

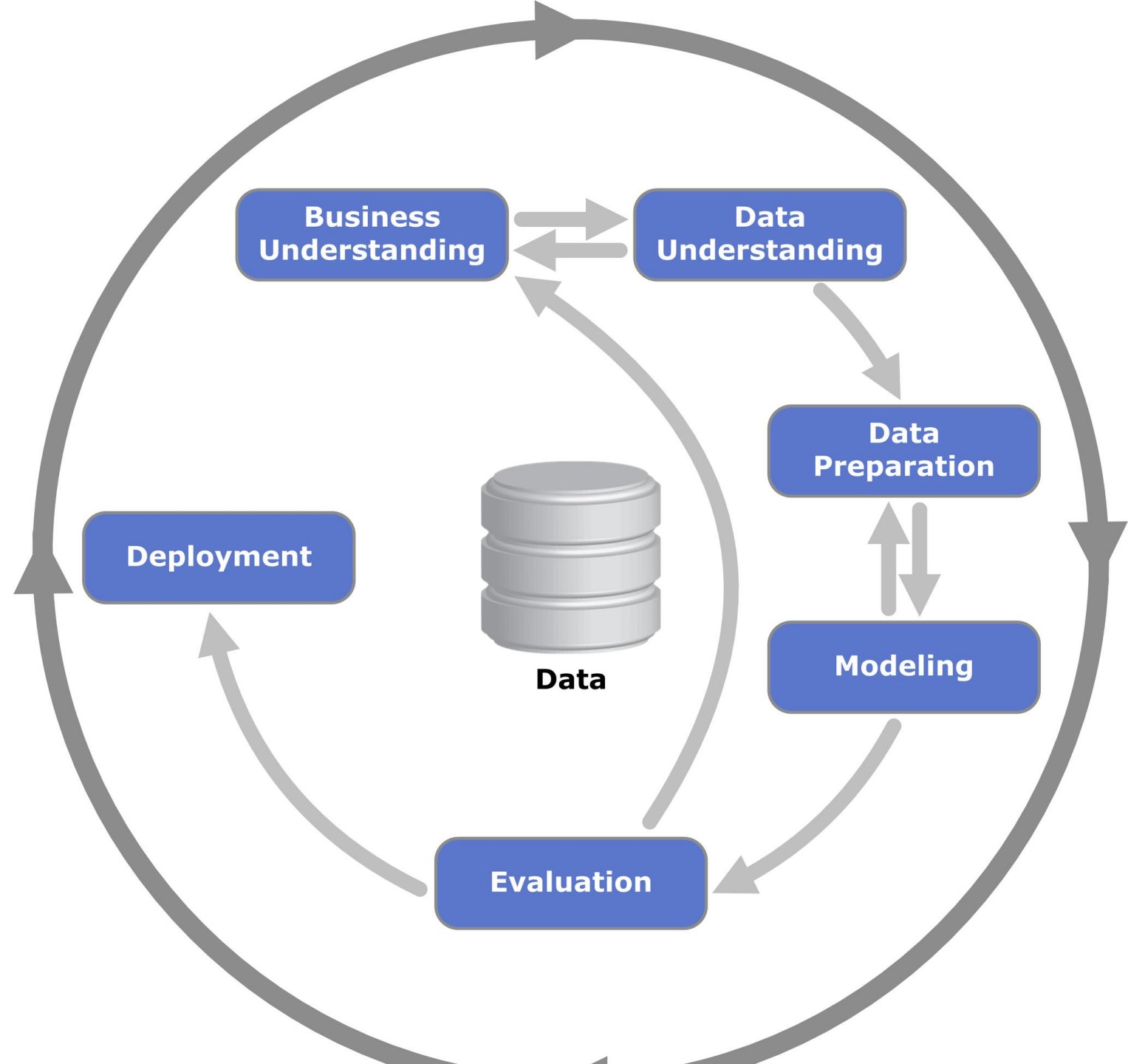
## **MULTI-CLASS CLASSIFICATION OF SKIN DISEASES**



## Group 3 members

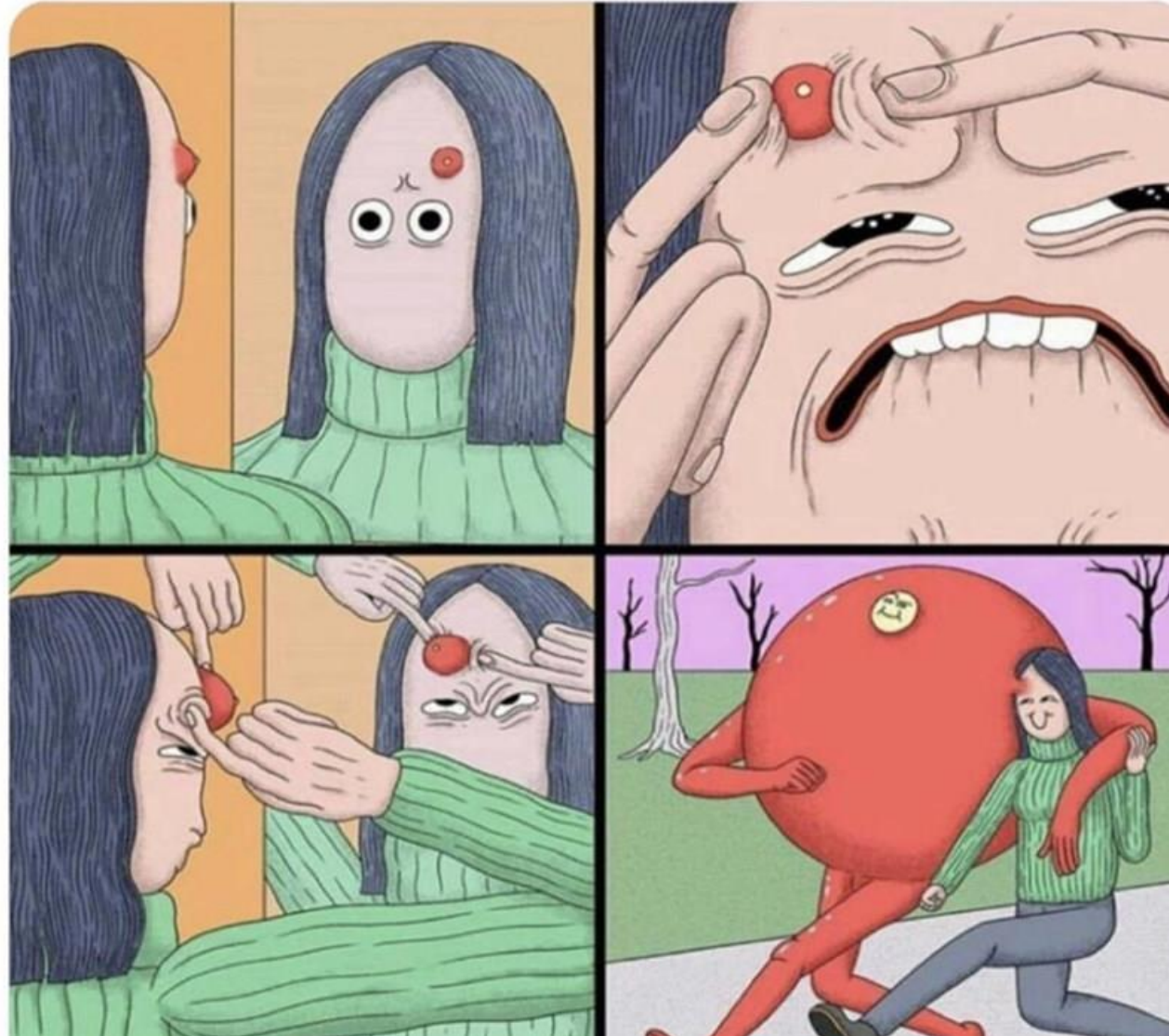
- Antony Kanai
- Brenda Kinoti
- Jared Bii
- Leah George
- Phelix Okumu
- Sharon Kimutai
- Janet Khainza

# Project Scope



I have a big day tomorrow

Pimple:







# Business Understanding

- Skin diseases can vary widely, **impacting overall health**, and some, **like skin cancer can be life-threatening**.
- **Early and accurate identification** of the types of skin diseases is of great importance.
- Cutting edge technologies can revolutionize dermatological diagnostics, **enhancing efficiency, reducing errors, and ultimately improving patient outcomes**.

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# Problem Statement

- Dermatologists at Flatter Dermatological Clinic struggle with **accurately categorizing skin diseases from medical images**.
- Current **manual inspection and personal judgment** - time-consuming, prone to errors leading to delayed or inaccurate diagnoses.
- This inefficiency can result in **missed patterns** and **life-threatening consequences**.



# Objectives

- **Main objective:** To build a convolutional neural network learning model capable of classifying the 9 different types of skin diseases with over 95% precision
- **Other objectives are;**
  - i. To **explore the distribution** of the different types/class of skin images in the dataset.
  - ii. To **assess the quality and consistency** of images in the dataset.





# Data Understanding

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- Dataset : **2357** images (Liverpool John Moore University)
  - **2,239** images for Training
  - **118** images for Testing
- The data set contains **9 skin diseases**:  
Actinic keratosis, **Basal cell carcinoma**, Dermatofibroma, **Melanoma**, Nevus, Pigmented benign keratosis, Seborrheic keratosis, **Squamous cell carcinoma** , Vascular lesion.



# Data Preparation

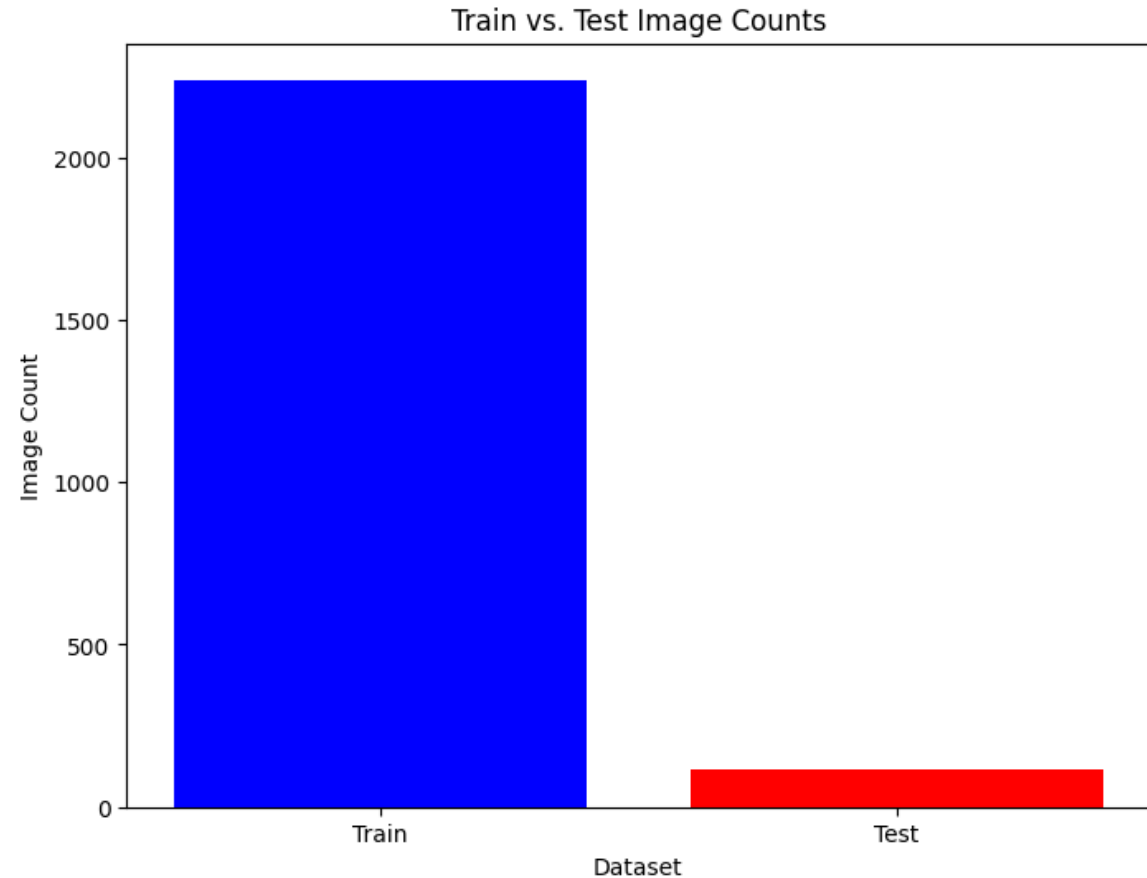
**Exploratory Data Analysis:** image counts, sampling per class, Class distributions, Class separation, Texture Analysis, RGB color channels and Pixel Intensity

**Data Preprocessing** – Splitting the data (Training Validation sets), Rescaling and Resizing, Dealing with imbalance and transforming images to create new, slightly altered images for training



# Image counts

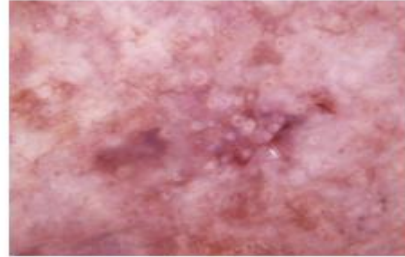
- Distribution of the skin diseases image dataset with **5%** of dataset reserved for **testing purposes** and **95%** of dataset for **training the Model**



# Image sample per class

- This images shows a sample of **image per class**
- The images have distinct appearance from **red, pink, brown, black and purple colors**
- **Actinic Keratosis** appears as a **visible rash**, **Melanoma** appears as a **dark patch** and **Dermatofibroma** presents like **tiny brownish patches**.

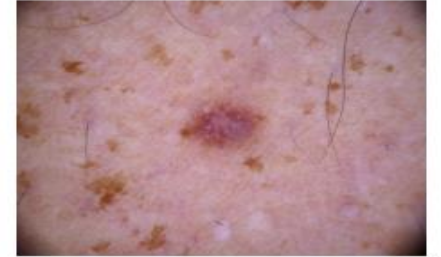
actinic keratosis



basal cell carcinoma



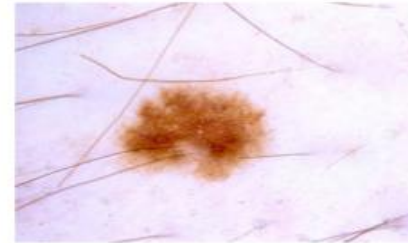
dermatofibroma



melanoma



nevus



pigmented benign keratosis



seborrheic keratosis

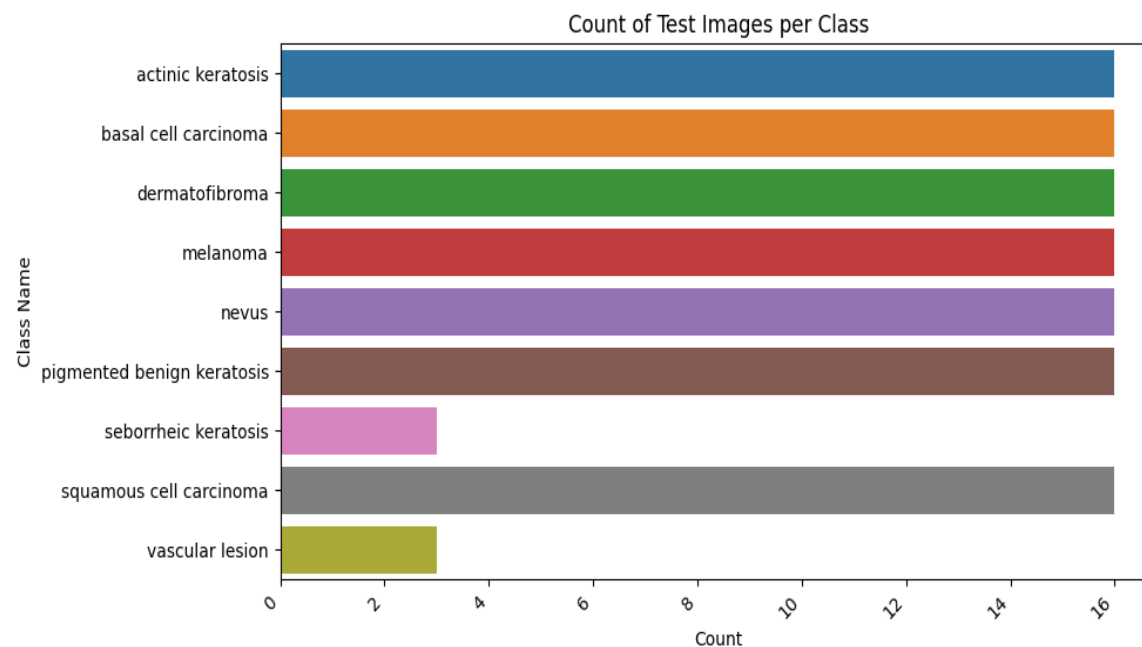
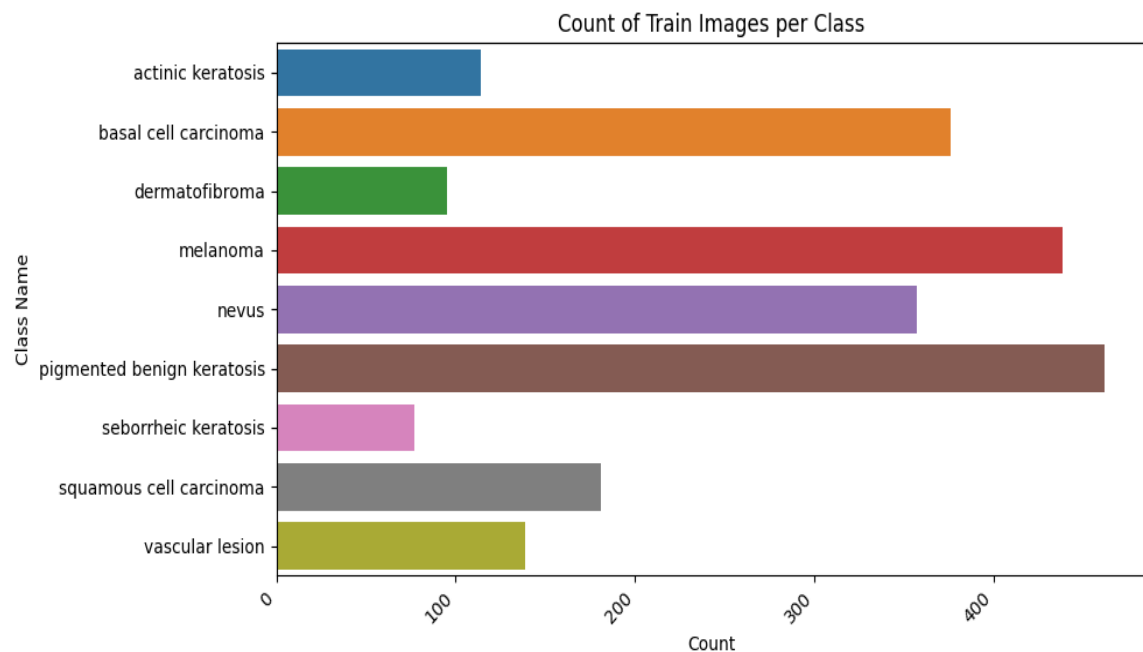


squamous cell carcinoma



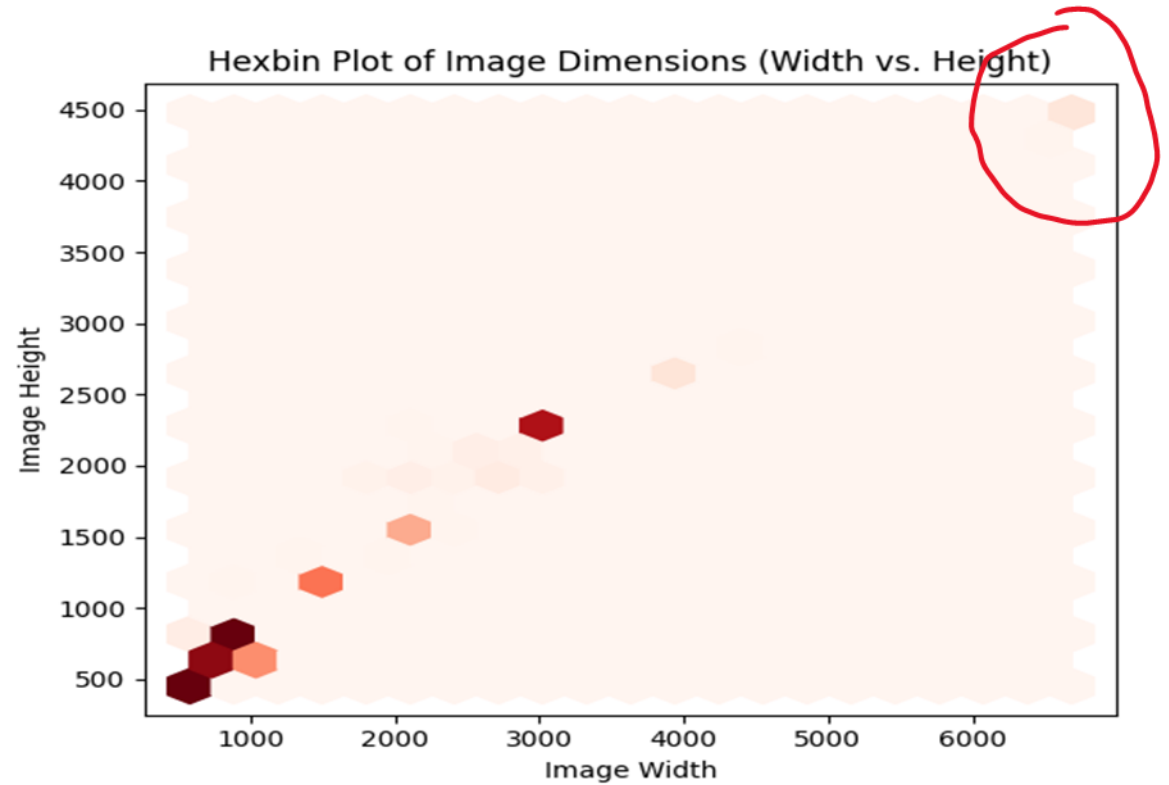
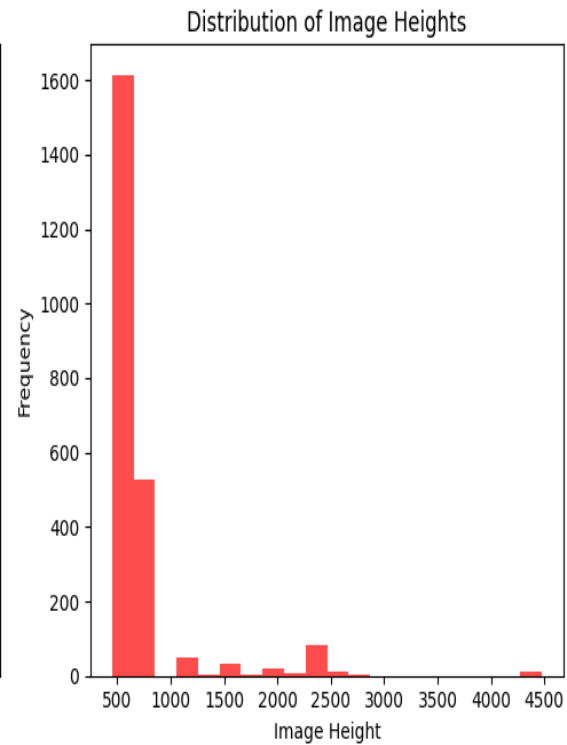
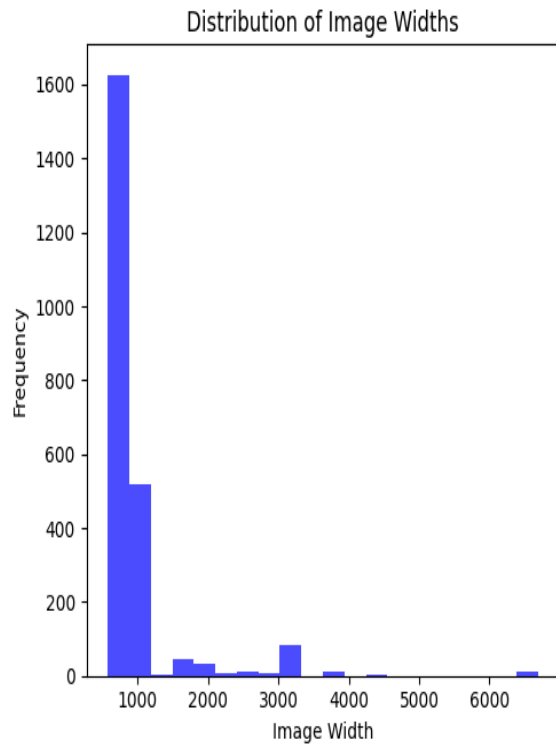
vascular lesion





# Class distribution

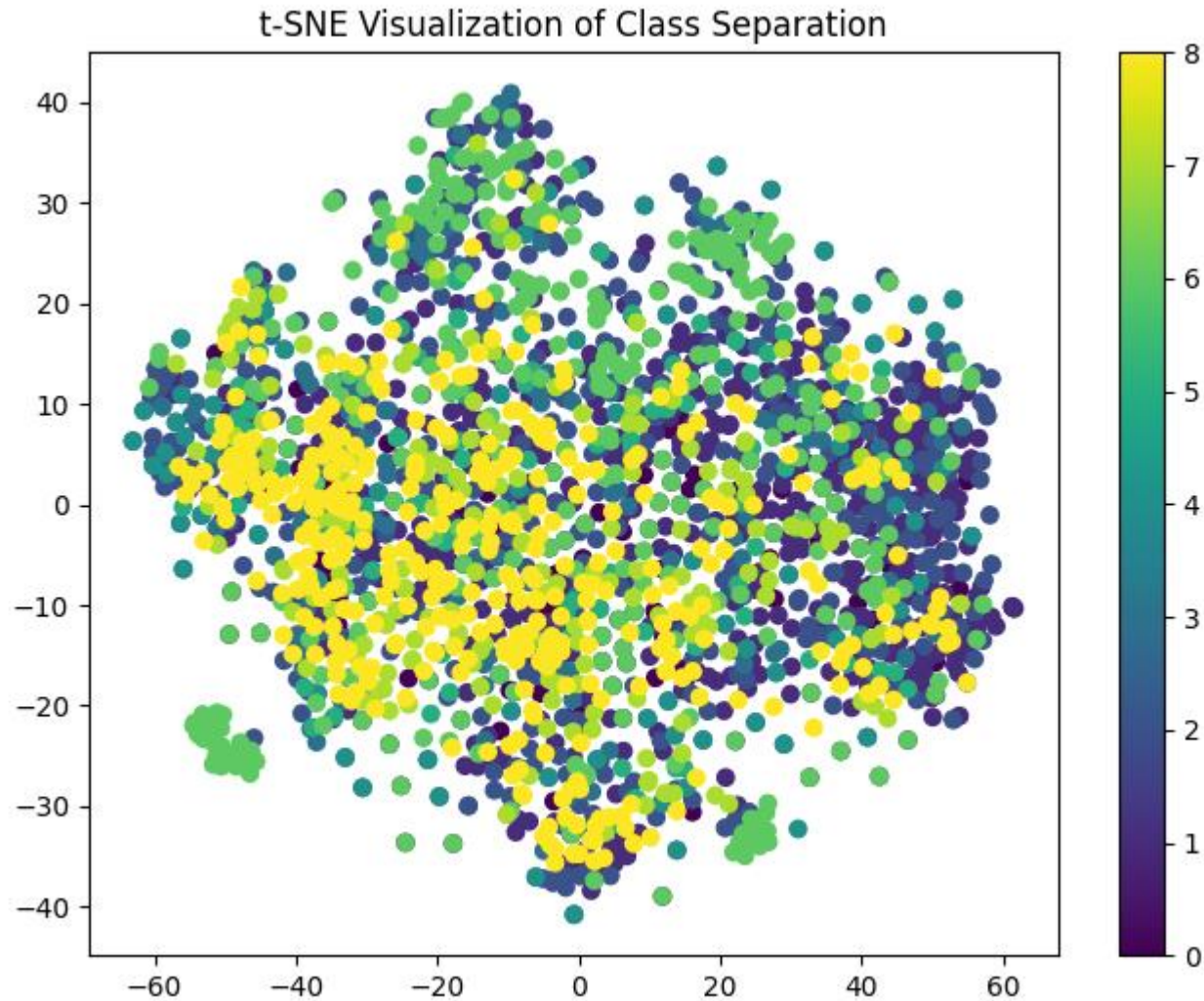
- There is a significant **class imbalance on the Train set**
- **Majority of test set** class samples are **balanced**.



## Height and Width Dimensions

- Majority of images dimensions - approximately around **500 pixels in width** and **450 pixels in height**.
- Outlier **circled in red** - dimensions approximately around **6500 pixels in width** and **4500 pixels in height**.
- Standardize the image dimensions by resizing to a common size.



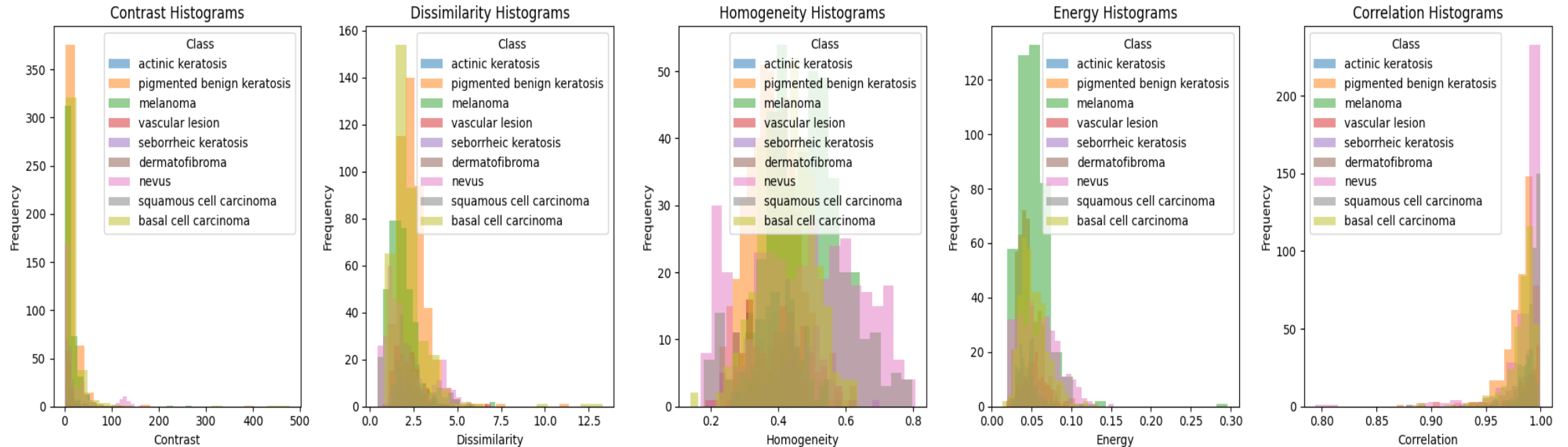


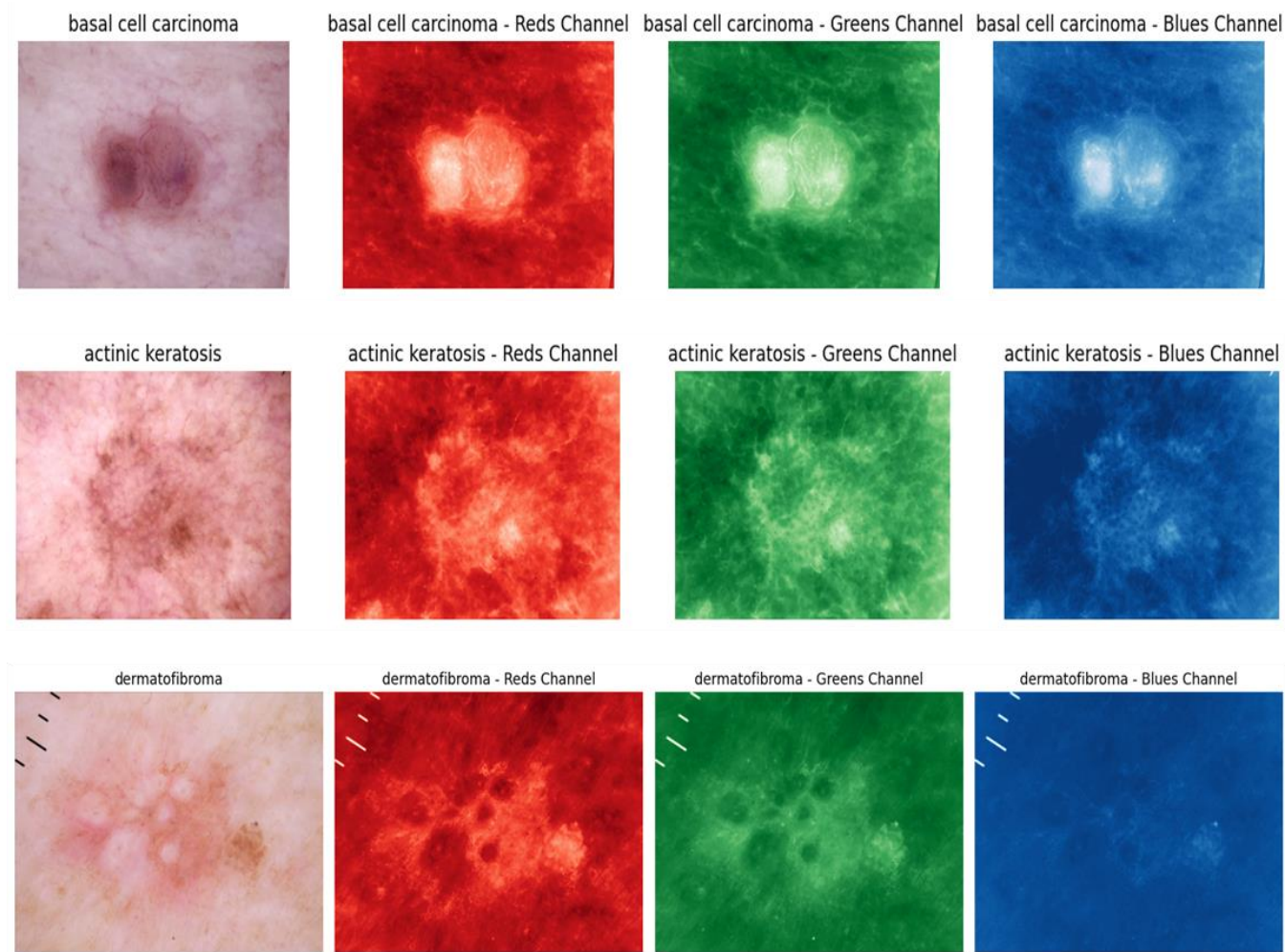
# Class Separation

- Absence of clear class separation - images either **have complex visual characteristics** or **share visual similarities**.
- Apply augmentation to provide diverse data allowing the model to accurately distinguish between different classes.

# Texture Analysis

- Majority of images in the classes exhibit **low contrast**, **low dissimilarity**, and **low energy**, indicating **minimal intensity variations**.
- Near-normal distributed homogeneity and higher correlation suggest a **uniform and consistent texture pattern** within the images



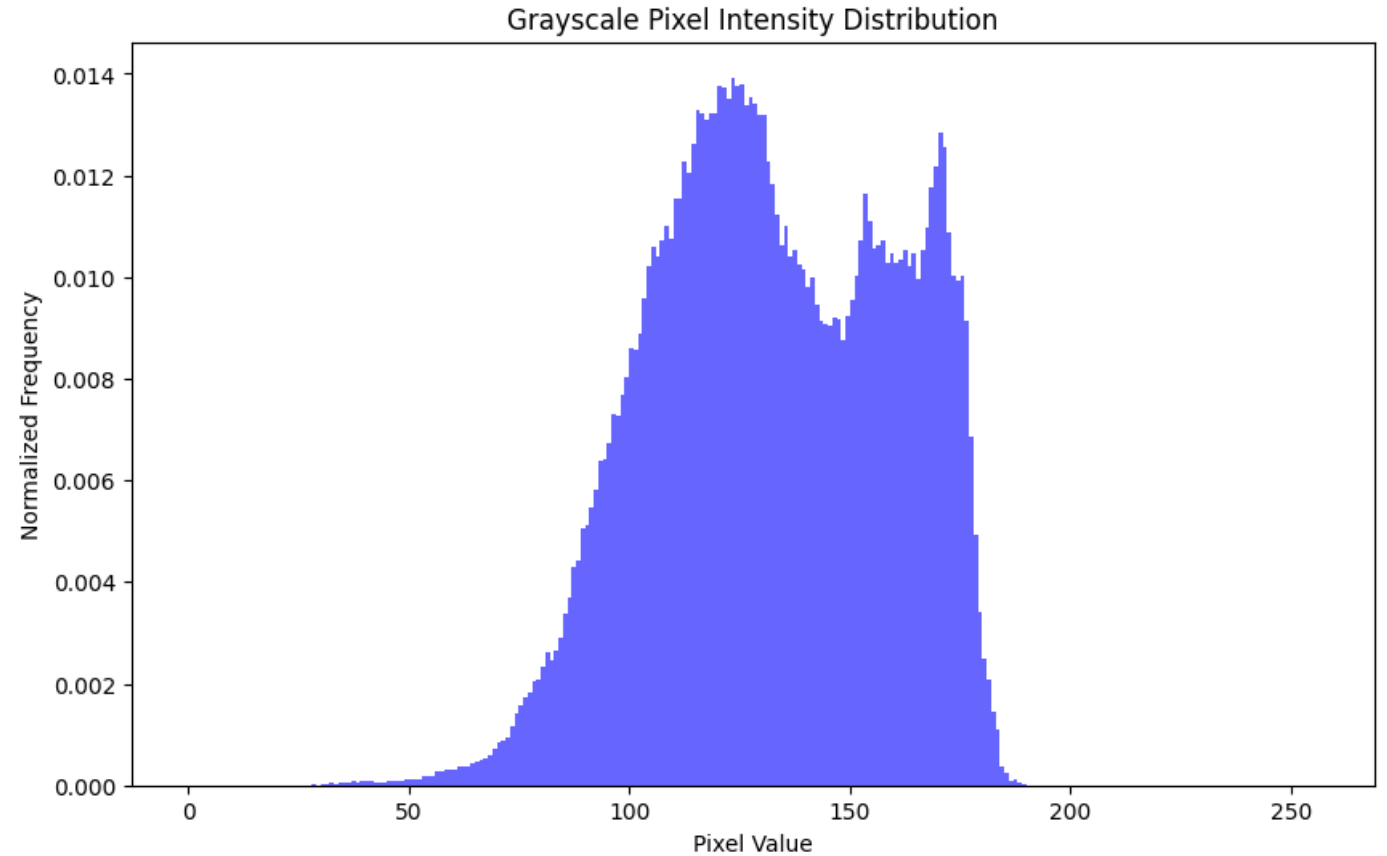


## RGB Color Channels

- Class images as they appears in **original, red, blue and green color channels.**
- The images seem to be **clearer on the red color channel.**

# Pixel Intensity

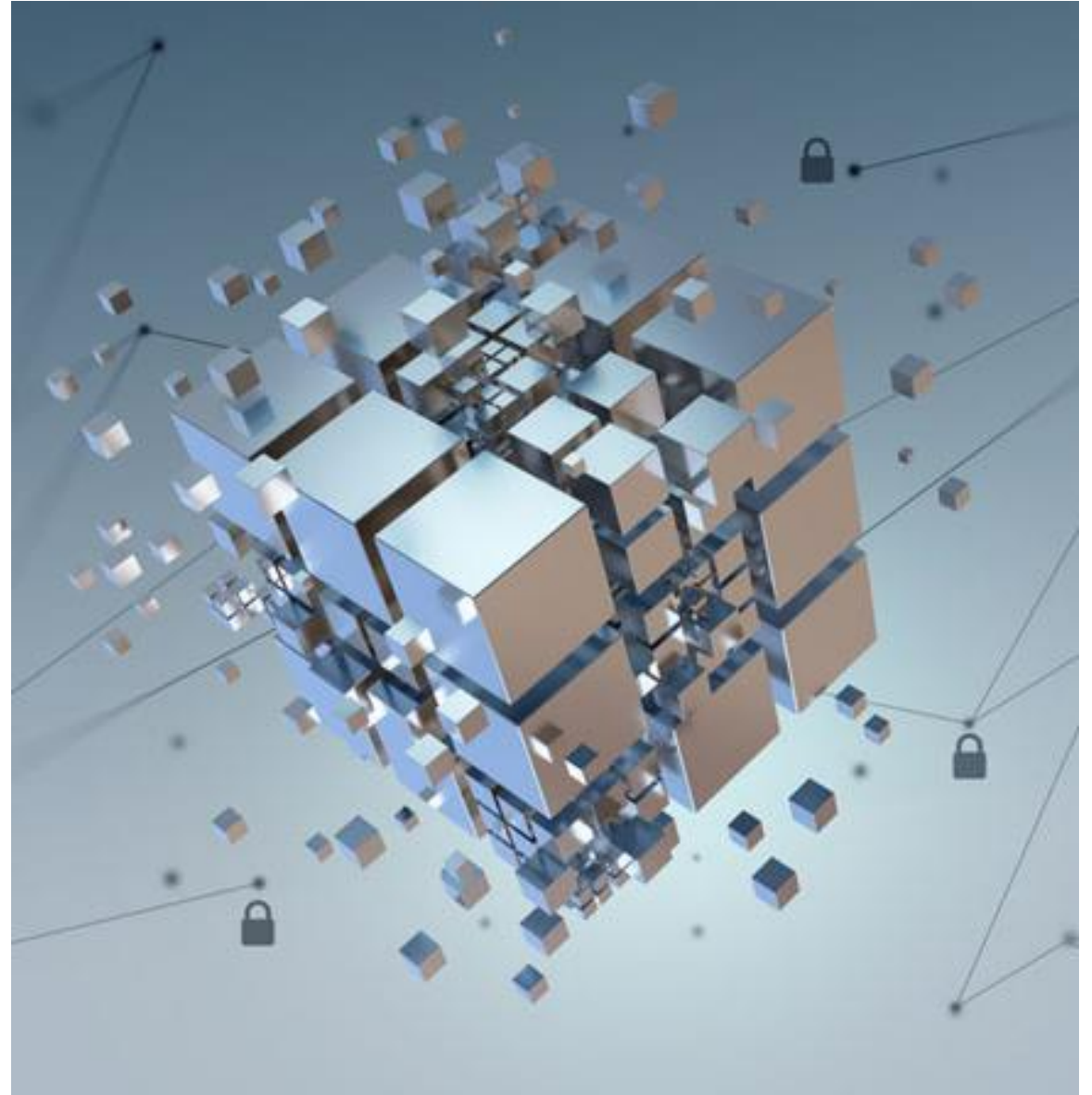
- 130 is the **most common pixel value in the image**, representing about 1.3% of the image's pixel distribution.
- Images exhibit **a broad range of grayscale values**, including both dark and bright regions (0-255)





# Modeling

- Among the four models , the best performer was **VGG16**, a pre-trained model originally trained on a large dataset.
- Model performance Improvement - **Enhanced the sample size** by **transforming images**, creating a more diverse set of samples and addressing class imbalance.
- Model Evaluation – Evaluated three metrics: Precision, Accuracy and Recall. Focused on **Precision**

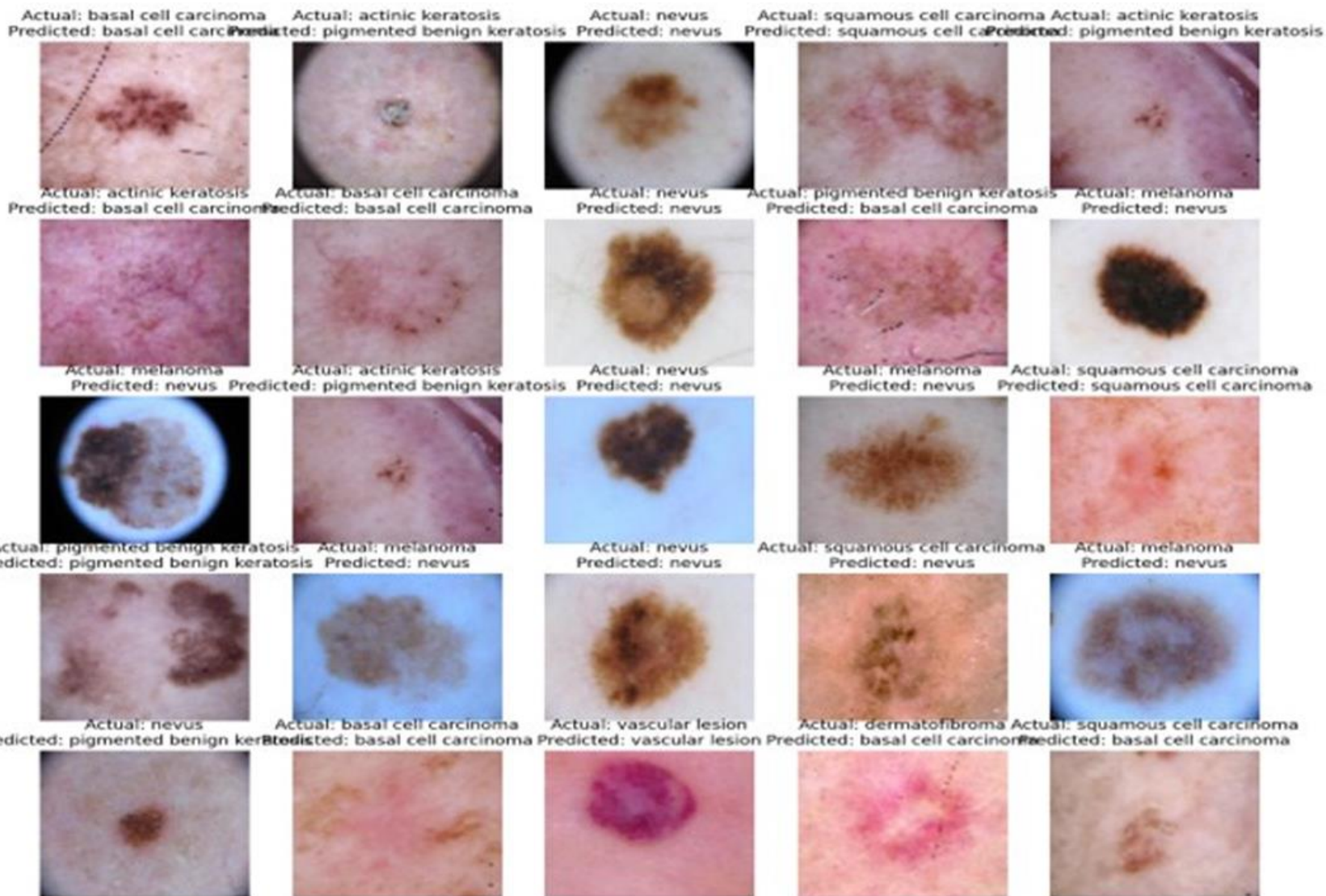




# Model Evaluation

Models	Baseline Model Using untransformed training sets	Model 2 using transformed training set	Model 3 using pre-trained model VGG16	Model 4 adding dropout optimization
Loss	1.1437	1.1367	0.762	0.6525
Val_loss	1.3475	1.2334	1.0313	1.1275
Precision	75.27	70.67	81.48	83.43
Val_precision	68.39	67.41	73.16	70.92
Accuracy	59.1	57.53	73.68	77.15
Val_accuracy	53.17	56.4	64.85	63.74
Recall	42.24	45.3	65.45	71.35
Val_recall	33.93	43.49	56.4	59.4

- While the models showed relatively high-performance metrics, **model3 demonstrated noticeable enhancements in precision scores and losses**
- Precision – **Training 81.48%** and **Validation 73.16%**



## Model Predictions

- The model seems to predict **Nevus** and **Basal cell carcinoma** very well, indicating high Precision in identifying these conditions.

# Data Limitation

- The skin disease **images size was relatively small** and could have significantly impacted the model performance
- The Data may have **not been from diverse geographical locations or age groups** limiting the model's generalizability.
- The dataset **may not account for variations in skin tones and ethnicities**, which can impact the model's performance in providing accurate diagnoses across diverse patient populations.



# Recommendations



- Precision of **73%** demonstrates the potential of our **model in enhancing dermatological diagnostics** and **ultimately improving patient care.**
- To build upon our success and advance the model, we recommend the following:
  - Utilize the model's proficiency in predicting **Basal cell carcinoma** and **Nevus.**
  - Obtain a **larger image data** for training the model.
  - Seek data from **multiple sources** and **geographical regions**
  - Collect data that spans **different time periods** and **age groups.**
  - Acquire patients consent on the use of their medical record in compliance to data privacy laws.

# Model Deployment

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- Model deployment was done using stream lit.
- Link to upload images: [CNN · Stream lit](#)

## Skin Condition Image Classifier

This app classifies images of skin conditions into one of nine classes.

Upload an image



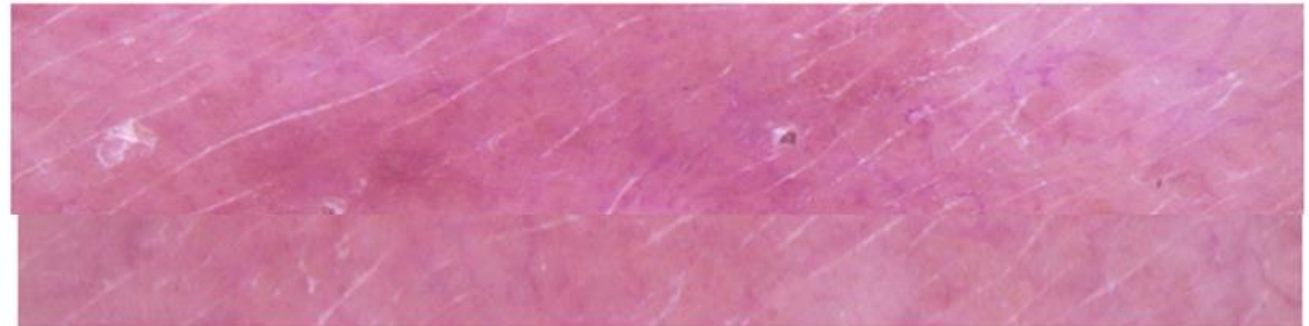
Drag and drop file here

Limit 200MB per file • JPG, JPEG, PNG

Browse files



ISIC\_0024386.jpg 346.2KB



Uploaded Image

Prediction: dermatofibroma

This is a simple skin condition image classification app using a CNN model.



*Thank  
you*

