




# PIGMENTED SKIN LESIONS DIAGNOSIS

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# MOTIVATION

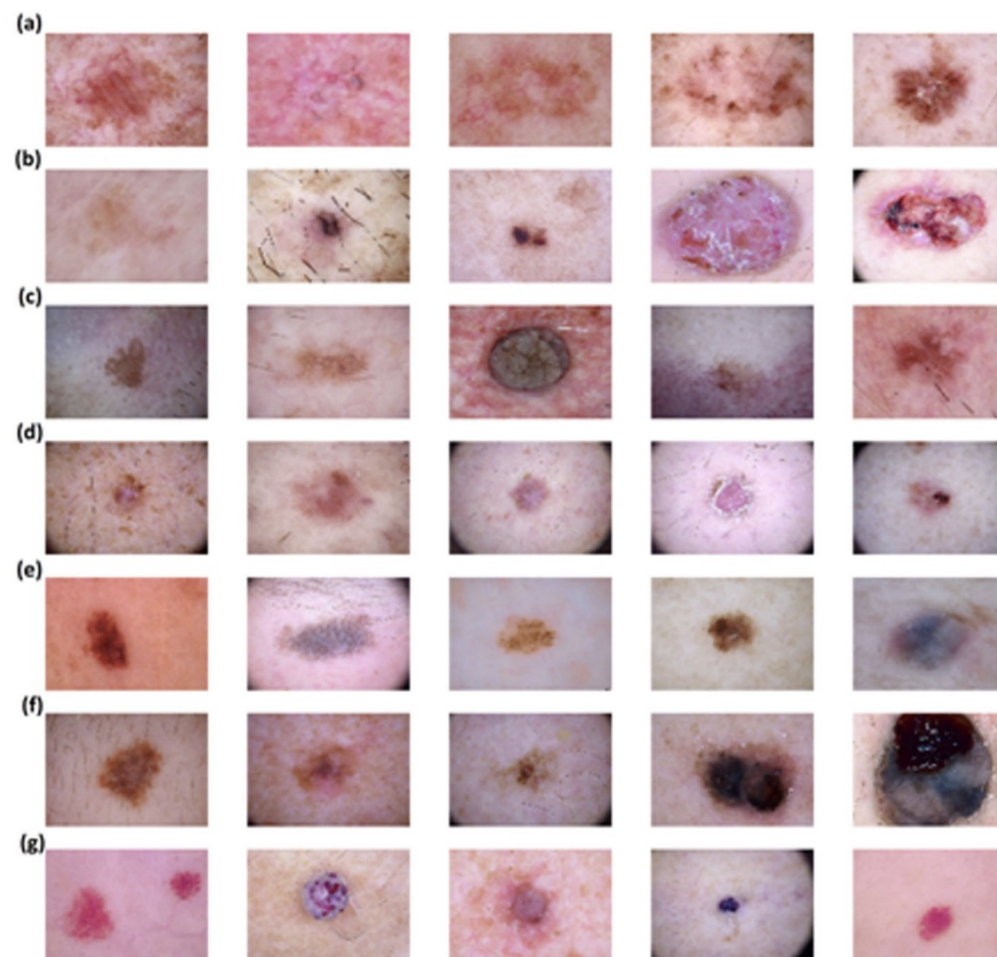
- Skin Cancer accounts for **1/3** of all diagnosed cancers worldwide.
- The dermatologists :62% to 80% in skin cancer diagnosis.
- In 2020 Chaturvedi, S.S. used **ResNeXt101** model gains maximum accuracy of **93.20%**.
- In 2022, A. K. Sharma et al., used Cascaded ensembled deep learning model gains 98.3% accuracy.

# DATA SOURCE

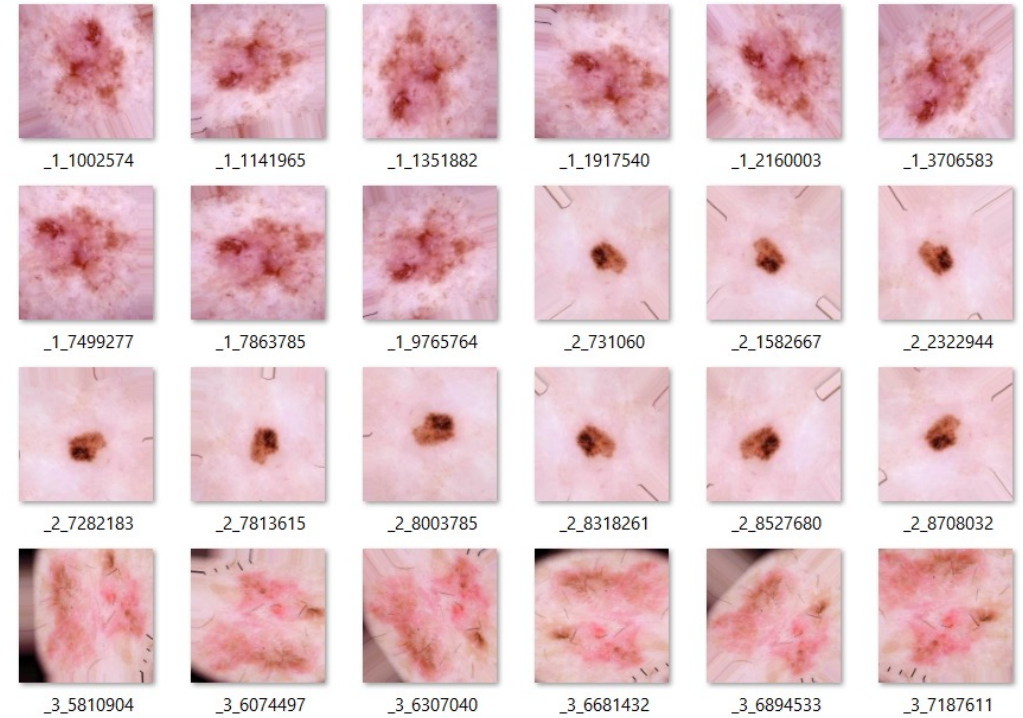
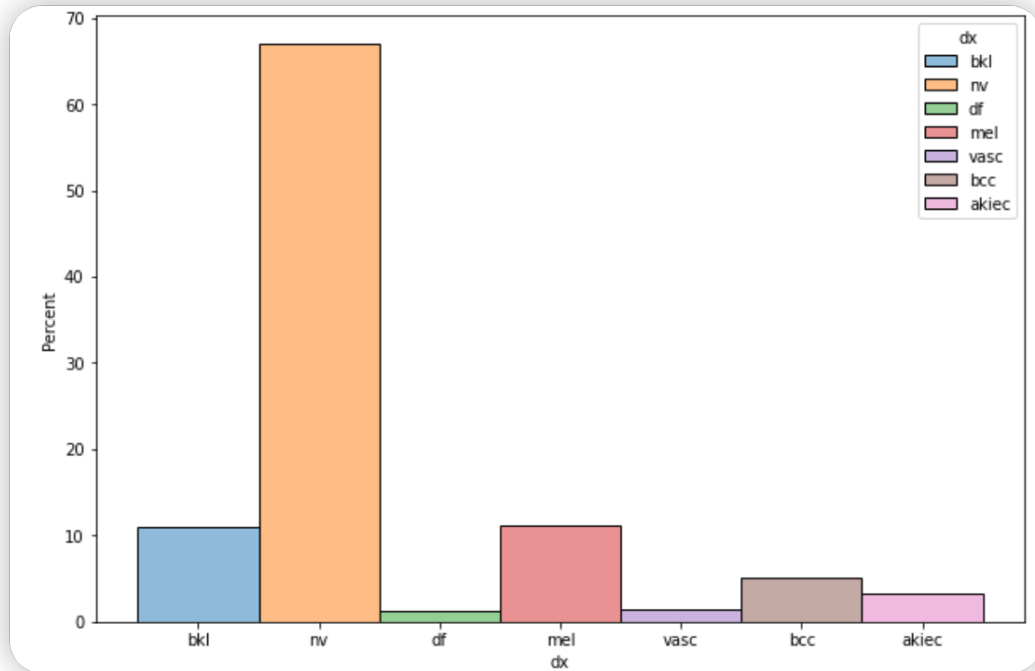
- Tschandl, Philipp, 2018, “**The HAM10000 dataset**, a large collection of multi-source dermatoscopic images of common pigmented skin lesions”, Harvard Dataverse, <https://doi.org/10.7910/DVN/DBW86T>

# DATASET

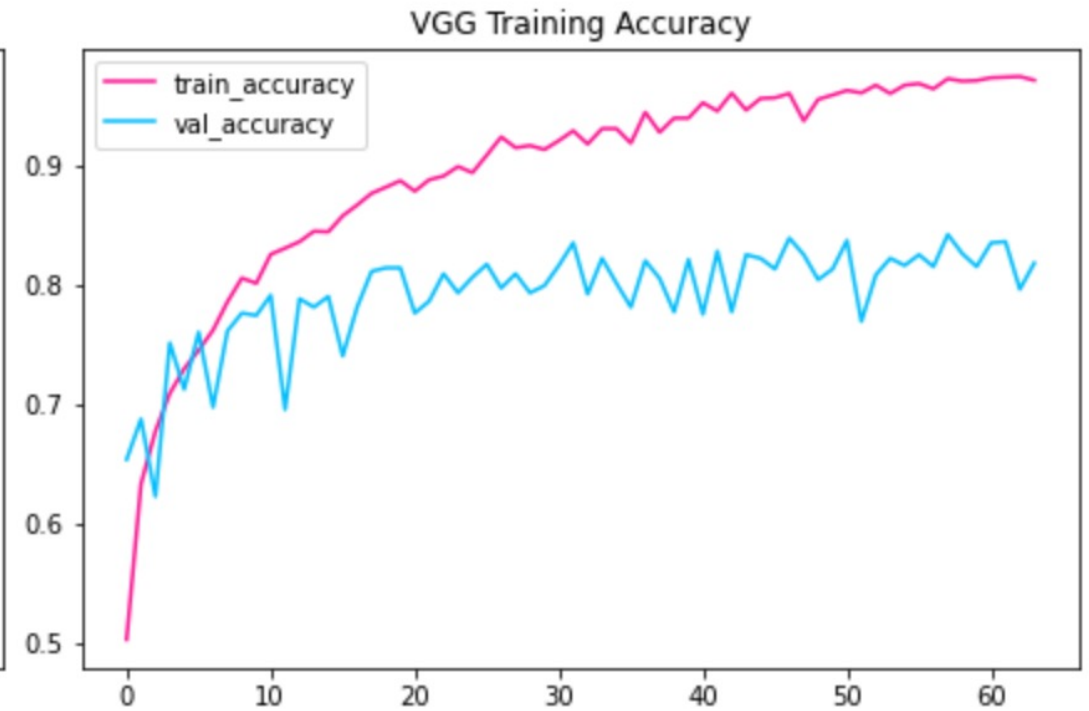
- 10,015 dermatoscopic images for Training
- 193 images for Testing
- 7 important diagnostic categories



# DATA AUGMENTATION



# APPROACH



- CNN, InceptionV3, VGG19, ResNet150V2

- Initiate with imagenet weights
- Transform last three layers

# RESULT

## Metrics

|              | precision | recall | f1-score | support |
|--------------|-----------|--------|----------|---------|
| akiec        | 0.60      | 0.38   | 0.46     | 8       |
| bcc          | 0.92      | 0.73   | 0.81     | 15      |
| bkl          | 0.47      | 0.32   | 0.38     | 22      |
| df           | 0.00      | 0.00   | 0.00     | 1       |
| mel          | 0.50      | 0.24   | 0.32     | 21      |
| nv           | 0.80      | 0.93   | 0.86     | 123     |
| vasc         | 1.00      | 1.00   | 1.00     | 3       |
| accuracy     |           |        | 0.75     | 193     |
| macro avg    | 0.61      | 0.51   | 0.55     | 193     |
| weighted avg | 0.73      | 0.75   | 0.73     | 193     |

Figure 2.1 CNN

|              | precision | recall | f1-score | support |
|--------------|-----------|--------|----------|---------|
| akiec        | 0.71      | 0.62   | 0.67     | 8       |
| bcc          | 1.00      | 0.80   | 0.89     | 15      |
| bkl          | 0.73      | 0.73   | 0.73     | 22      |
| df           | 1.00      | 1.00   | 1.00     | 1       |
| mel          | 0.68      | 0.62   | 0.65     | 21      |
| nv           | 0.90      | 0.94   | 0.92     | 123     |
| vasc         | 1.00      | 1.00   | 1.00     | 3       |
| accuracy     |           |        | 0.86     | 193     |
| macro avg    | 0.86      | 0.82   | 0.84     | 193     |
| weighted avg | 0.86      | 0.86   | 0.86     | 193     |

Figure 2.2 Inception

|              | precision | recall | f1-score | support |
|--------------|-----------|--------|----------|---------|
| akiec        | 0.67      | 0.50   | 0.57     | 8       |
| bcc          | 0.60      | 0.80   | 0.69     | 15      |
| bkl          | 0.65      | 0.68   | 0.67     | 22      |
| df           | 0.00      | 0.00   | 0.00     | 1       |
| mel          | 0.71      | 0.57   | 0.63     | 21      |
| nv           | 0.90      | 0.92   | 0.91     | 123     |
| vasc         | 1.00      | 0.33   | 0.50     | 3       |
| accuracy     |           |        | 0.81     | 193     |
| macro avg    | 0.65      | 0.54   | 0.57     | 193     |
| weighted avg | 0.81      | 0.81   | 0.81     | 193     |

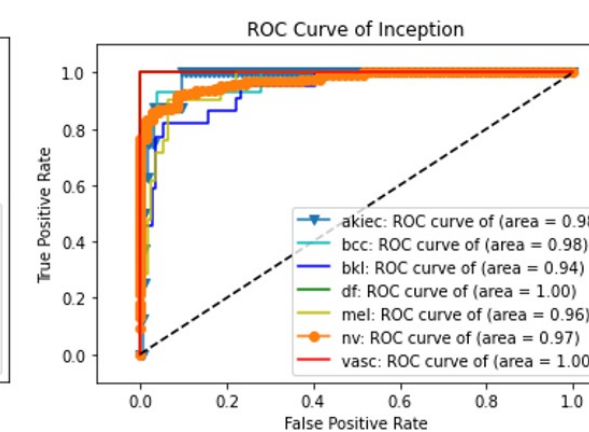
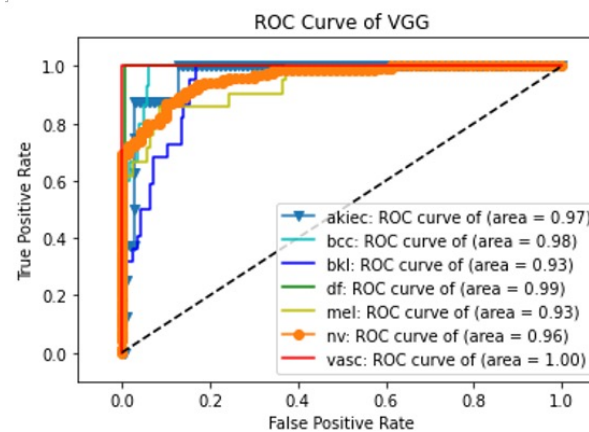
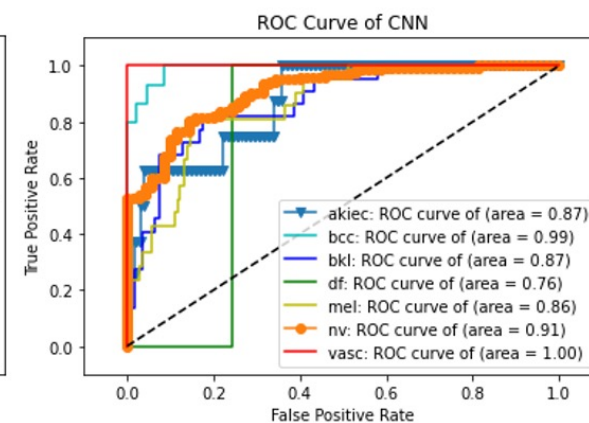
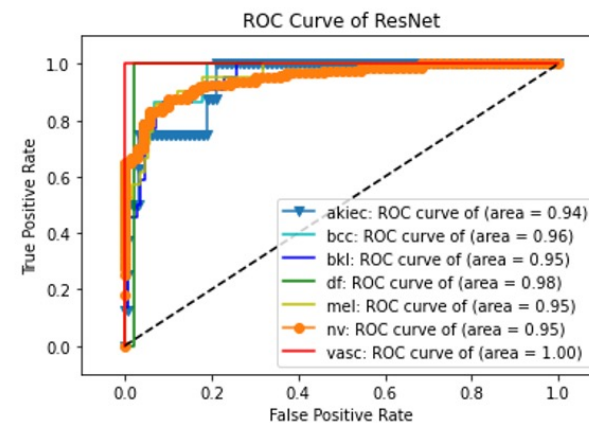
Figure 2.3 ResNet150V2

|              | precision | recall | f1-score | support |
|--------------|-----------|--------|----------|---------|
| akiec        | 0.38      | 0.38   | 0.38     | 8       |
| bcc          | 0.62      | 0.67   | 0.65     | 15      |
| bkl          | 0.57      | 0.36   | 0.44     | 22      |
| df           | 0.00      | 0.00   | 0.00     | 1       |
| mel          | 0.62      | 0.76   | 0.68     | 21      |
| nv           | 0.90      | 0.92   | 0.91     | 123     |
| vasc         | 1.00      | 1.00   | 1.00     | 3       |
| accuracy     |           |        | 0.79     | 193     |
| macro avg    | 0.58      | 0.58   | 0.58     | 193     |
| weighted avg | 0.78      | 0.79   | 0.78     | 193     |

Figure 2.4 VGG19

# RESULT

## ROC Curve





# CONCLUSION

InceptionV3 is the best model (86% weighted accuracy)  
Reasons can be:

- Factorized Convolution

By replacing  $5 \times 5$  kernel using 2  $3 \times 3$  kernel, replacing  $3 \times 3$  kernel by  $1 \times 3$  and  $3 \times 1$  kernel, improve computation efficiency.

- Auxiliary Classifier

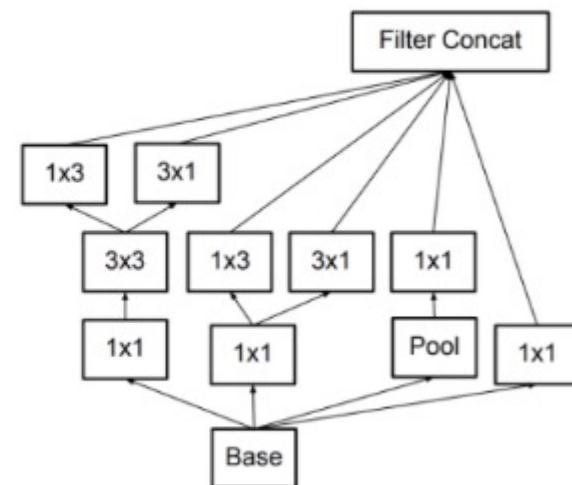
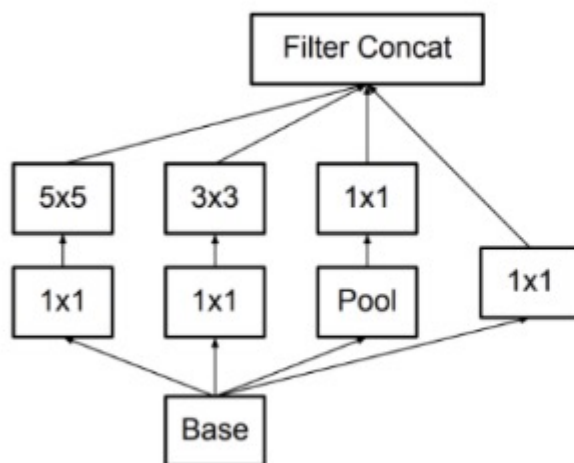
An auxiliary classifier is a small CNN inserted between layers during training, and the loss incurred is added to the main network loss. It works as a regularizer.



# Thanks

Q&A

## Backup Factorized Convolutions:



## Backup Auxiliary classifier

