Skin Cancer Detection

Research Question:

The goal is to leverage data augmentation techniques to enhance the accuracy of a deep learning model for skin cancer detection, enabling the model to perform multi-label classification of skin lesions.

Summary:

Our research focuses on improving automated melanoma skin cancer detection using deep learning models, addressing the limitations of traditional methods that rely heavily on size of the model to distinguish. Our research aims to address that this approach can lead to unreliable classifications when testing images vary in scale and context. We will use data augmentation techniques such as rotations, contrast adjustments, and resizing strategies to train the model for multi-label classification. These methods aim to enhance the model's accuracy by preventing overfitting to specific image attributes and simulating real-world conditions in detection. Our ultimate goal is to enable the model to perform multi-label classification of skin lesions effectively, thus contributing to more reliable and comprehensive automated skin cancer detection systems.

Methodology:

- **Dataset:** We will use ISIC (International Skin Imaging Collaboration) dataset which has 9 labels of different types of skin lesion.
- **Data Preprocessing:** Images will be normalized to a size of 224x224 pixels. Data augmentation techniques, such as rotation, contrast adjustment, and resizing, will be applied to simulate arbitrary image capturing conditions.
- **Model Architecture:** CNN model on VGG architecture.

Resources Needed:

- **Computational Resources:** GPU is required for high-performance and faster training.

Annotated Bibliography:

DiSanto, Nick, et al. *Leveraging Contextual Data Augmentation for Generalizable Melanoma Detection*, California Baptist University, 2023, arxiv.org/pdf/2212.05116v3.

This paper explores the impact of contextual data augmentation on improving the generalizability of melanoma detection models. The authors argue against traditional classifiers that rely solely on attributes like mole size, which can be misleading and inconsistent in real-world applications. By implementing various data augmentation techniques the study demonstrates significant improvements in model accuracy and robustness across diverse testing environments.

Bissoto, Alceu, et al. "Skin Lesion Synthesis with Generative Adversarial Networks." *arXiv.Org*, 8 Feb. 2019, arxiv.org/abs/1902.03253v1.

This paper addresses the challenge of generating realistic synthetic skin lesion images using Generative Adversarial Networks (GANs). The authors highlight the critical need for annotated data in skin cancer research, which is expensive and labor-intensive to obtain. They propose using GANs to generate visually-appealing synthetic images that incorporate clinically-meaningful information. Their approach aims to improve the quality and quantity of data available for training deep learning models.

Milton, Md Ashraful Alam. "Automated Skin Lesion Classification Using Ensemble of Deep Neural Networks in ISIC 2018: Skin Lesion Analysis towards Melanoma Detection Challenge." *arXiv.Org*, 30 Jan. 2019, arxiv.org/abs/1901.10802.

The paper investigates deep learning methods for detecting melanoma and skin lesion cancers using dermoscopic images. It evaluates several neural networks (PNASNet-5-Large, InceptionResNetV2, SENet154, InceptionV4) on the ISIC dataset. Pre-processing includes image normalization and augmentation techniques. Training details involve fine-tuning pre-trained models, optimizing hyperparameters, and using ensemble methods.