

Title: AI Dermatologist

Domain: Computer vision (Deep Learning)

Objective: Integrate computer vision techniques in healthcare and leverage deep convolutional neural networks to help differentiate between melanoma and other skin pigments.

Social impact: Providing a quick and cheap diagnosis for melanoma. It is generally diagnosed visually, beginning with an initial clinical screening and followed potentially by dermoscopic analysis and biopsy. This procedure can be time consuming and expensive. Early diagnosis by automated classification of skin lesions can save thousands of lives.

Technologies used: Tensorflow (Keras) for building the neural network. Plus a web app to make the model easily accessible, built with Flask (backend) and HTML, CSS, JS

Dataset: The dataset is taken from the ISIC (International Skin Image Collaboration) Archive. It consists of 1800 pictures of benign moles and 1497 pictures of malignant classified moles.

Scalability: There are many other different types of SPLs (Suspected Pigmented Lesions), like Basal cell carcinoma, vascular lesion, actinic keratosis, etc. Our model lays the groundwork for skin cancer classification and can be extended to other skin problems, as mentioned above.

Flow of app: On the web app, there is an upload image widget with a submit button on the front end. On uploading an image and clicking the button, the image is sent to the backend where it is run through the neural network and the prediction of the model is sent back as response and displayed on the front end.

Steps involved:

- Data preprocessing which involves normalization (normalizing pixel values from 0-255 range to 0-1 range) and data augmentation (rotating, shifting of images) for improving model's performance.
- Split data into training and testing data.
- Building model in Tensorflow (Keras) using various Conv2D, MaxPooling2D, Dropout, Dense layers.
- Testing the model and evaluating performance based on various metrics, such as accuracy, F1 score, etc.
- Exploring ways to improve performance of model, including Transfer Learning (we are building our own model from scratch, transfer learning involves using a pre trained model and fine tuning it as per our use case)
- Building Flask backend to handle HTTP requests from front end, run the model and send a response.
- Building front end with team and project details, an upload image widget and a submit button using HTML, CSS and JS.

Some stats and additional info:

1. The American Cancer Society's estimates for melanoma in the United States for 2023 are: About 97,610 new melanomas will be diagnosed (about 58,120 in men and 39,490 in women). About 7,990 people are expected to die of melanoma (about 5,420 men and 2,570 women).
 2. In 2023, an estimated 97,610 adults (58,120 men and 39,490 women) in the United States will be diagnosed with invasive melanoma of the skin. Worldwide, an estimated 324,635 people were diagnosed with melanoma in 2020.
- In the United States, melanoma is the fifth most common cancer among men. It is also the fifth most common cancer among women.
3. Melanoma accounts for about 1% of all skin cancers diagnosed in the United States, but it causes most of the deaths from skin cancer.
 4. A researcher from MIT claimed, "Our research suggests that systems leveraging computer vision and deep neural networks, quantifying such common signs, can achieve comparable accuracy to expert dermatologists." Doing so would allow for more rapid and accurate assessments of SPLs (Suspicious Pigmented Lesions) and could lead to earlier treatment of melanoma, according to the researchers.