Skin Lesion Detection Project Report

1. Overview

This project implements a skin lesion classification system using deep learning. The goal is to allow users to upload a dermatoscopic image of a skin lesion and receive the predicted lesion type. The project runs through a **Flask backend** and is **containerised with Docker**, so no additional software or Python environment setup is required.

2. Dataset

The model was trained using the **HAM10000** dataset, which contains dermatoscopic images of skin lesions across seven categories.

Dataset link: *https://api.isic-archive.com/collections/212/*

Preprocessing

- Images were **centre-cropped** and then **resized to 256×256**.
- **Data augmentation** was applied on the training set to improve generalisation.

3. Model

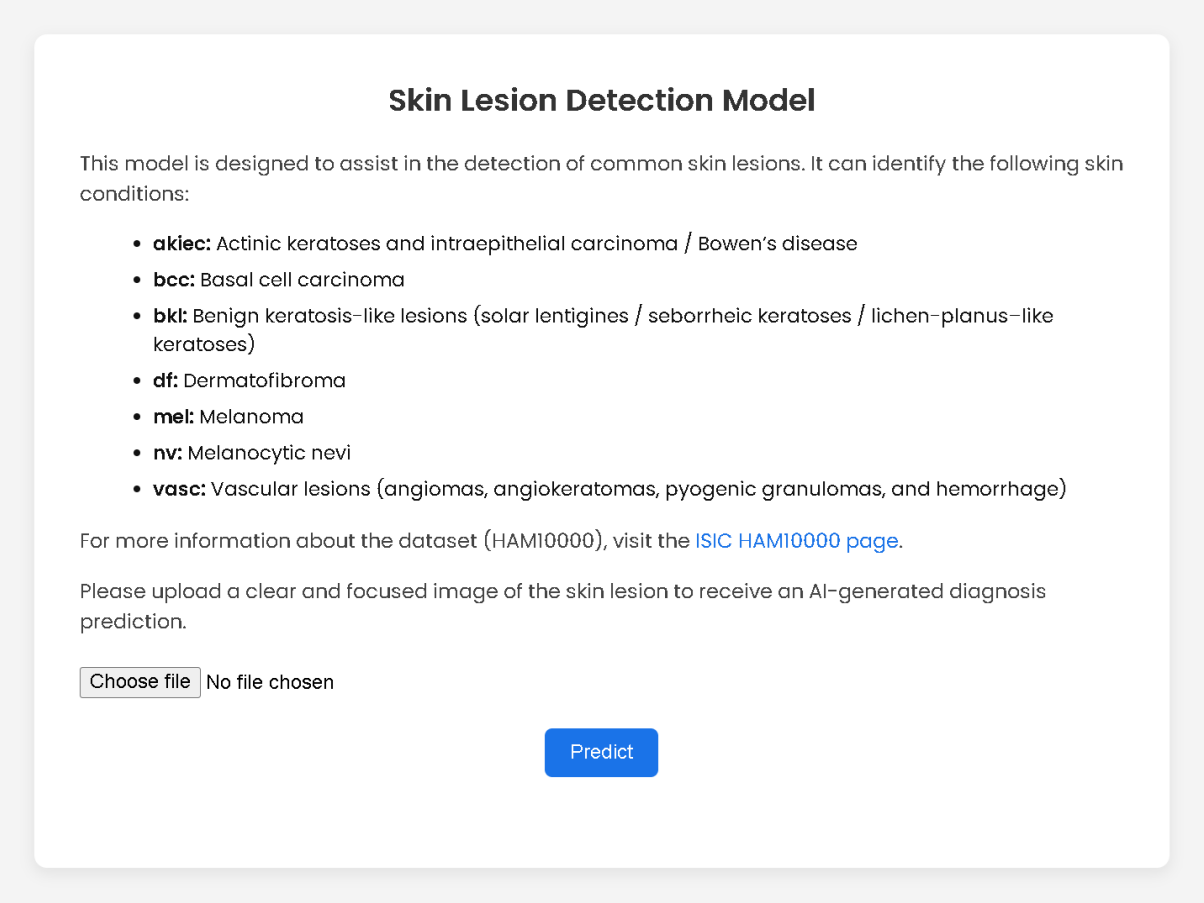
The model used is **EfficientNetB0**.

- Transfer learning was applied.
- The **top 30 layers** of the network were **unfrozen** for fine-tuning.
- After training, **threshold tuning** was performed to find the best per-class decision thresholds that maximize the **F1 score** of each class.

4. Application Interface

The user interface is a simple webpage served through Flask.

- The user uploads an image.
- The backend preprocesses the image and runs inference.
- The predicted lesion class is displayed



5. Deployment

The entire project is packaged using **Docker**, meaning:

- No external dependencies need to be installed.
- The application can be started using standard Docker commands.

6. Results

Model performance was evaluated after threshold tuning. A classification report and confusion matrix summarise how well the model performs across the seven lesion classes.

```
              precision    recall  f1-score   support

       akiec       0.30      0.58      0.40        74
         bcc       0.50      0.62      0.55       123
         bkl       0.51      0.58      0.54       278
          df       0.49      0.71      0.58        35
         mel       0.48      0.55      0.51       262
          nv       0.94      0.82      0.87      1558
        vasc       0.76      0.78      0.77        41

    accuracy                           0.74      2371
   macro avg       0.57      0.66      0.60      2371
weighted avg       0.78      0.74      0.76      2371

[[  43   11    9    4    3    4    0]
 [  19   76    6    3    9    7    3]
 [  45    8  162    5   35   22    1]
 [   2    1    1   25    2    2    2]
 [  17    9   41    2  144   49    0]
 [  17   43   96   12  108 1278    4]
 [   0    3    3    0    0    3   32]]
```

7. Conclusion

This project provides a functional skin lesion classification system using EfficientNetB0 and the HAM10000 dataset. Threshold tuning improved per-class F1 scores. The system is easy to run due to containerization, and the user interface allows image-based predictions.