Multiclass Skin Cancer Classification

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Problem Statement

- Skin cancer diagnosis is crucial but challenging due to fine-grained variability. Dermatologists visually diagnose, but recent studies show CNNs outperform them.

Convolutional Neural Networks

A convolutional neural network (CNN) is a type of artificial neural network that uses three-dimensional data to perform image classification and object recognition tasks.

Neural Network

A neural network is a method in artificial intelligence that teaches computers to process data in a way that is inspired by the human brain. It is a type of machine learning process, called deep learning, that uses interconnected nodes or neurons in a layered structure that resembles the human brain.

F1 Score:

- A performance metric for classification
- Computes the average of precision and recall
- Score > 0.7 is good

Transfer Learning

Transfer learning is a technique where a model trained on a large and general dataset (like ImageNet) is re-purposed for a specific task (skin cancer classification).

Data Preprocessing:

- Remove hairs from images.
- Augment dataset for variability.
- Resize images for model requirements.

Model Training:

- Use transfer learning on pre-trained ImageNet weights.
- Fine-tune EfficientNets BO-B7 on HAM10000 dataset.

ImageNet

ImageNet is a large visual database of over 14 million images that are used to research visual object recognition software.

By using these pre-trained weights, the model can learn relevant features related to skin cancer without starting from scratch

Evaluation Metrics:

- Evaluate using Precision, Recall, Accuracy, F1 Score, and Confusion Matrices.
- Consider high-class imbalance.

HAM10000 Dataset

HAM10000 is a dataset of 10000 training images for detecting pigmented skin lesions.

Lesions are areas of damaged or abnormal tissue that can occur on or within the body.

EfficientNets

EfficientNets are a family of CNN models designed to balance performance and efficiency by scaling network width, depth, and resolution together. They use efficient building blocks and compound scaling methods to achieve state-of-the-art results with fewer parameters compared to traditional models.

EfficientNet Variants

EfficientNet variants are different versions of the EfficientNet architecture, denoted by labels like B0, B1, B2, up to B7. Each variant represents a different scale of the model, with B0 being the smallest and least computationally intensive, and B7 being the largest and most complex.

Preprocessing Pipeline

- Used to enhance the quality of skin lesion images
- Uses techniques such as Hair removal, data augmentation and resizing

Image Preprocessing Techniques:

1. Hair removal:
   a. Morphological operations
   b. Edge detection
   c. Masking
2. Data Augmentation:
   a. a statistical technique that involves making small changes to existing data to create new data, or synthetically generating new data from existing data
3. Image standardization:
   a. Resize all images to a standardized input size suitable for the models (e.g., 224x224 pixels for EfficientNet variants).
   b. Apply normalization techniques to ensure consistent pixel intensity values across images