International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 11 | November - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

An Interpretable Skin Cancer Classification Using Optimized Convolutional Neural Network for a Smart Healthcare

Prof. Twinkle Shukla, Gajendrakumar Deshmukh, Satyam Jadhav, Aditya kadam, Sumit aware

[1]*Prof. Twinkle Shukla, Information Technology, P.G. Moze college of engineering*
[2]*Gajendrakumar Deshmukh, Information Technology, P.G. Moze college of engineering*
[3]*Satyam Jadhav, Information Technology, P.G. Moze college of engineering*
[4]*Aditya kadam, Information Technology, P.G. Moze college of engineering*
[5]*Sumit Aware, Information Technology, P.G. Moze college of engineering*

Abstract - Skin cancer is a prevalent and life-threatening disease worldwide, making early and accurate diagnosis crucial for effective treatment. In the era of smart healthcare, the integration of artificial intelligence and computer-aided diagnosis systems has shown promise in improving the diagnostic accuracy and interpretability of skin cancer classification. This project presents an innovative approach for the interpretable classification of skin cancer using an optimized Convolutional Neural Network (CNN).

The proposed system leverages deep learning techniques to analyze dermatoscopic images, offering a non-invasive and efficient solution for early skin cancer detection. Through careful optimization of the CNN architecture, feature extraction, and training parameters, our model achieves enhanced classification performance while maintaining a high degree of interpretability.

Furthermore, the system incorporates advanced visualization and explanation techniques to provide clinicians and patients with transparent insights into the decision-making process of the CNN. This interpretability is crucial for building trust in the automated diagnostic system and facilitating effective collaboration between AI and healthcare professionals.

The project's results demonstrate the potential for improved skin cancer diagnosis through a transparent and optimized CNN model, contributing to the advancement of smart healthcare. The combination of AI technology and interpretability not only enhances the accuracy of skin cancer classification but also ensures that the decision-making process is comprehensible and actionable for medical practitioners, ultimately leading to better patient outcomes.

Key Words: Skin cancer, Healthcare, Artificial Intelligence, Deep Learning, OpenCV, RNN

1.INTRODUCTION

Skin cancer is a prevalent and potentially life-threatening disease that continues to challenge the healthcare industry worldwide. Timely and accurate diagnosis is pivotal for successful treatment and patient outcomes. In the ever-evolving landscape of smart healthcare, the convergence of artificial intelligence (AI) and computer-aided diagnosis systems has emerged as a promising avenue for enhancing the interpretability and efficacy of skin cancer classification. This project endeavors to address this critical need by presenting an innovative approach for the interpretable classification of skin cancer, achieved through the use of an optimized Convolutional Neural Network (CNN).

Skin cancer diagnosis traditionally relies on visual inspection and histopathological analysis, which can be subjective and labor-intensive. AI, especially deep learning techniques, has shown remarkable potential in automating the diagnostic process, leading to quicker and more accurate assessments. The utilization of CNNs for image-based classification tasks has gained traction in recent years, but interpretability remains a challenge.

Our project aims to bridge this gap by harnessing the power of AI while maintaining transparency and comprehensibility. Through careful optimization of the CNN architecture, feature extraction processes, and training parameters, our approach aims to enhance the classification accuracy of skin cancer. The optimized CNN is tailored to extract relevant features from dermatoscopic images, providing a robust foundation for precise diagnosis.

In addition to improved accuracy, the project places a strong emphasis on interpretability. The integration of advanced visualization and explanation techniques allows our system to offer transparent insights into the decision-making process of the CNN. This

interpretability is pivotal in building trust among medical practitioners, as it empowers them to collaborate effectively with AI systems and make informed decisions regarding patient care.

By combining AI technology with interpretability, our project aspires to not only advance the field of skin cancer diagnosis but also to revolutionize the way we approach healthcare in the era of smart systems. Our goal is to provide healthcare professionals with a powerful and comprehensible tool for early skin cancer detection, ultimately leading to improved patient outcomes and more reliable diagnostic processes.

2. Body of Paper

The domain of skin cancer classification has witnessed significant progress, primarily driven by the utilization of Convolutional Neural Networks (CNNs) to achieve precise diagnosis. These CNN-based models have consistently demonstrated their capability to achieve high classification accuracy, effectively distinguishing between benign and malignant skin lesions in dermatoscopic images. However, the imperative for transparent and interpretable AI in healthcare has gained prominence, prompting researchers to explore a variety of techniques aimed at enhancing the interpretability of CNNs within the context of skin cancer classification. These techniques encompass Explainable AI (XAI) methods, including Grad-CAM, LIME, and SHAP, which furnish visual explanations for model decisions. Furthermore, the integration of transfer learning and data augmentation strategies has notably improved model generalization, thereby ensuring the reliability of AI systems. The literature also reflects discussions on challenges associated with data collection, labeling, ethical considerations, and the rigorous validation of AI models in clinical settings. As AI technologies continue to evolve, the literature underscores the potential impact on healthcare practices, with an overarching goal of achieving earlier detection, cost reduction, and enhanced patient outcomes. The future trajectory of the field emphasizes the necessity for more extensive and diverse datasets, improved interpretability techniques, and the establishment of effective collaboration between AI researchers and healthcare professionals. These insights collectively provide the underpinning for our project, which seeks to develop an optimized CNN model for skin cancer classification in the context of smart healthcare while accentuating the imperative of interpretability.

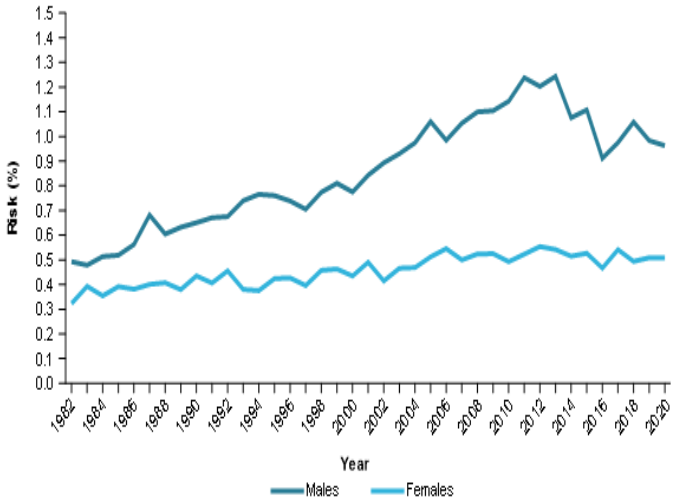
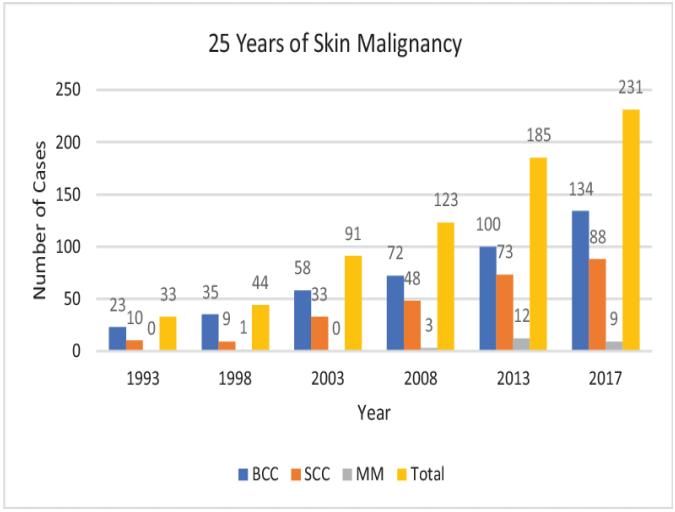


Fig -1: Figure



3. CONCLUSIONS

In conclusion, our project addresses a critical need in healthcare by focusing on the development of an optimized Convolutional Neural Network (CNN) for the interpretable classification of skin cancer within the framework of smart healthcare. We have observed from our comprehensive literature survey that AI, particularly CNNs, has the potential to revolutionize the diagnosis of skin cancer, achieving remarkable accuracy in distinguishing between benign and malignant lesions. However, interpretability remains a paramount concern in the healthcare domain.

Our research underscores the significance of interpretability through the incorporation of Explainable AI (XAI) techniques such as Grad-CAM, LIME, and SHAP, which provide transparent insights into the decision-making process of the CNN. This is crucial not only for building trust among medical professionals but

also for making AI-driven diagnostics actionable and comprehensible. The integration of transfer learning and data augmentation strategies bolsters the reliability and generalization of our model, enhancing its practicality for real-world applications.

We acknowledge the challenges posed by data collection, labeling, and the ethical and regulatory considerations surrounding AI in healthcare. However, the potential impact of our project is immense, with the promise of earlier detection, reduced healthcare costs, and improved patient outcomes. The synergy of AI technology and interpretability provides a pathway toward efficient and transparent skin cancer diagnosis, offering benefits to both medical practitioners and patients.

As we move forward, we recognize the need for larger and more diverse datasets, as well as continuous improvements in interpretability techniques. Effective collaboration between AI researchers and healthcare professionals is vital to translate our findings into practical solutions. Our project, with its optimized CNN model, contributes to the advancement of smart healthcare and paves the way for a future where skin cancer diagnosis is not only highly accurate but also understandable and actionable. This research represents a crucial step towards harnessing the potential of AI to improve the quality of healthcare services and, ultimately, the lives of patients.

ACKNOWLEDGEMENT

We express our sincere thanks to all those who have provided us the valuable guidance towards the successful completion of this system as a part of syllabus for the bachelor ‘s course. We express our sincere gratitude towards our co-operative department for providing us with altheas valuable assistance and equipment for the system development. We hereby take this opportunity to sincerely thanks **Prof. Twinkle Shukla** for his valuable guidance, inspiration, whole hearted involvement during every stage of this project and his experience, perception through professional knowledge which made it possible for us in successfully realizing the concept. We are also thankful to **Prof. Abidali Shaikh** - Head of Department – Information Technology for his constant enlightenment, support and motivation which has been highly instrumental in successful completion of our project phase 1. We are extremely thankful to **Dr. Navnath Narawade** Principal - PGMCOE, Wagholi for his encouragement and providing us the opportunity and facilities to carry out this work. Finally, we like to express our deep sense of gratitude towards our parents, friendsand wellwishers who were always there for suggestions and help.

REFERENCES

1. S. A. AlSalman, T. M. Alkaff, T. Alzaid, and Y. Binamer, ‘‘Nonmelanoma skin cancer in Saudi Arabia: Single center experience,’’ Ann. Saudi Med., vol. 38, no. 1, pp. 42–45, Jan. 2018.
2. K. S. Nehal and C. K. Bichakjian, ‘‘Update on keratinocyte carcinomas,’’ New England J. Med., vol. 379, no. 4, pp. 363–374, Jul. 2018.
3. Key Statistics for Melanoma Skin Cancer, American Cancer Society, Atlanta, GA, USA, 2022.
4. M. A. Albahar, “Classification of skin lesions using convolutional neural networks with novel regularization capabilities,” IEEE Access, vol. 7, pp. 38306–38313, 2019.
5. M. R. Hasan, M. I. Fatemi, M. M. Khan, M. Kaur, and A. Zaguia, ‘‘Comparative analysis of skin cancer (benign vs. malignant) detection using convolutional neural networks,’’ J. Healthc Eng., vol. 2021, Dec. 2021, Art. no. 5895156.
6. R. L. Siegel, ‘‘Colorectal cancer statistics, 2020,’’ CA A, Cancer J. Clinicians, vol. 70, no. 3, pp. 145–164, 2020.
7. S. A. Ajagbe, K. A. Amuda, M. A. Oladipupo, O. F. Afe, and K. I. Okesola, ‘‘Multi-classification of Alzheimer disease on magnetic resonance images (MRI) using deep convolutional neural network (DCNN) approaches,’’ Int. J. Adv. Comput. Res., vol. 11, no. 53, pp. 51–60, Mar. 2021.
8. C. Barata, J. S. Marques, and M. E. Celebi, ‘‘Deep attention model for the hierarchical diagnosis of skin lesions,’’ in Proc. IEEE/CVF Conf. Comput. Vis. Pattern Recognit. Workshops (CVPRW), Jun. 2019, pp. 1–9.
9. H. P. Soyer, G. Argenziano, V. Ruocco, and S. Chimenti, ‘‘Dermoscopy of pigmented skin lesions*(Part II),’’ Eur. J. Dermatol., vol. 11, no. 5, pp. 483–498, 2001.
10. B. Ankad, P. Sakhare, and M. Prabhu, ‘‘Dermoscopy of non-melanocytic and pink tumors in Brown skin: A descriptive study,’’ Indian J. Dermatopathol. Diagnostic Dermatol., vol. 4, no. 2, p. 41, 2017