Wound Classification

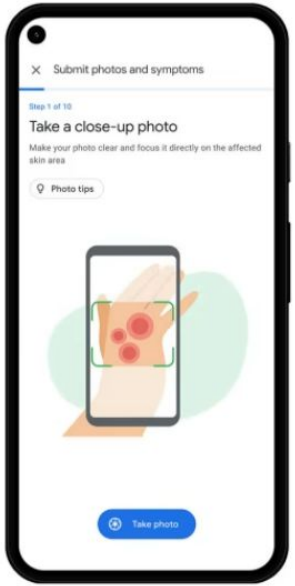
- Abhishek, Mrinoy, Samyukta

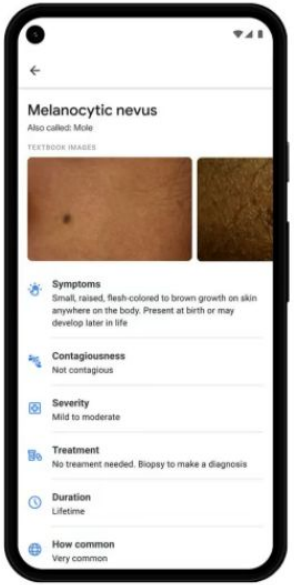
Motivation

Due to an unfortunate incident, I found myself stuck on a snowy mountain with my two friends. Things got worse and one of us ended up getting a frostbite. In this moment of despair we would have loved to have a wound detection application which could not only classify the frostbite and tell us about the severity but also give us immediate safety measures.

Previous Approaches

- GoogleDerm Assist - leveraged InceptionV4 (2016 release). [https://www.nature.com/articles/s41591-020-0842-3]
- Our approach, trying different model architectures to compare results like EfficientNet model (2019 release) and ResNet50.



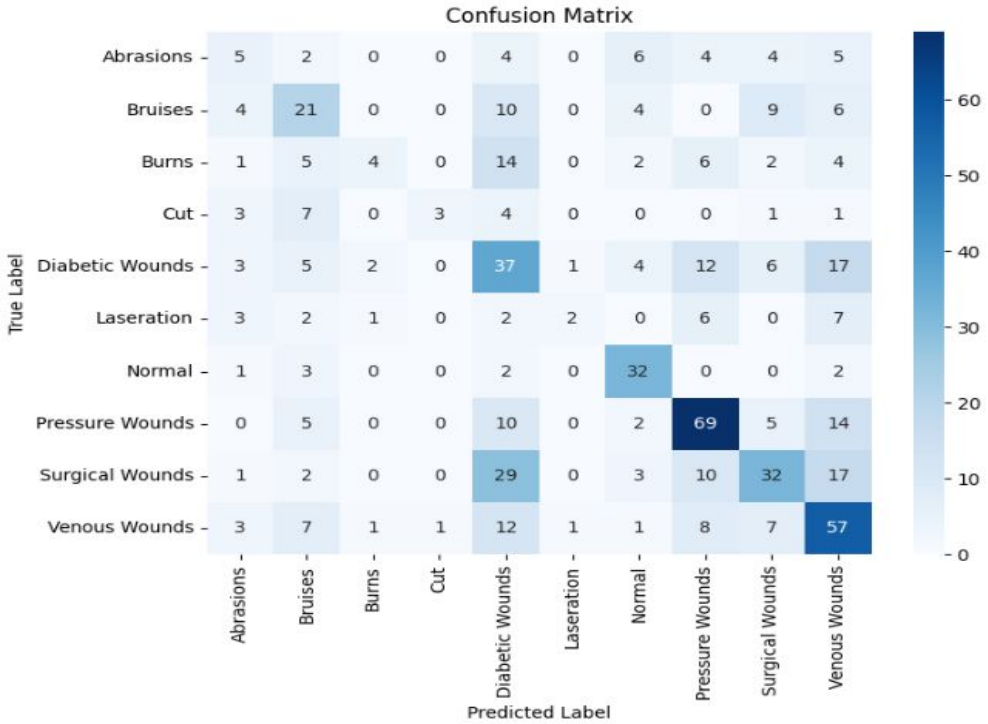


Non-Deep Learning Approach

Random Forest Classifier with StratifiedKFold

Results:

- Validation Accuracy - 0.48
- Test Accuracy - 0.45



Data Pipeline

Dataset

Collected and Categorized Wound Images Dataset: 10 classes; 2940 images

kaggle

Train_full

~90%

Test

~10%

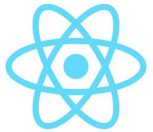
Data Augmentation

Modelling

Stratified - Cross Validation

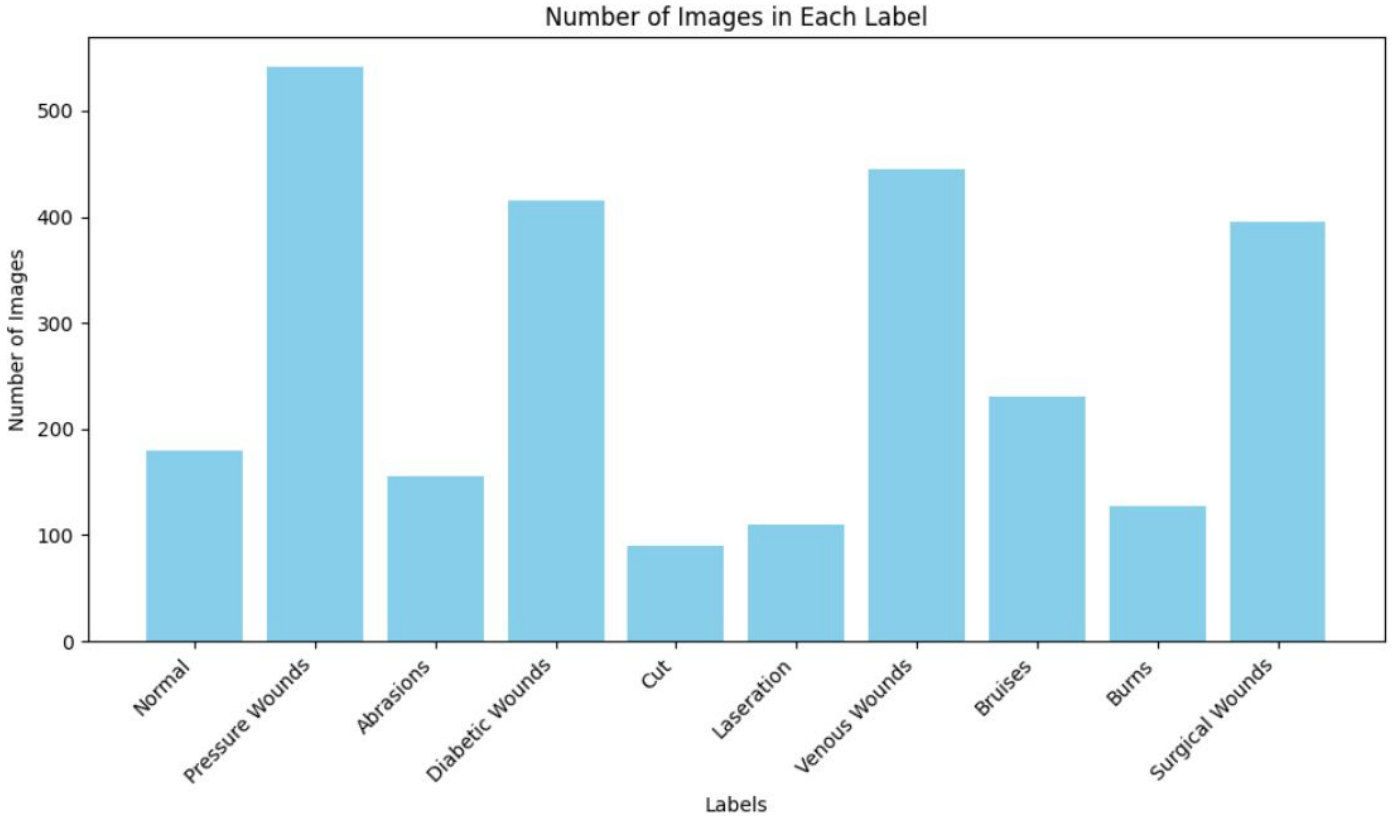
Evaluation on the best model

Pytorch -> Onyx -> Tensorflow Js



React App

Data Distribution



Data Augmentation

01 ReSize

Re-sized all images to (224, 224)

02 Horizontal & Vertical Flip

03 Rotation

By 10

04 Normalize

Based on ResNet50 - [0.485, 0.456, 0.406], [0.229, 0.224, 0.225]

Model Architectures

01
ResNet34

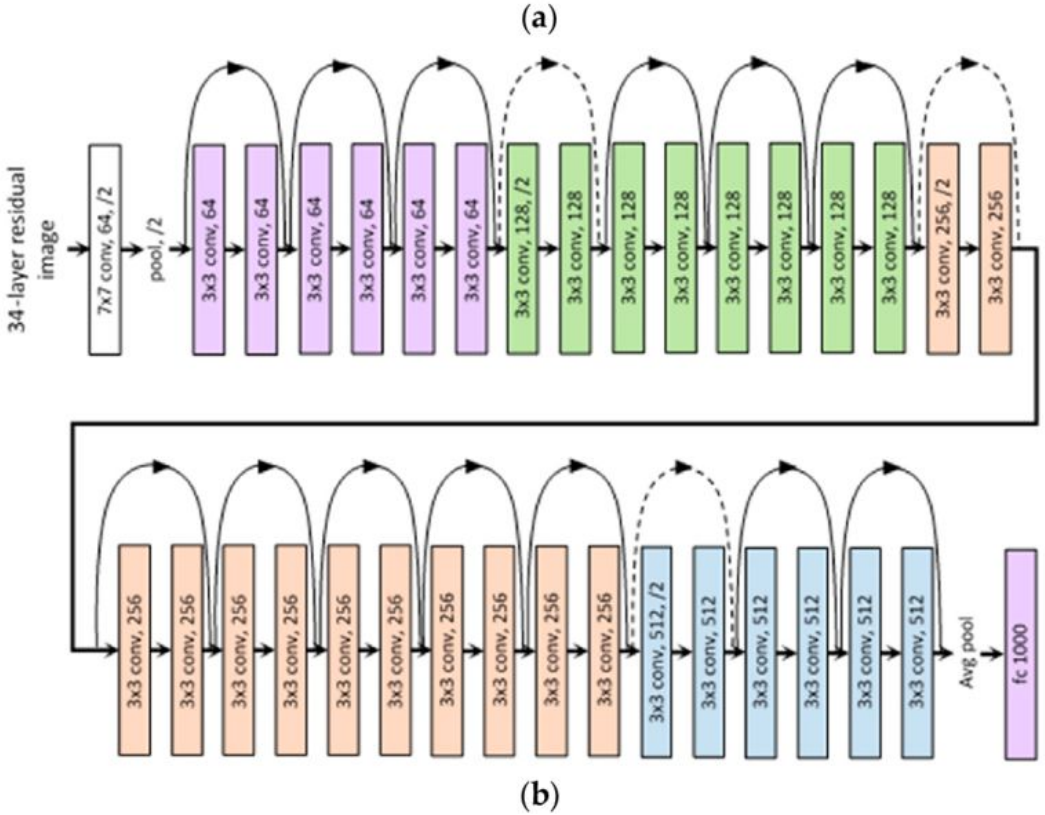
02
ResNet50

03
InceptionV3

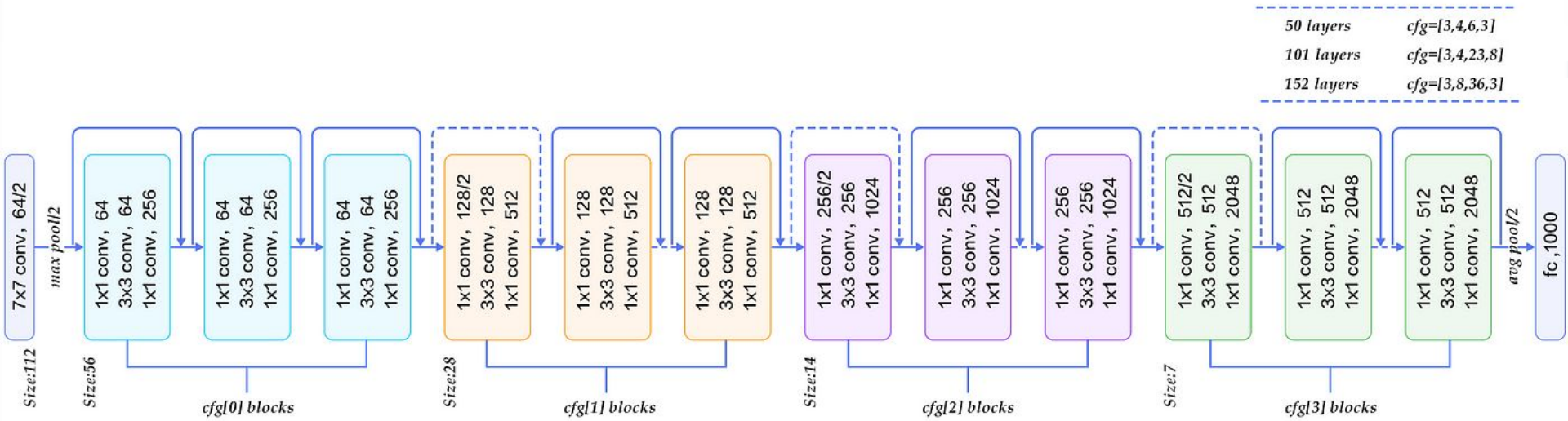
04
EfficientNet

Naive Method: ResNet34

- Froze the feature extractor layers
- Updated FC for 10 classes.

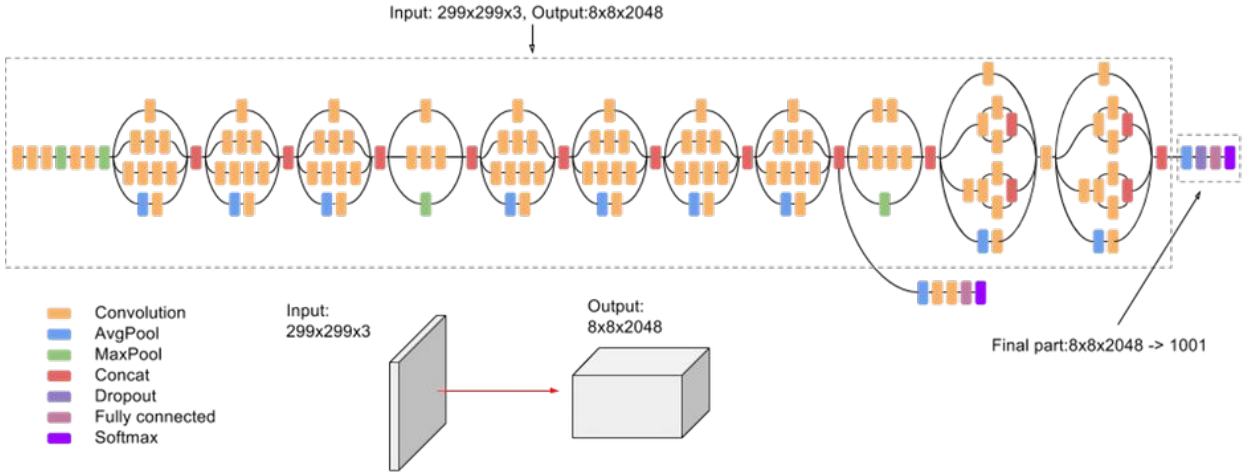


ResNet50



- Froze the feature extractor layers
- Updated FC for 10 classes.

InceptionV3



- Same processing & architecture changes

EfficientNet

It is a convolutional neural network architecture and scaling method that uniformly scales all dimensions of depth/width/resolution using a compound coefficient.

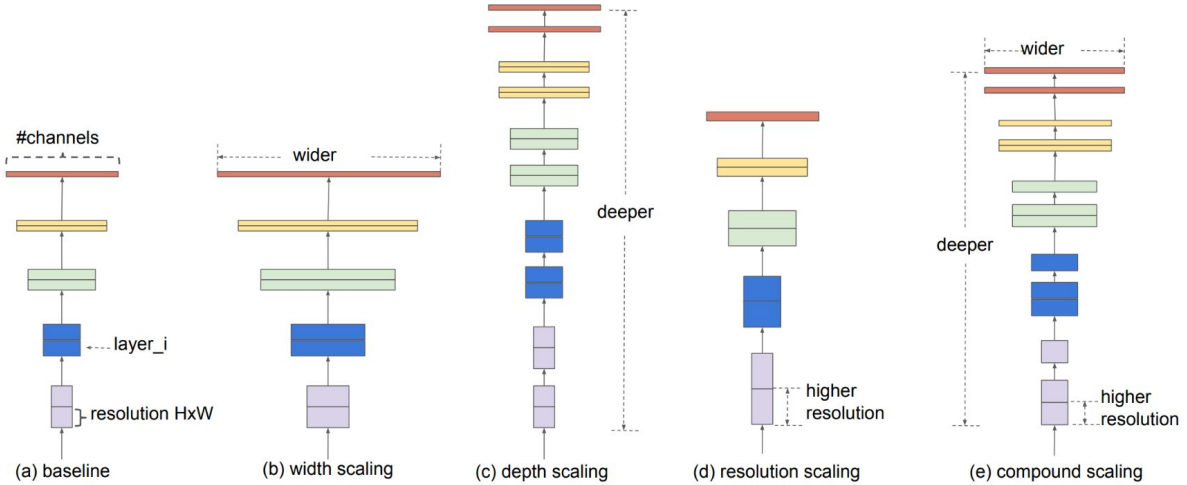
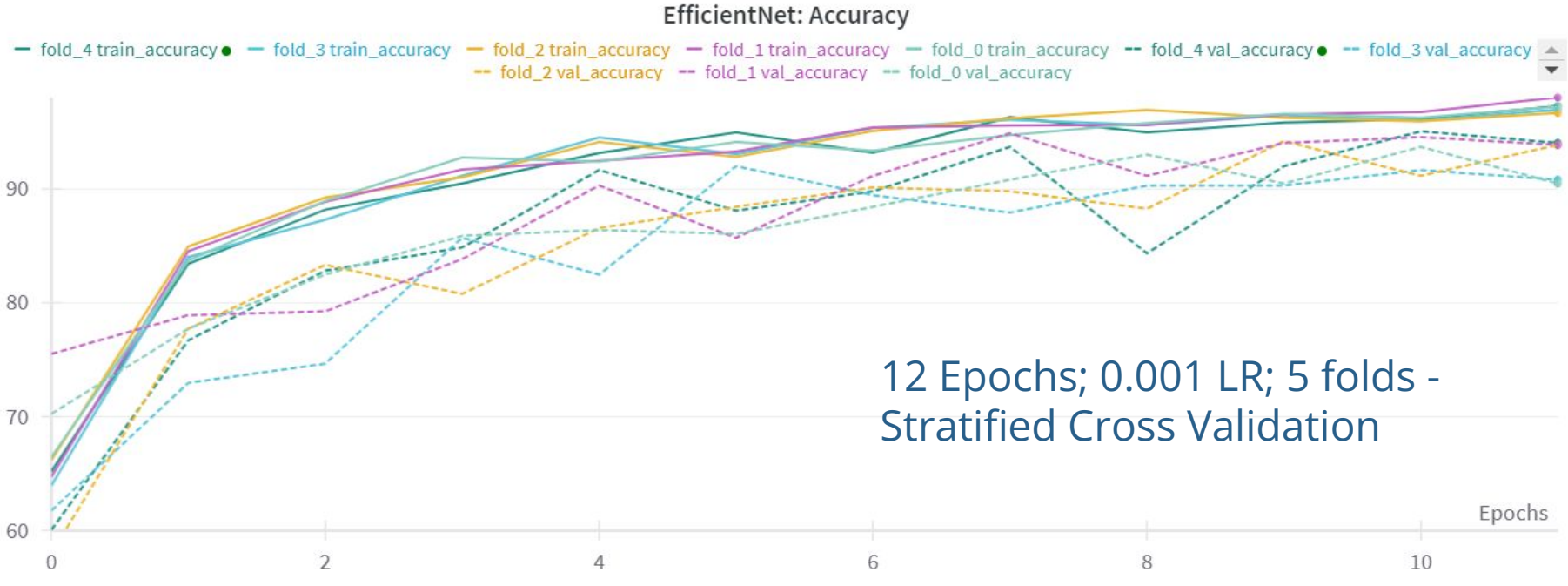


Figure 2. **Model Scaling.** (a) is a baseline network example; (b)-(d) are conventional scaling that only increases one dimension of network width, depth, or resolution. (e) is our proposed compound scaling method that uniformly scales all three dimensions with a fixed ratio.

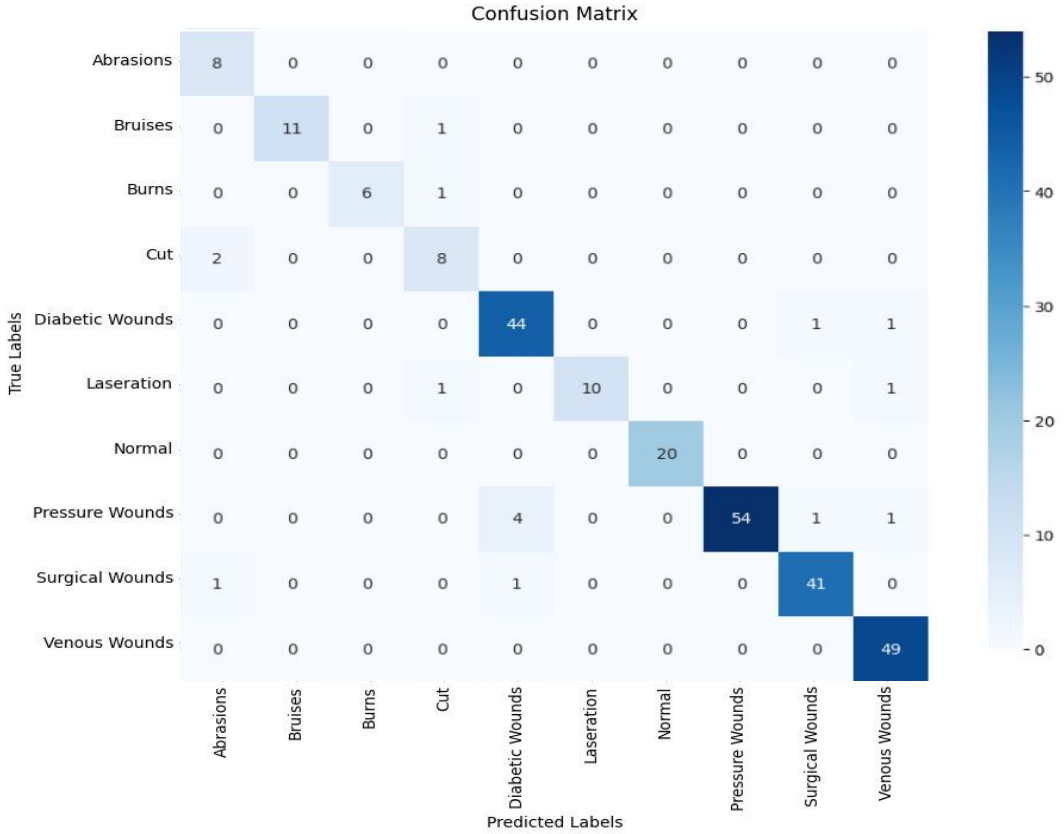
Results Summary

	EfficientNet	Inceptionv3	ResNet50	ResNet34	RandomForest
Accuracy	0.94	0.79	0.82	0.82	0.52
Precision	0.95	0.84	0.84	0.83	0.53
Recall	0.94	0.79	0.82	0.82	0.52
F1 score	0.94	0.80	0.82	0.81	0.50

EfficientNet Results



12 Epochs; 0.001 LR; 5 folds - Stratified Cross Validation



Confusion Matrix - EfficientNet

Label: Burns, Predicted: Burns

Label: Abrasions, Predicted: Abrasions

Label: Venous Wounds, Predicted: Venous Wounds

Label: Abrasions, Predicted: Abrasions

Results

Demo

Future Growth

Future app versions will feature real-time wound analysis and severity assessment. We'll train our model for wound classification and severity, using Faster R-CNN for better wound localization. This data will then be analyzed by a finely-tuned LLM to provide detailed wound insights.

Thank you!