# Skin Disease Multi-Class Classification

## Deep Learning

Team R
Nil Tomàs Plans
Yuxiang Jiang
Pau Reig Vaqué

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# Problem Statement

# Objective

## Design and train

A lightweight Convolutional Neural Network (CNN) inspired by MobileNetv2.

## Achieve

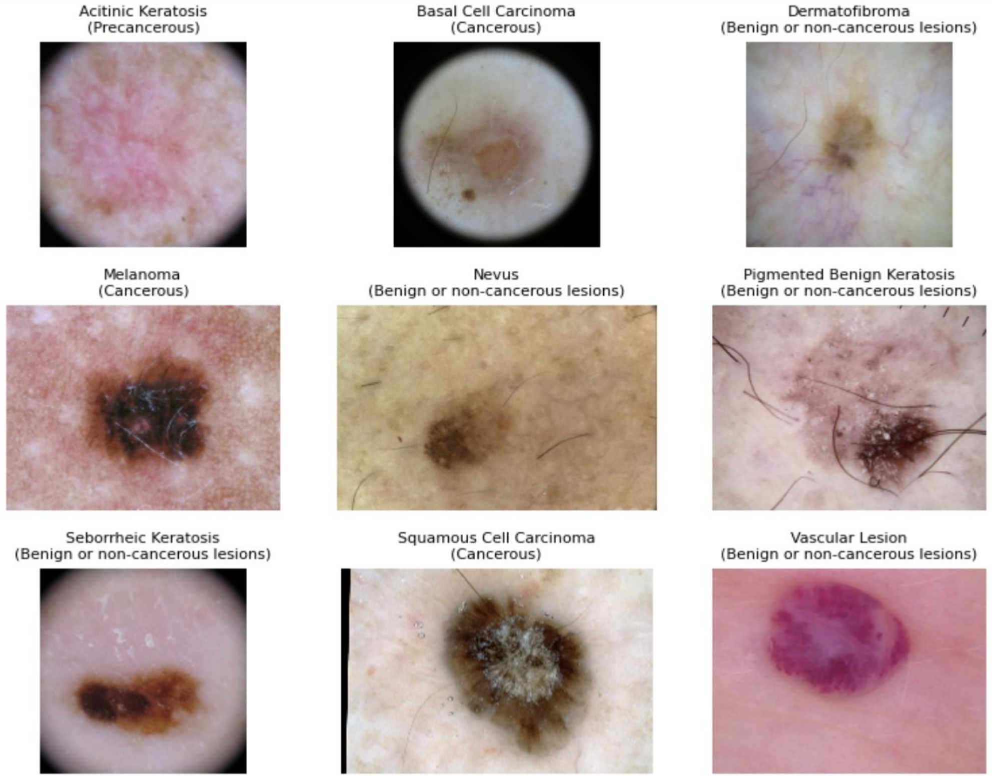
Performance comparable to the VGG16 model.

## Low and efficient

Low computational cost and time efficient.

# Dataset characteristics

Multiple Skin Disease Image Dataset.

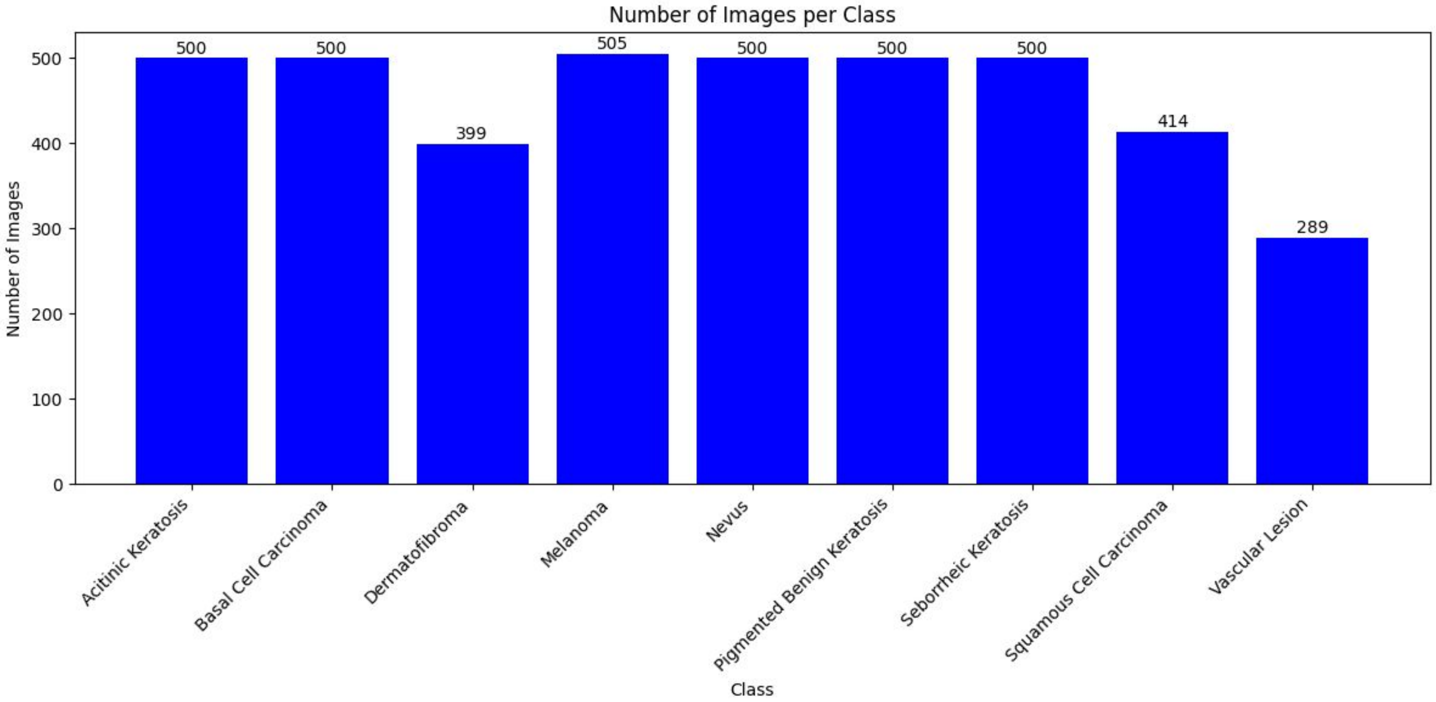



## Limitations

Small dataset: 4109 images
Noise: hair, microscope lens borders and marker artifacts.

# Dataset characteristics

## Distribution



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# State-of-art

# State of the Art

## State - of - the - art skin disease classification: a review of deep learning models

- Average an accuracy of 86.20% achieved by different deep learning models and data.

## Best model using the same dataset: VGG16 89% of accuracy

- Transfer learning with a VGG16 model with pre-trained ImageNet weights.
- >20M parameters.

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# MyEfficientCNN

# Architecture

### Inspired by MobileNetV2

### MyEfficientCNN vs MobileNetv2

- # Inverted residual blocks→# channels, parameters

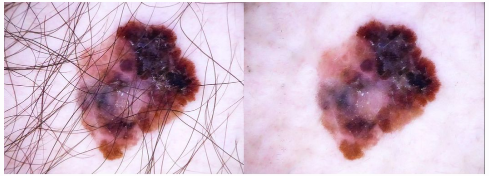
### Model structure

- Uses inverted residuals, depthwise separable convolutions, and linear bottlenecks

# Experiments

## Training approach

- Previous knowledge: good performance on simple data MNIST
- Performance in complex data?
    - Worse performance (1.5 loss, 50.7% accuracy)
    - Test with data pre-processing (Dull Razor algorithm) →



- Data augmentation: ±15° rotation, flipping
    - + Generalization
    - + Robustness
    - Diverse data

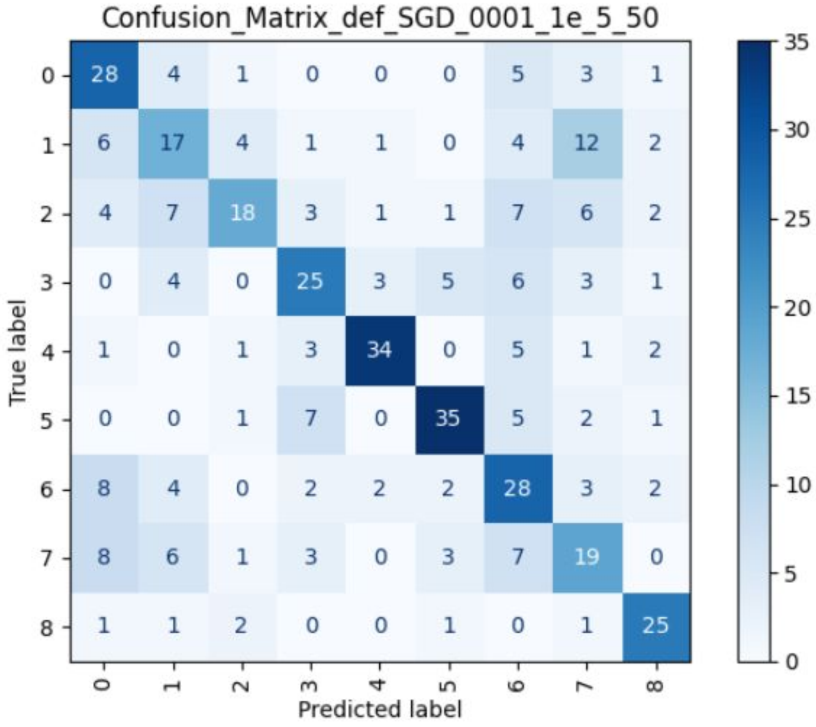
- Hyperparameters

# Experiments

## Test

Results test set:
**Loss**: 1.26
**Recall**: 56.63%
**Accuracy**: 55.58%

**Confusion mtx:** observe label predictions against labels of each class



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# Transfer Learning

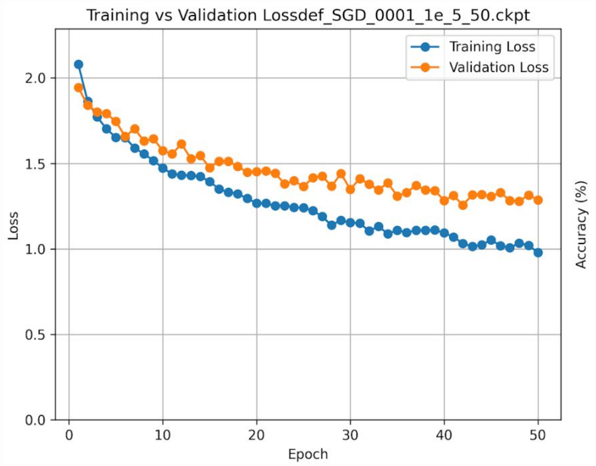
# Transfer Learning Methodology

## MobileNetV2

- Pretrained on ImageNet (1,000 classes).
- Lightweight model: ~2M parameters vs ~20M in VGG.

## Why we choose it?

- Custom model are not strong enough
- Limited input data




## Data adaptation

- Normalized with ImageNet mean and std.

# Experiments

## Training approach

- Input size: 224x224
- Number of total parameters: 2,235,401
- Feature Extraction
    - **Validation Loss:** 1.30, **Accuracy:** 57.32%, **Recall:** 56.82
    - **Trainable variables**: 11,529

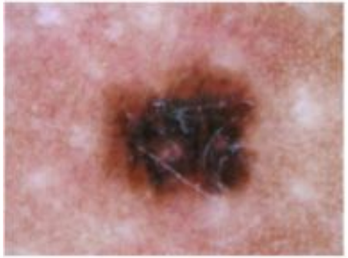
- Fine Tuning (Unfreezing the last layers)
    - **Validation Loss:** 0.82, **Accuracy:** 73.41%, **Recall:** 73.03%
    - **Trainable variables**: 1,996,041

# Experiments

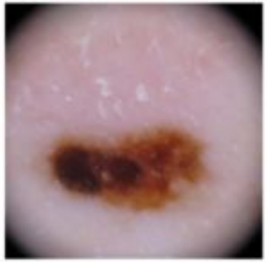
## Test

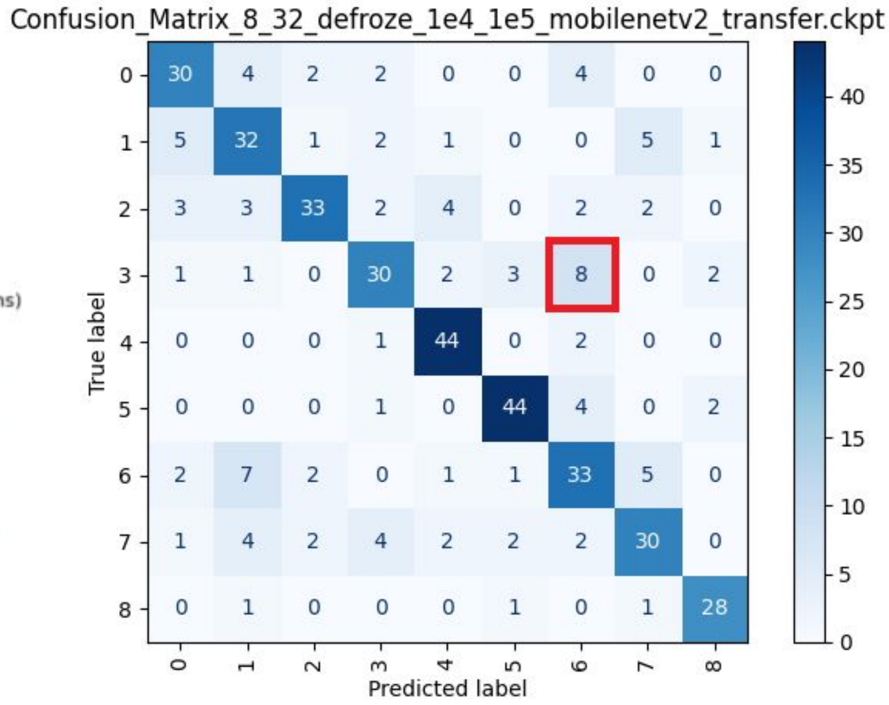
Results test set:
**Loss**: 0.8205, **Accuracy**: 73.79%,
**Recall**: 74.38%

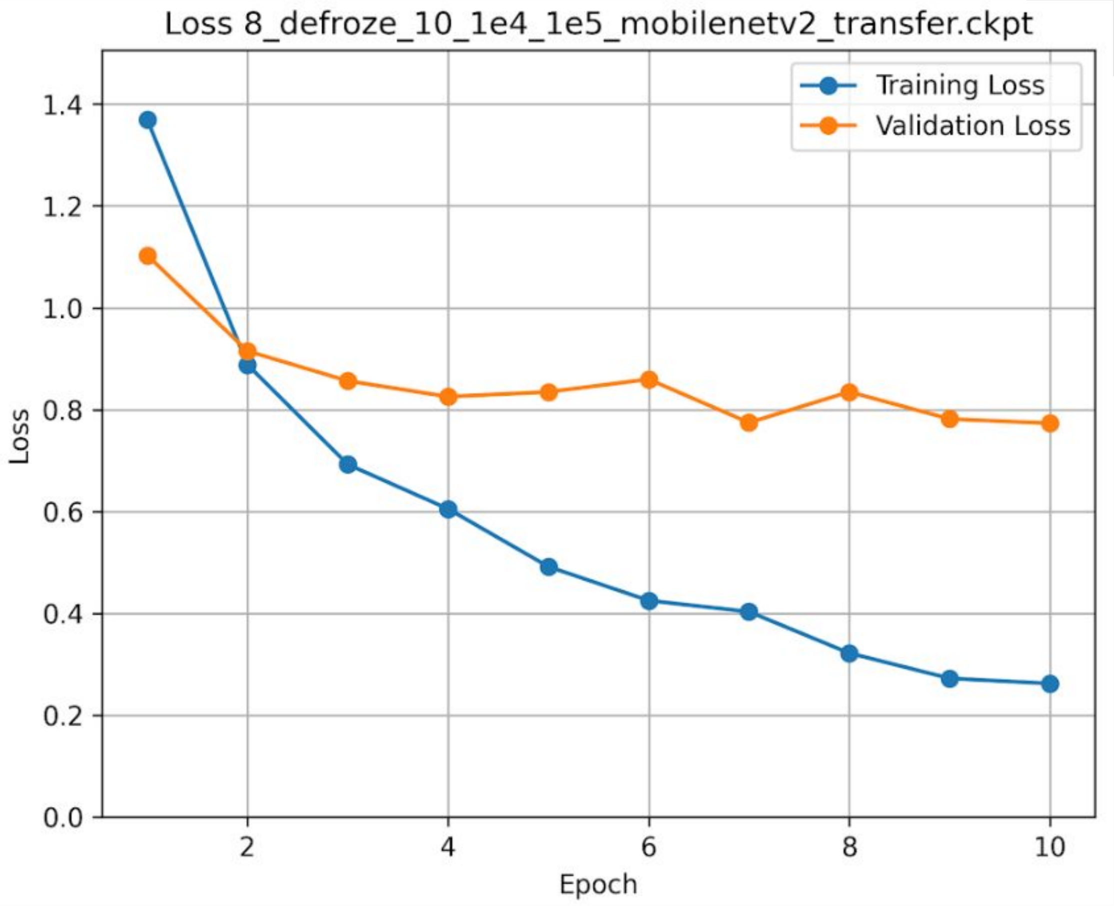
Melanoma
(Cancerous)



Seborrheic Keratosis
(Benign or non-cancerous lesions)






Loss 8_defroze_10_1e4_1e5_mobilenetv2_transfer.ckpt
Training Loss
Validation Loss
Loss
Epoch
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
2
4
6
8
10

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# Conclusions

## What worked?

- Transfer learning improves performance over our model.
- 2M param close results to VGG16 (20.5M).

## What didn't work?

- Did not achieve the VGG16 results.
- Obtain acceptable results with MyEfficientCNN.

## Future work:

- Image processing techniques: segmentation, color spaces.
- Cross validation: builds a robust model.

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# References

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# THANK YOU

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