continuously collect data on a patient's vital signs.[1]	-Limited Data Interpretation Capabilities. -Data Privacy and Security Concerns. -Clinical Validation and Real-World Effectiveness.

2.	R. Wilson and T. Lee (2022). Explores how AI-based decision support systems (DSS) can assist healthcare professionals.[2]	-Data Quality and Availability. -Explainability and Transparency. -Ethical and Legal Considerations.
3.	S. Johnson and M. Smith (2019) Introduces a machine learning (ML) framework aimed at optimizing personalized cancer treatment.[3]	-Data Availability and Integration. -Patient Acceptance and Compliance. -Model Interpretability.
4.	H. Brown and J. Turner (2019). Discusses how AI and predictive analytics are transforming oncology by enabling more accurate predictions of cancer progression.[4]	-Long-Term Impact and Adaptation. -Ethical and Regulatory Concerns. -Interpretability and Trust.
5.	M. Stevens and L. Harris (2022). Explores the potential of blockchain technology to enhance the security and privacy of healthcare data sharing in oncology.[5]	-Scalability and Efficiency. -Integration with Existing Healthcare Systems. -Regulatory and Legal Framework.
6.	J. DeFrank and A. Luiz (2022). Discuss on using artificial intelligence (AI) to create personalized treatment recommendations for cancer patients.[6]	-Data Heterogeneity. -The clinical validation of these models in real-world settings remains limited. -Ethical Considerations and Bias.
7.	I. Rahman (2023). Discusses an AI-based framework designed to provide personalized treatment recommendations in healthcare.[7]	-Data Privacy and Security. -Clinical Adoption and Integration. -Model Transparency and Explainability.
8.	M. Khan, A. Shiwlani, M. U. Qayyum, A. M. K. Sherani, and H. K. Hussain (2024). Explores the transformative role of AI in revolutionizing cancer treatment.[8]	-Clinical Validation and Real-World Effectiveness. -Clinical Validation and Real-World Effectiveness.
9.	H. Shimizu and Nakayama K.I. (2020). Explores the growing role of artificial intelligence (AI) in oncology, focusing on its applications in diagnosis, treatment planning, and patient care.[9]	-Lack of Standardization Across AI Tools. -Data Privacy and Security Risks. -Data Heterogeneity and Integration.

10.	Z. Wang, Y. Liu, and X. Niu (2023). Explores the application of artificial intelligence (AI) in the early detection and prediction of therapeutic outcomes for gastric cancer.[10]	-Real-Time Data Processing and Decision-Making. -Accountability and Liability. -AI System Maintenance and Updates.

A. Methodology

This would be an AI-based system that personalizes cancer treatment and care by using comprehensive data sources, such as genomics,imaging, and medical history, with advanced machine learning algorithms. The system would aim to improve early detection of cancer, personalize treatment plans, and enhance patient outcomes through continuous monitoring and adaptive care.

B. Data Collection and Integration

1) Clinical Data: Electronic Health Records (EHRs), lab results, medical imaging (e.g., CT, MRI, X-rays), and pathology reports.
2) Genomic Data: DNA sequencing data (e.g., whole genome sequencing, exome sequencing) to identify genetic mutations associated with cancer.
3) Lifestyle Data: Data from wearable devices (e.g., Fitbit, Apple Watch), such as physical activity, sleep patterns, heart rate, and diet, that can influence cancer progression.
4) Patient History: Information regarding prior cancer treatments, comorbidities, family history, and environmental exposures (e.g., smoking, diet).
5) Use an integrated healthcare database system that combines structured (numerical/clinical data) and unstructured data (e.g., medical notes, imaging), ensuring all patient data is accessible for analysis by AI systems.

C. Data Preprocessing And Cleaning

1) Use data imputation techniques like mean/mode imputation, k-nearest neighbors, or regression-based imputation to deal with missing values in clinical data, such as missing test results.
2) If there are missing values in the genomic data use predictive models to estimate such missing data with known associations in related patient profiles.

D. Personalized Treatment Planning

1) AI models will analyze each patient's tumor characteristics, genetic data, and treatment history to suggest the most effective treatment options, such as chemotherapy, targeted therapies (e.g., HER2 inhibitors), immunotherapy (e.g., checkpoint inhibitors), or radiation therapy.
2) It will also consider factors of individual patients: their age ,comorbidities, and general state of health to fine-tune the recommendations.
3) Incorporate clinical guidelines *and medical literature to ensure that AI recommendations align with current best practices.*

E. Real Time Monitiring

1) Continuous patient data can be integrated via IoT devices, such as wearable health monitors, to track real-time metrics, including vital signs, such as blood pressure and heart rate, side effects, and physical symptoms.
2) Using reinforcement learning algorithms, the system will recommend treatment adjustments in response to patient data, optimizing outcomes *based on ongoing patient feedback and clinical data.*

F. Patient Feedback

1) AI-powered systems will collect real-time patient feedback about their treatment experience, side effects, and general well-being through mobile apps or patient portals.
2) AI will analyze patient feedback and adjust treatment plans. For example, if side effects are too severe, AI may recommend alternative therapies or if the patient is not responding to treatment.

III. CONCLUSION

AI has been integrated into the medical field, especially within cancer care. This has provided a significant leap forward in medical technology. Early detection and personalized treatment planning is within the realm of what AI can do to transform cancer diagnosis and treatment.

The reviewed literature has mentioned that there are many applications in AI these include some models of machine learning for particular treatment planning, deep learning for early detection, some predictive analytics for treatment results, and blockchain for data sharing in a secure environment. These advancements are promising but also marking challenges and gaps that lie ahead in the current state of AI in oncology.

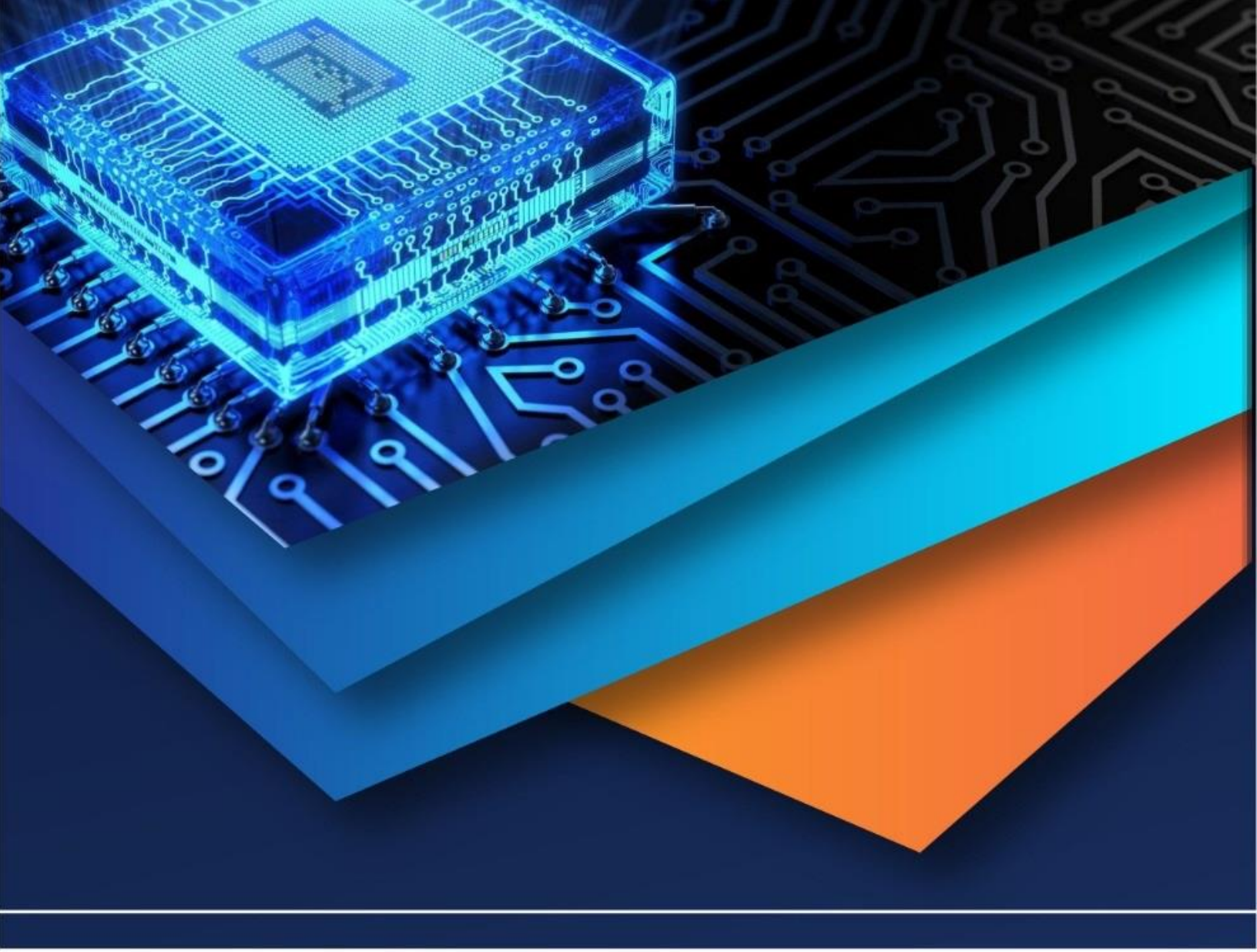
The proposed AI system is expected to transform cancer care by providing personalized treatment plans, improving early detection, and optimizing outcomes all while reducing costs and enhancing the quality of life for patients.

IV. FUTURE SCOPE

In summary, the scope of the AI HealthCare project gives us a wide range of functionalities, from personalizing cancer treatment planning to proactive screening management and data sharing in a secure environment, patient engagement, and ongoing research. With a combination of AI, data analytics, and secure cloud infrastructure, this project aims to create a transformational solution that will make a difference in improving cancer care delivery, support health care providers, and give patients control over their journey. The system will continue to evolve and include other types of cancers, multi-modal data, like text from patient interactions, and new treatment methods.

REFERENCES

[1] P. Singh and R. Gupta, "Real-Time Patient Monitoring for Cancer Care with Wearable Devices," IEEE Transactions on Biomedical Engineering, vol. 68, no. 11, pp. 2314-2324, 2021.
[2] R. Wilson and T. Lee, "AI-based decision support systems in cancer care: Opportunities and challenges," Artificial Intelligence in Medicine, vol. 45, no. 2, pp. 99-110, 2022.
[3] S. Johnson and M. Smith, "A Machine Learning Framework for Personalized Cancer Treatment," Journal of Cancer Research and Therapy, vol. 15, no. 3, pp. 112-124, 2019.
[4] H. Brown and J. Turner, "Predictive Analytics for Oncology: An AI-Driven Approach," Journal of Clinical Oncology, vol. 36, no. 10, pp. 1587-1597, 2018.
[5] M. Stevens and L. Harris, "Blockchain Technology for Secure Healthcare Data Sharing in Oncology," Journal of Medical Systems, vol. 42, no. 5, pp. 115-123, 2018.
[6] DeFrank, J., & Luiz, A. (2022). AI-based personalized treatment recommendation for cancer patients. Journal of Carcinogenesis, 21(2).
[7] Rahman, I. (2023). AI-powered Personalized Treatment Recommendation Framework for Improved Healthcare Outcomes. Journal of Computational Social Dynamics, 8(11), 42-51.
[8] Khan, M., Shiwlani, A., Qayyum, M. U., Sherani, A. M. K., & Hussain, H. K. (2024). AI-powered healthcare revolution: an extensive examination of innovative methods in cancer treatment. BULLET: Jurnal Multidisiplin Ilmu, 3(1), 87-98.
[9] Shimizu, H., & Nakayama, K. I. (2020). Artificial intelligence in oncology. Cancer science, 111(5), 1452-1460.
[10] Wang, Z., Liu, Y., & Niu, X. (2023, August). Application of artificial intelligence for improving early detection and prediction of therapeutic outcomes for gastric cancer in the era of precision oncology. In Seminars in Cancer Biology (Vol. 93, pp. 83-96). Academic Press.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY