Capstone Project:
Acne detection using Convolutional Neural Network (CNN)

Presented by Wei Hua

Background

Company launching new acne skincare products

Objective

To build a CNN model and make predictions to determine acne skin

Benefits

Enhance shopping experience both online and physical stores

General Workflow

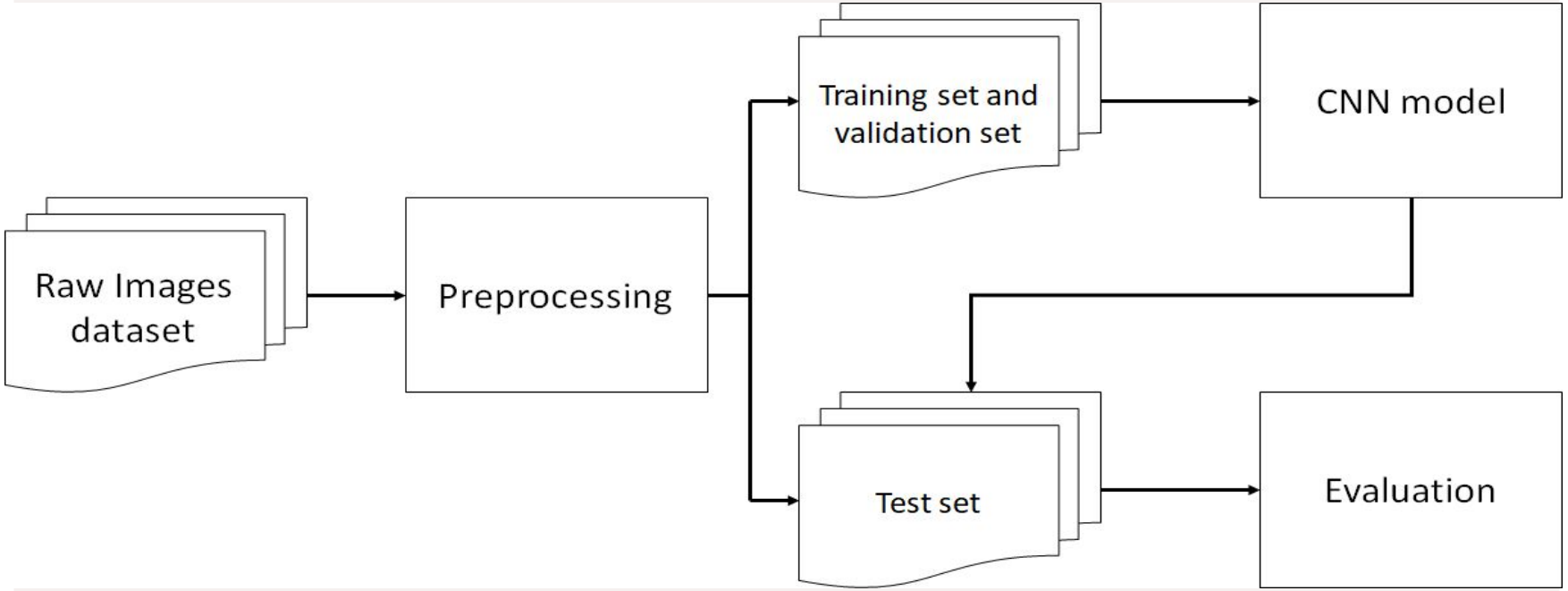


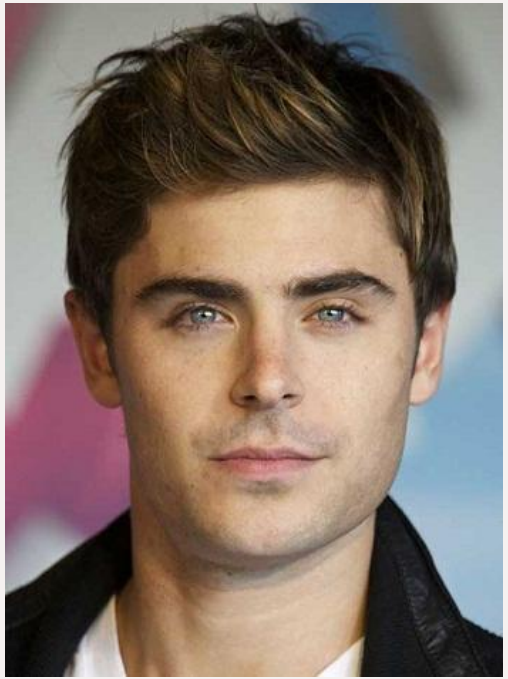
Image preprocessing (Non-Acne)

Apply method:

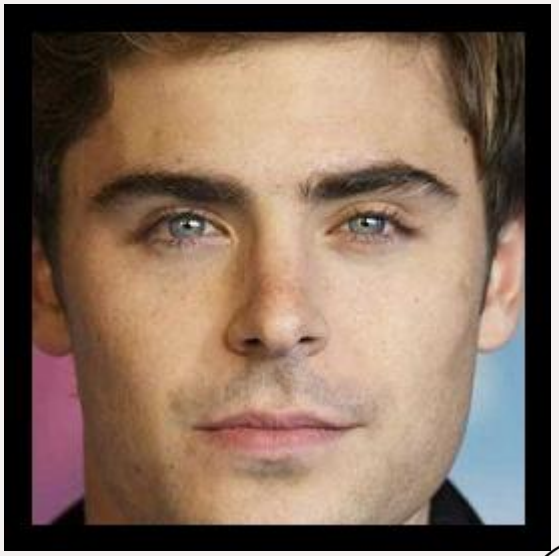
1. Haar Cascade for face detection

2. Add border to the image

Before



After



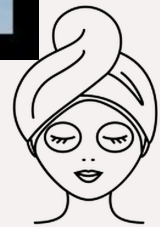


Image preprocessing (Acne)

Apply method:

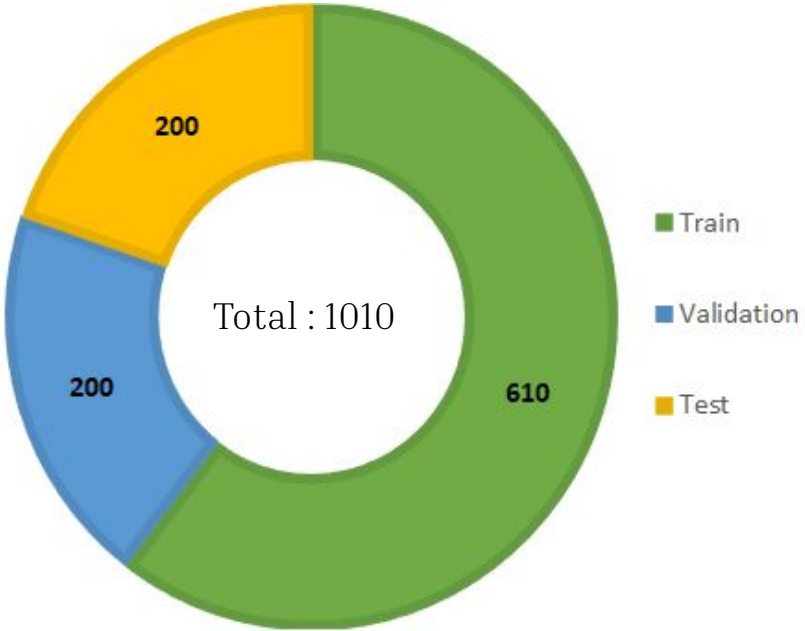
1. Haar Cascade for face detection

2. Add border to the image

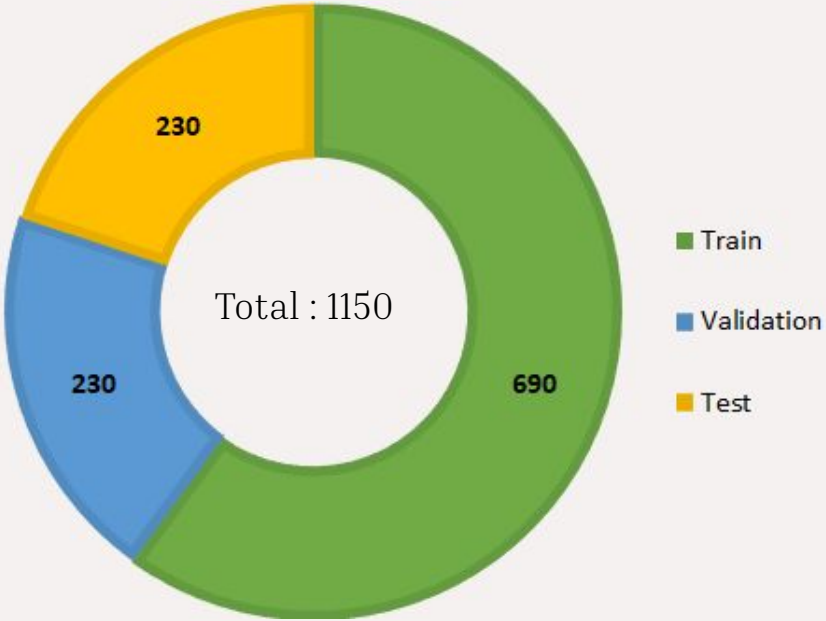
Before

After

Acne Dataset



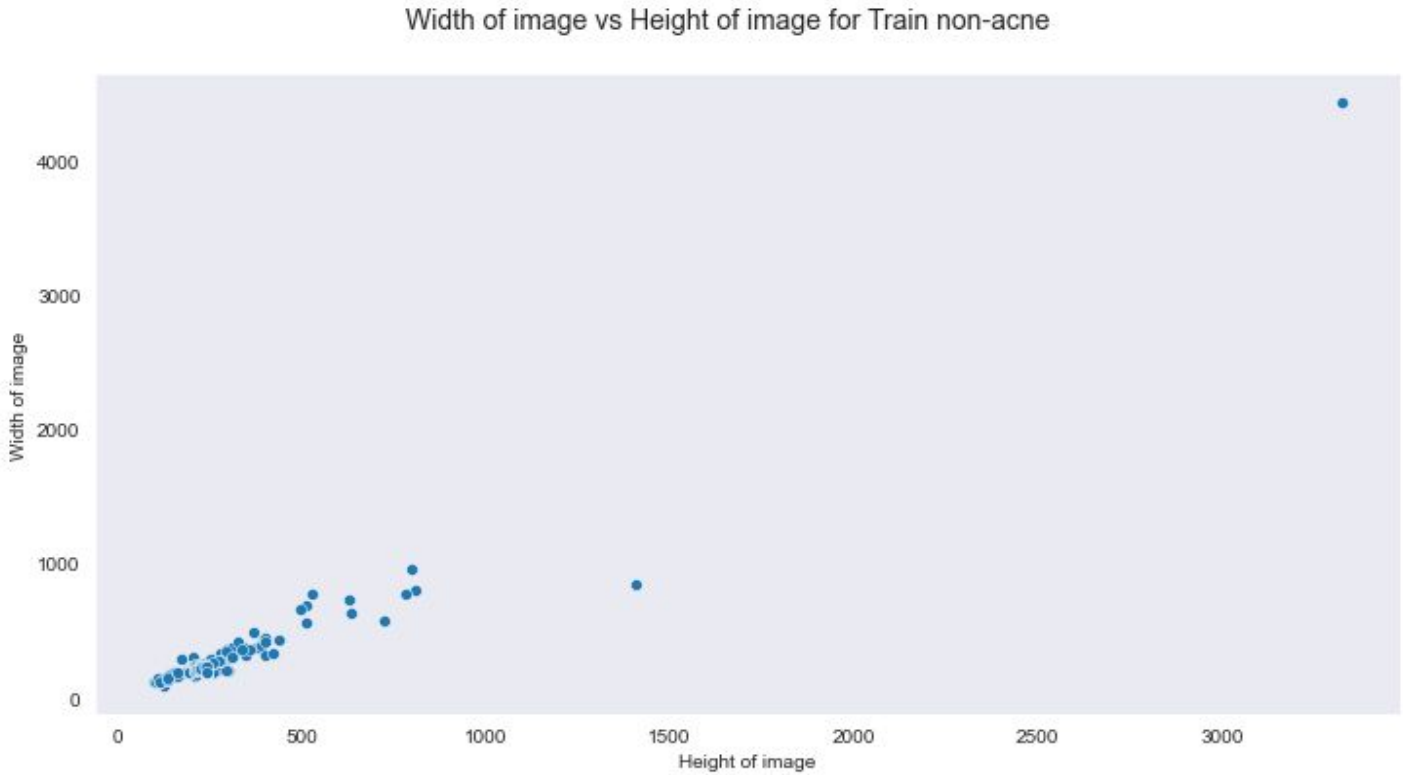
Non-Acne Dataset



EDA


Distribution of images in train
count
700
600
500
400
300
200
100
0
NON_ACNE
ACNE

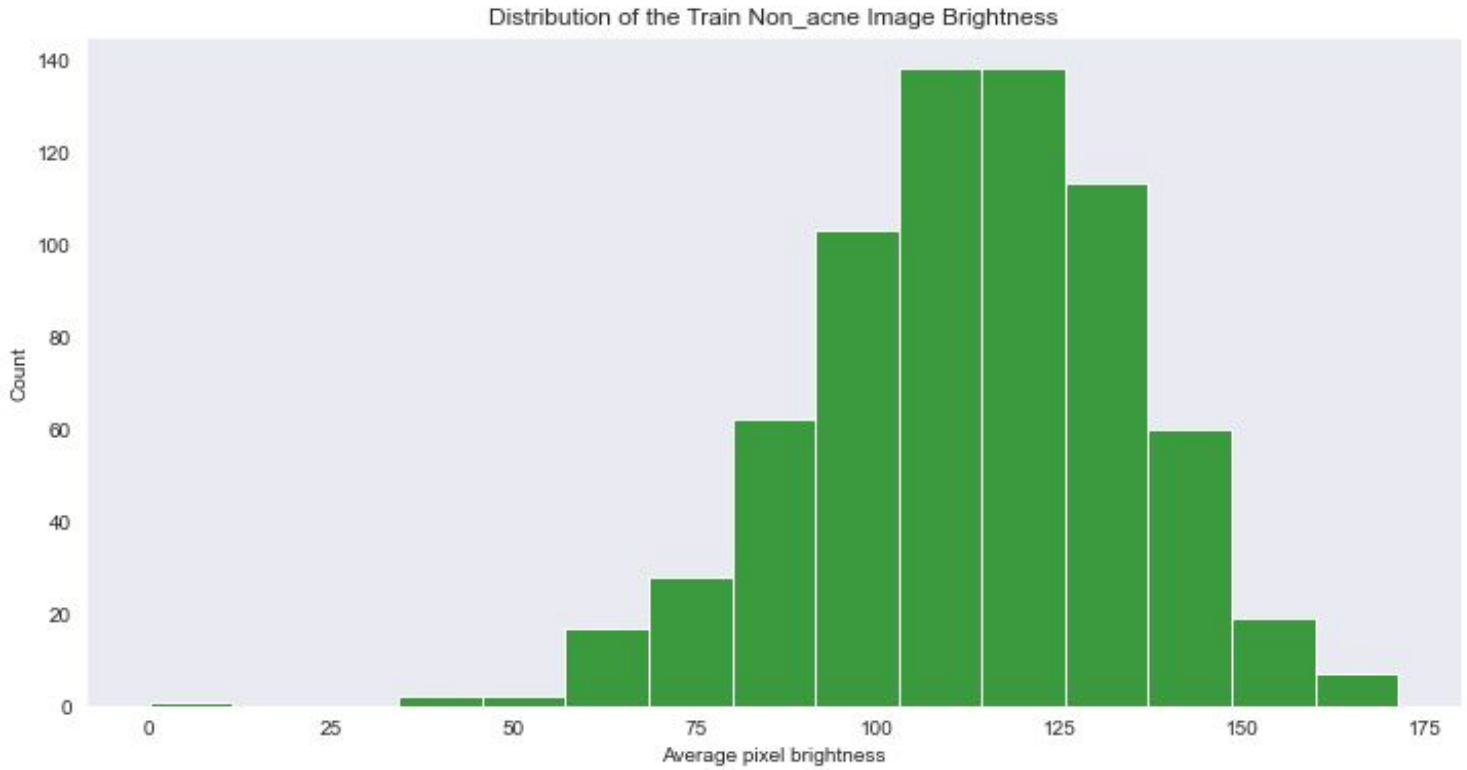
EDA


Width of image vs Height of image for Train non-acne
Width of image
Height of image
0
1000
2000
3000
4000
0
500
1000
1500
2000
2500
3000

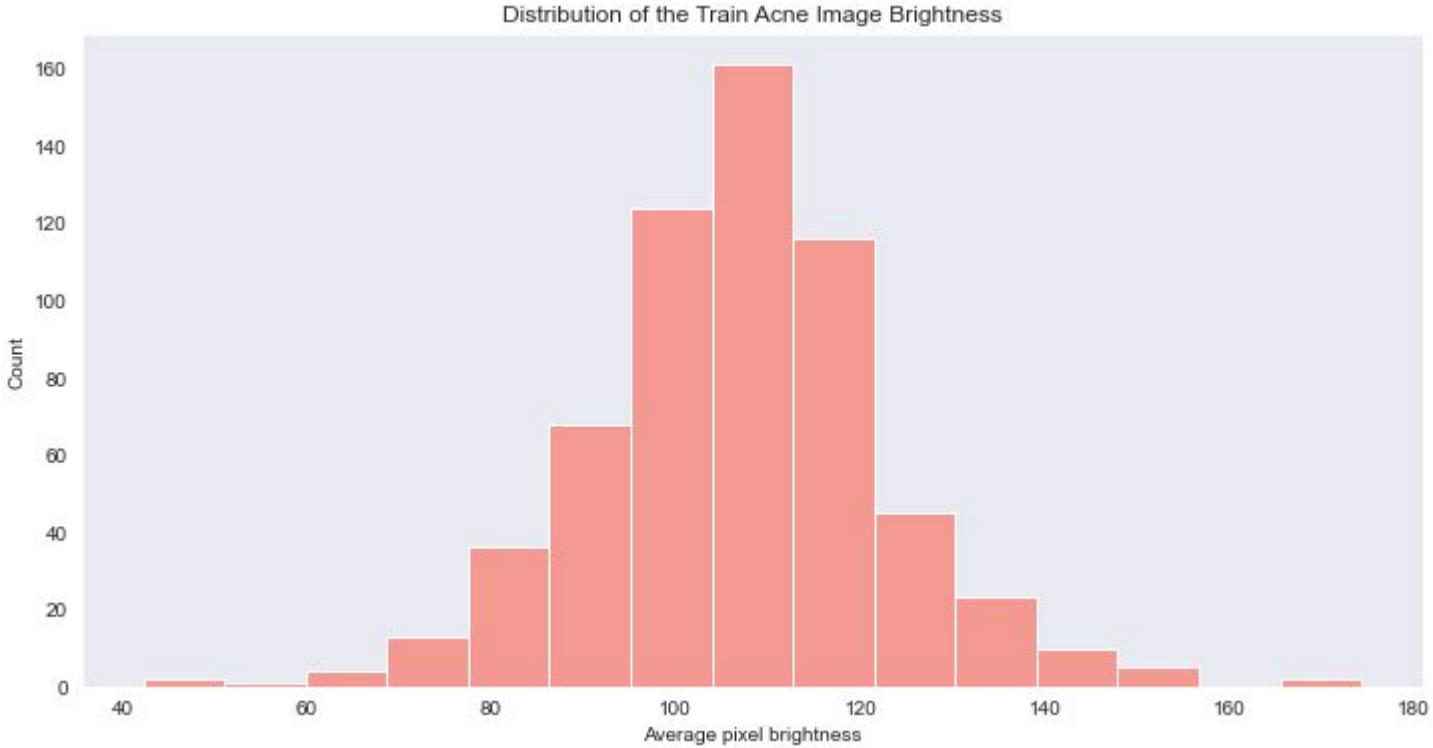
EDA


Width of image vs Height of image for Train acne
Width of image
Height of image
0
500
1000
1500
2000
2500

EDA


Distribution of the Train Non_acne Image Brightness
Count
0
20
40
60
80
100
120
140
0
25
50
75
100
125
150
175
Average pixel brightness

EDA


Distribution of the Train Acne Image Brightness
Count
0
20
40
60
80
100
120
140
160
40
60
80
100
120
140
160
180
Average pixel brightness

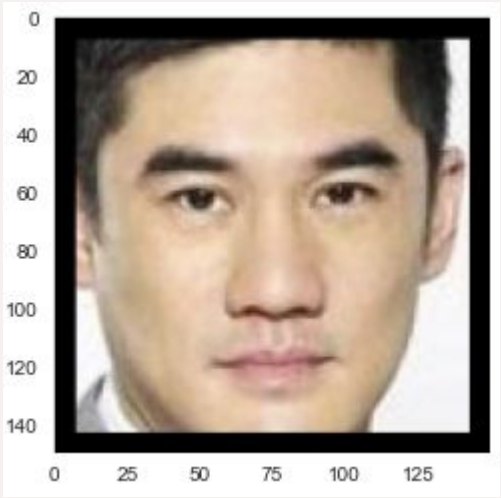
Data Preprocessing and Data Augmentation

Apply method:

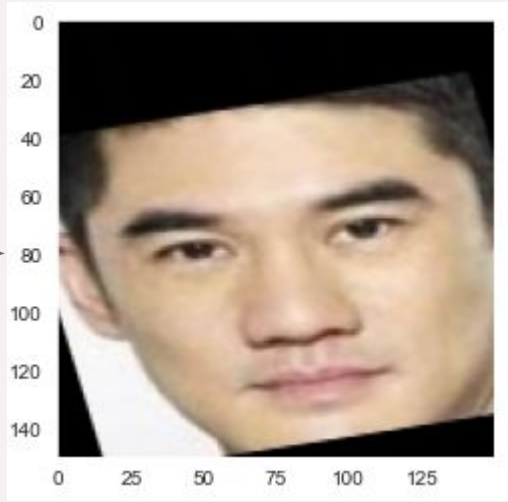
1. Image resize and normalising

2. Image Data Generator for train images

Before



After



CNN model

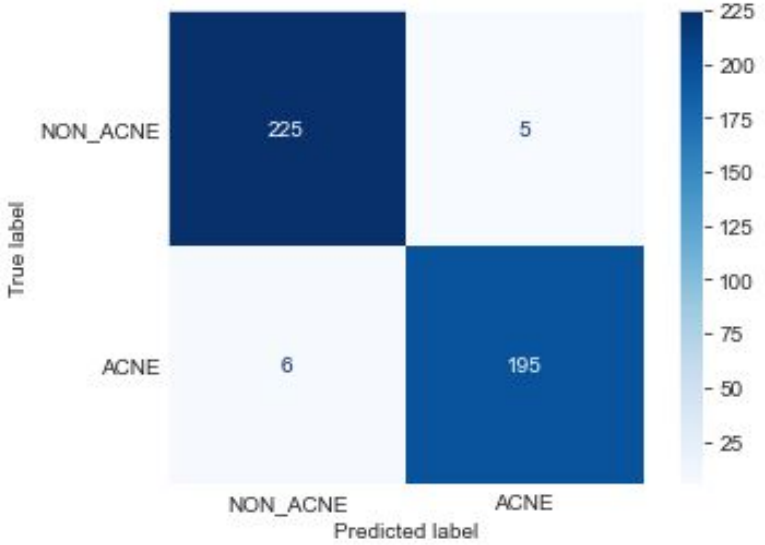
```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 148, 148, 32)      896
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 74, 74, 32)        0
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 72, 72, 64)        18496
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 36, 36, 64)        0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 34, 34, 64)        36928
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 17, 17, 64)        0
_________________________________________________________________
flatten (Flatten)            (None, 18496)             0
_________________________________________________________________
dense (Dense)                (None, 128)               2367616
_________________________________________________________________
activation (Activation)      (None, 128)               0
_________________________________________________________________
dropout (Dropout)            (None, 128)               0
_________________________________________________________________
dense_1 (Dense)              (None, 1)                 129
_________________________________________________________________
activation_1 (Activation)    (None, 1)                 0
=================================================================
Total params: 2,424,065
Trainable params: 2,424,065
Non-trainable params: 0
_________________________________________________________________
```

Evaluation


Training and Validation Accuracy
0.95
0.90
0.85
0.80
0.75
0.70
0
20
40
60
80
100
Training Accuracy
Validation Accuracy

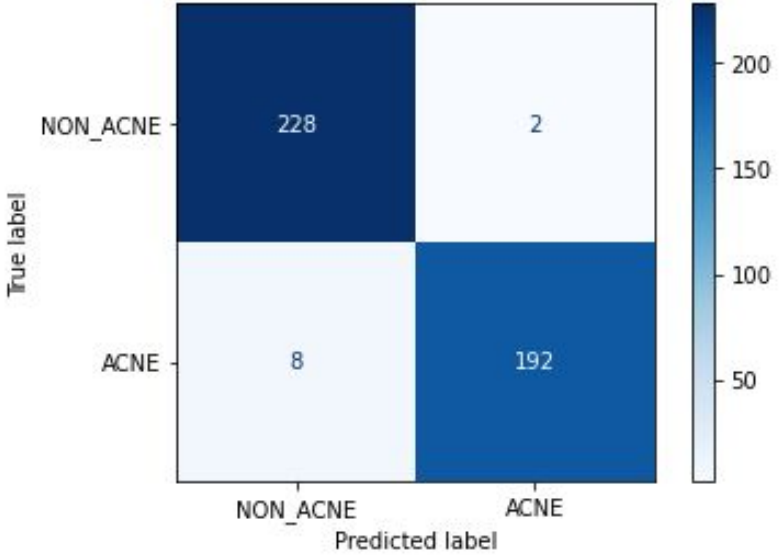

Training and Validation Loss
0.5
0.4
0.3
0.2
0.1
0
20
40
60
80
100
Training Loss
Validation Loss

Evaluation on Validation



	precision	recall	f1-score	support
NON_ACNE	0.97	0.98	0.98	230
ACNE	0.97	0.97	0.97	201
accuracy			0.97	431
macro avg	0.97	0.97	0.97	431
weighted avg	0.97	0.97	0.97	431

Evaluation on Test



	precision	recall	f1-score	support
NON_ACNE	0.97	0.99	0.98	230
ACNE	0.99	0.96	0.97	200
accuracy			0.98	430
macro avg	0.98	0.98	0.98	430
weighted avg	0.98	0.98	0.98	430

Evaluation

Goal : To achieve high accuracy and f1 score

Dataset	Accuracy	F1 score	True Positive	False Positive	True Negative	False Negative
Train	0.99	0.99	686	4	606	4
Validation	0.97	0.98	225	5	195	6
Test	0.98	0.98	228	2	192	8

Conclusion and Recommendation

- The model achieve an accuracy of 97% and f1 score of 98% on validation data

- The model can be deployed on website to recommend skin care product based on the predictions.

- The model is recommended to be used on lighter skin tone

Limitation and future work

The limitation:

1. Face Detection
2. Dark skin tone

Future work:

1. Face detection using MTCNN library , YOLO
2. Increase darker skin tone image
3. SMOTE
4. Collect more images
5. Live predictions on video

Any Questions?