Chapter 11
Advancing Skin Cancer Diagnosis Using Computer Vision to Aid the Visually Impaired

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ABSTRACT

Skin cancer is one of the most common forms of cancer, with early detection being crucial for effective treatment. Individuals with visual impairment often struggle to monitor skin lesions independently, typically depending on caregivers or dermatologists for assistance. This study develops a skin cancer detection system using dermoscopic images from the HAM10000 dataset, evaluating four deep learning models to assist caregivers and dermatologists in providing faster analysis for the individuals who are visually impaired. The research employs segmentation masks to crop images during preprocessing, with data augmentation and transfer learning for optimizing performance. Among the models used, EfficientNetV2-L achieved the highest accuracy of 95.1% and a recall of 86.3% for malignant lesions in binary

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classification, showing reliable classification of cancerous lesions. This system helps caregivers and dermatologists with a tool to efficiently monitor skin health for visually impaired individuals, reducing diagnostic delays and supporting faster decision making.

INTRODUCTION

Skin cancer is one of the most prevalent types of cancer worldwide, primarily caused by genetic and environmental factors, with prolonged exposure to ultraviolet (UV) radiation being a significant risk factor (Craythorne & Al-Niami, 2017). Skin lesions, which refer to areas of skin that differ from the surrounding skin, are common and often result from injuries or environmental exposure. Early detection is essential for better outcomes, but visually impaired individuals encounter distinct challenges in examining their own skin for suspicious lesions, often resulting in delayed diagnoses. The goal is to enable faster decision-making for dermatologists and caregivers in addressing skin cancer for the visually impaired individuals, improving their quality of life.

At least 2.2 billion people have vision impairment globally, with 1 billion cases being potentially preventable or are not addressed due to limited access to eye care services (World Health Organization, 2019). Additionally, according to recent statistics, over 331,722 new cases of skin cancer were reported in 2022, making it the 14th most common cancer among both men and women (World Cancer Research Fund, 2024). Visually impaired individuals often cannot visually inspect their skin for lesions, relying instead on caregivers or family members, which can result in inconsistent or delayed detection. Caregivers bear additional burdens, highlighting the need for tools that streamline this process.

Artificial Intelligence (AI) is transforming the healthcare industry by leveraging various machine learning techniques such as deep learning and computer vision. AI has been applied in healthcare to reduce costs, provide guidance during surgeries, support clinical trials, and improve patient care (Shaheen, 2021). Machine learning techniques, particularly convolutional neural networks (CNNs) and computer vision, play a significant role in analyzing skin cancer patterns. These technologies have been shown to outperform professional dermatologists in certain diagnostic scenarios, enhancing early detection accuracy and reducing healthcare workload. The use of machine learning in skin cancer detection leads to improved treatment outcomes and reduced mortality rates (Nahata & Singh, 2020).

While AI excels in general detection, a key gap lies in caregiver-focused applications for visually impaired individuals, where traditional methods like manual checks fall short. This chapter bridges this gap by evaluating deep learning models