Empirical analysis of basic Neural Networks, Transfer Learning Models & Vision Transformer for Skin Cancer Classification using images

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Overview

Skin cancer is a common type of cancer that usually forms on skin exposed to the sun, but it can also develop on areas not usually exposed to sunlight[2]. There are two main types: melanoma and non-melanoma. Skin cancer is the most diagnosed cancer, with one in every three cancers diagnosed is a skin cancer according to Skin Cancer Foundation Statistics. A 10% decrease in ozone levels could lead to additional 300,000 non-melanoma and 4,500 melanoma skin cancer cases[4]. Early detection of skin cancer is crucial, as the survival rate is nearly 97% when caught early. However, diagnosing skin cancer accurately can be challenging, time consuming and depends on the skill of the doctor. Even the best dermatologists have less than 80% accuracy in diagnosing skin cancer correctly[3].

Recent advancements in deep learning technology can help make diagnoses more accurate, speed up important medical decisions and referrals, and lessen the workload for healthcare system and staff.

Objectives

Through this project, I aim to accomplish the following objectives:-

- An empirical analysis: Compare various deep learning models ranging from convolutional neural networks (CNNs) to advanced transfer learning models(i.e., VGG, ResNet, EfficientNet etc.)
- Vision Transformer Training: Train and evaluate the latest Vision Transformer(ViT) model and compare its performance with other models[1]
- Hyper-parameter Tuning Analysis: To analyze the effects of hyper-parameter tuning on the performance of each model to determine the optimal settings for accurate classification.
- Performance Metrics Evaluation: To assess and compare the effectiveness of each model using relevant performance metrics(i.e., accuracy, recall, specificity to see which model is correctly classifying True positive and True negative cancer cases while also maintaining False negative and False positive cases low)
- Possible Scope Extension: Test model on larger dataset, include Explainable AI(XAI) if feasible with timeline

Dataset

Kaggle version of International Skin Imaging Collaboration(ISIC) Skin Cancer Detection Dataset.

References

[1] *AN IMAGE IS WORTH 16X16 WORDS: TRANSFORMERS FOR IMAGE RECOGNITION AT SCALE.* URL: https://arxiv.org/pdf/2010.11929.pdf.

[2] Mayo Clinic. *Skin Care.* URL: https://www.mayoclinic.org/diseases-conditions/skin-cancer/.

[3] Sulaiman Al Riyaee Mohammad Ali Kadampur. *Skin cancer detection: Applying a deep learning based model driven architecture in the cloud for classifying dermal cell images.* URL: https://www.sciencedirect.com/science/article/pii/S2352914819302047#bib26.

[4] WHO. *UV radiation and skin cancer.* URL: https://www.who.int/news-room/questions-and-answers/item/radiation-ultraviolet-(uv)-radiation-and-skin-cancer/.