TITLE: Skin Cancer Segmentation and Classification using Deep Learning and Transfer Learning

TEAM:

Team Leader: Sudhanshu Vaibhav

Team Members:

No.	Roll No.	Student Name	Mobile No.	Email
1.	2200640139006	Sudhanshu Vaibhav	8859454492	sudhanshu3115@gmail.com
2.	2100640130023	Diya Gupta	8938922179	diyagupta2910@gmail.com
3.	1806413014	Kushagra Kulshrestha	6397359944	kusagrakulshrestha@gmail.com
4.	2100640130014	Astha	9639235521	astha96392255@gmail.com

INTRODUCTION

Skin Cancer is one of the most world-wide diseases that cause death. There are two types of skin cancer called Melanoma and Non-melanoma. An automated system is required for skin lesion segmentation and classification. This segmentation and classification system utilize the techniques of image processing and artificial intelligence. Early detection is critical for effective treatment and improving survival rate. With the advent of deep learning, we can classify skin cancer detection into seven different classes.

Significance of the Project:

By employing deep learning algorithm and transfer learning, the project aims to enhance the precession of skin cancer diagnosis. It automates the analysis of skin images, significantly reducing the time required for diagnosis compared to manual methods early and accurate. Early and accurate identification of skin cancer can lead to timely interventions.

Problem Statement:

The challenge is to develop an automated and accurate segmentation and classification system that can assist in identifying skin cancer types at an early stage using medical images via segmentation.

OBJECTIVES

1. Developing a Model:

The primary objective of this project is to develop a robust and accurate deep learning model for the segmentation and classification of skin cancer.

2. Type Identification:

The model aims to distinguish between types of skin lesions, particularly focusing on identifying malignant melanoma, which is the most dangerous form of skin cancer, from benign lesions. To achieve this, the project leverages both deep learning and transfer learning techniques, ensuring high performance even with limited data.

3. Dataset Collection and Processing:

Prepare the images by resizing, normalizing, and using augmentation techniques to improve the model's performance. Collect a large dataset of labeled skin lesion images, covering all types of cases.

4. Validate and Refine the System:

Create a user-friendly interface for doctors and patients that makes it simple to access risk assessments and get personalized prevention tips. Test and improve the predictive model and user interface in real-world clinical environments to ensure they are accurate, reliable, and easy to use. Explore the feasibility of implementing the trained model in clinical practice.

5. Segmentation Implementation:

To perform a segment-based process in order to leverage our data set resulting in the creation of a new collection of images which are now segmented and ready to be analyzed further for the classification being used in the project eventually improving the end results of cancer classification and segmentation by the usage of Deep learning, Machine learning and Transfer learning.

METHODOLOGY

To classify the types of cancer caused by various skin diseases, we will be incorporating Deep Learning techniques by utilizing advanced Convolutional Neural Network (CNN) models and compare their performance in various aspects for the classification of skin diseases.

Setup Implementation:

Our practical setup implementation will include training and evaluation of three different CNN architectures namely-

VGG19:

It is a deep learning model with 19 layers that specializes in image classification. It uses simple 3x3 convolutional layers to extract features, but requires significant computing power and memory. While it's accurate, it's slower to train compared to newer models.

Xception:

It is a smart deep learning model that builds on inception by using a special type of convolution called depth wise separable convolutions. This makes it more efficient, giving high accuracy while using less computing power. It’s well-suited for detailed image recognition tasks.

CNN model:

A standard CNN model uses convolutional layers to detect features from images, pooling layers to reduce data size, and fully connected layers to make predictions. It’s effective for tasks like image recognition.

U-Net Algorithm, Watershed Algorithm, Mask R-CNN, Fully Convolutional Networks etc.

Data Collection and Processing:

We’ll use publicly available medical image datasets, such as PH2, which include labeled images of various skin conditions for training and testing models. Data preprocessing will involve techniques like image augmentation (rotating and flipping) and normalization to enhance the model's performance and accuracy.

EXPECTED OUTCOMES

1. Potential Results:

The project is able is to classify the skin cancer types into seven different classes such as, melanocytic nevi, melanoma, benign keratosis-like lesions, actinic keratosis, basal cell carcinoma, dermatofibroma, vascular skin lesions.

2. Real Time Application and Scalability:

After training, these models can be used in real time diagnostic systems, assisting healthcare professionals in identifying suspicious lesions quickly and accurately.

3. Cost Effectiveness:

Once developed, AI model for skin cancer segmentation and classification can offer cost effective solution for early detection, reducing the need for expensive diagnosis. Deploying these models in low-cost mobile and web applications can enable remote diagnosis, making early detection more accessible.

4. Speed and Automation:

Deep learning models can process and analyse medical images much faster than human experts, enabling rapid diagnosis in clinical environments

REFERENCES

1. https://pdfs.semanticscholar.org/9c83/f7cb79012327a32286a255a50bd75b41bc89.pdf
2. https://www.uit.edu.mm/wp-content/uploads/2020/05/NCL-7.pdf
3. https://www.researchgate.net/publication/329911082_Skin_Cancer_Classification_using_Deep_Learning_and_Transfer_Learning
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8662405/
5. Cancer Detection (With CNN for Beginners) (kaggle.com)
6. Skin Cancer (Including Melanoma)—Patient Version - NCI
7. XCeption Model and Depthwise Separable Convolutions - (maelfabien.github.io)