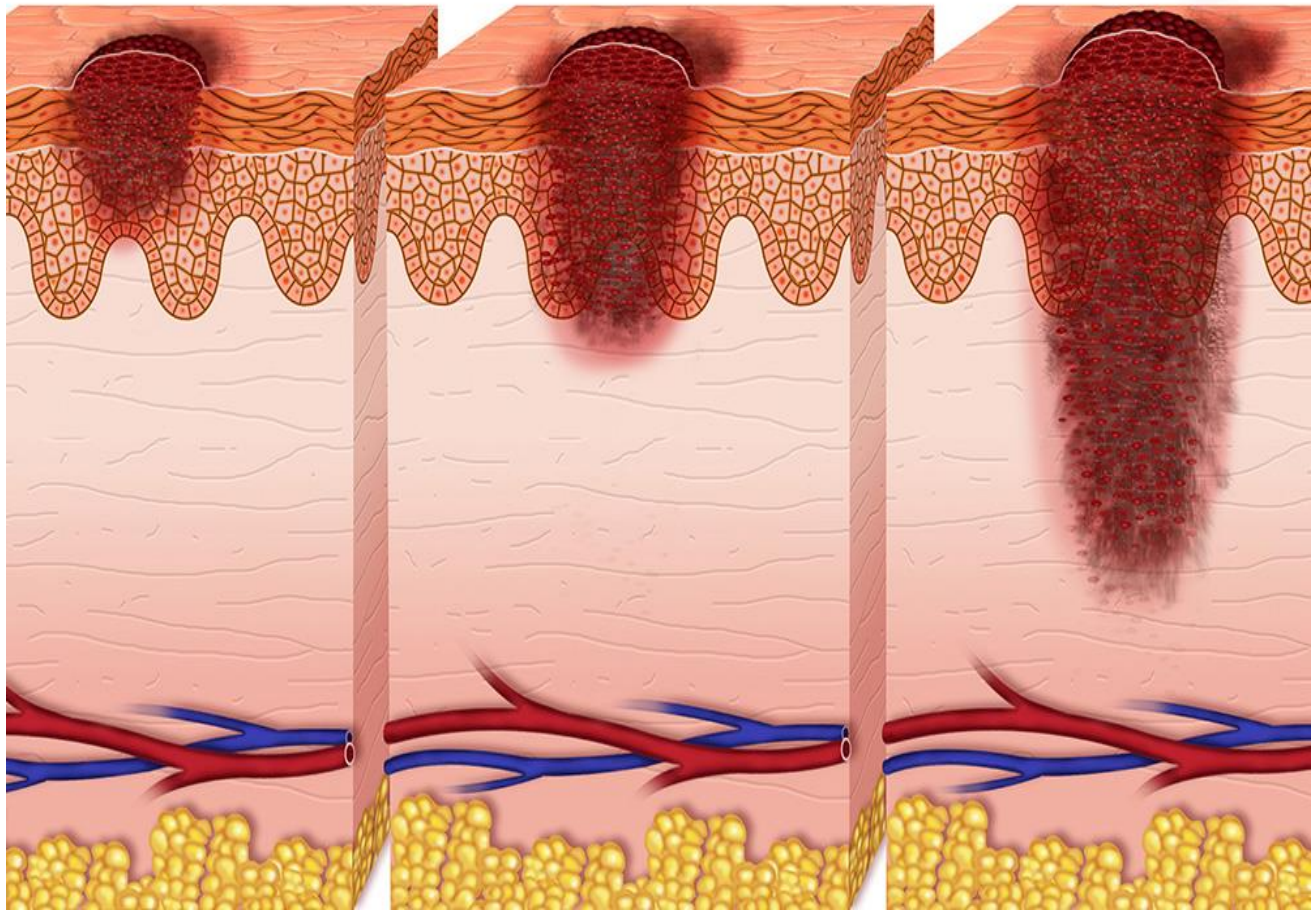
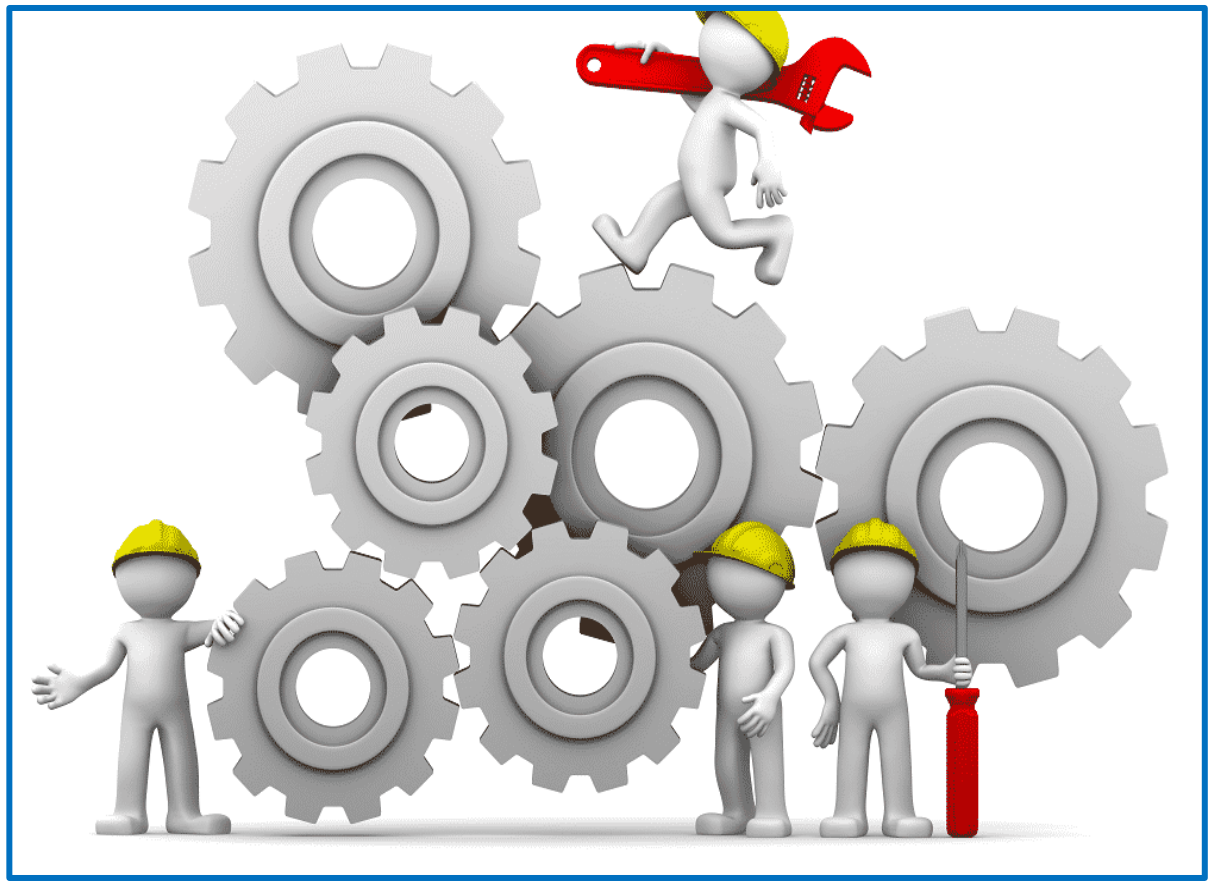


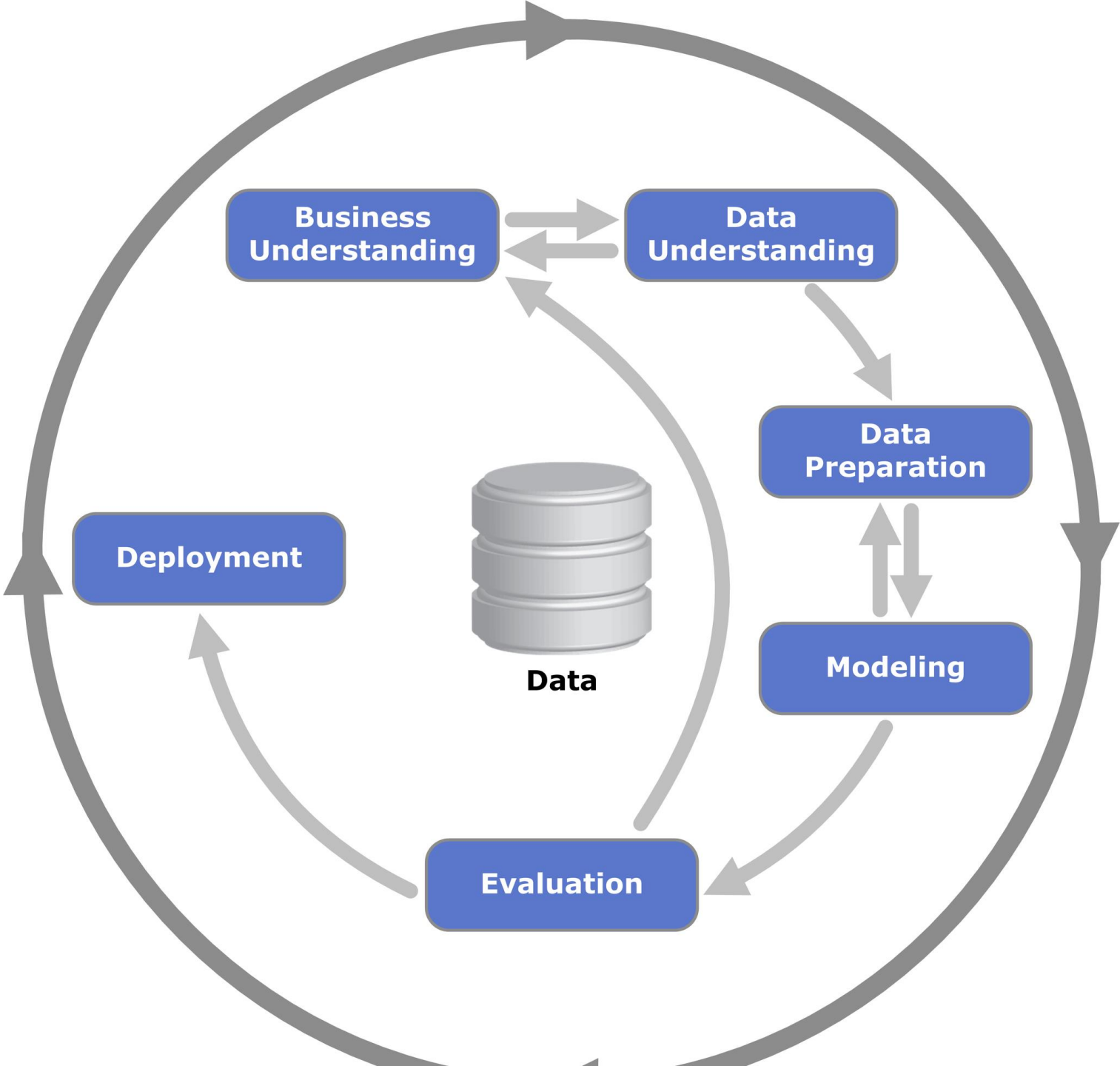
CLASSIFICATION OF SKIN DISEASES



Group 3 members

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

Project Scope



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**.

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 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

- Dataset : **2357** images
  - **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

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

2. **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 CNN Model**

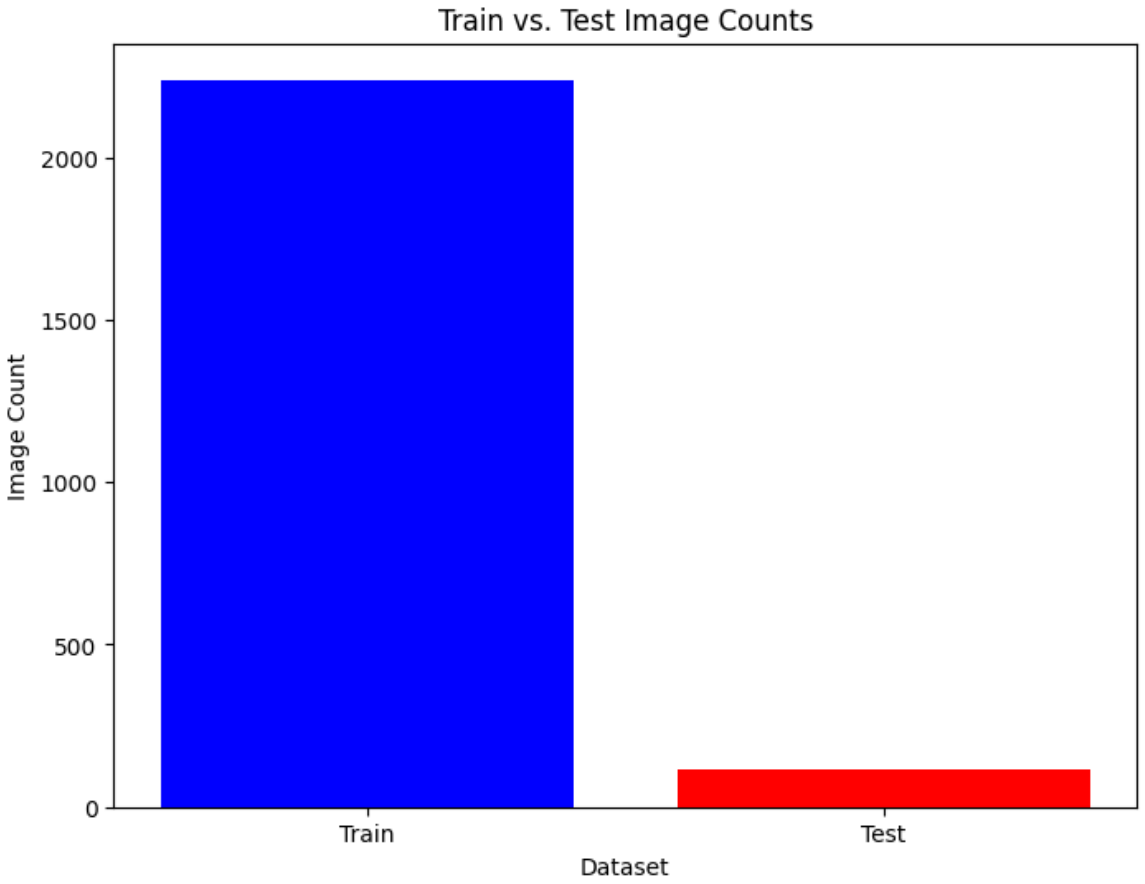
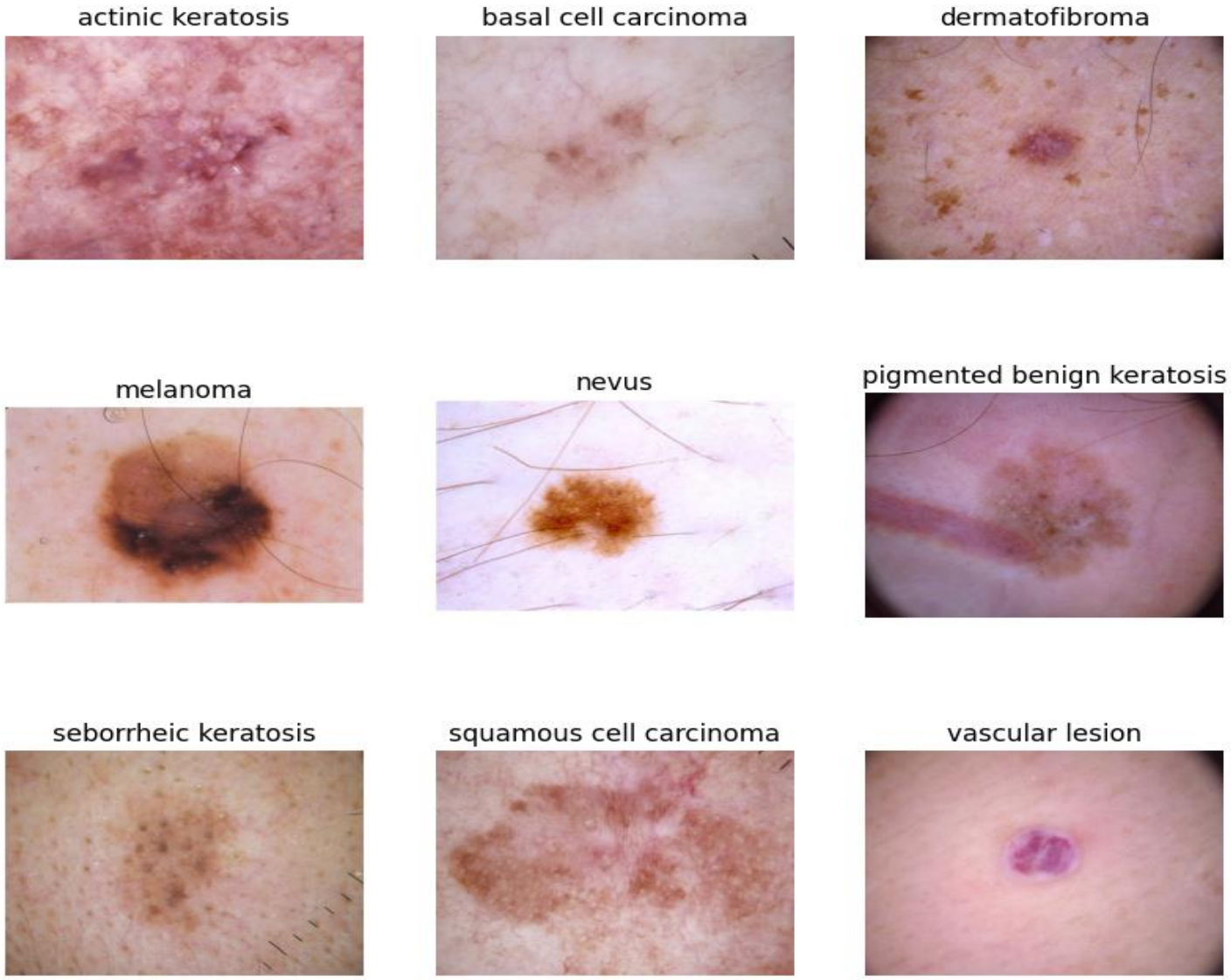
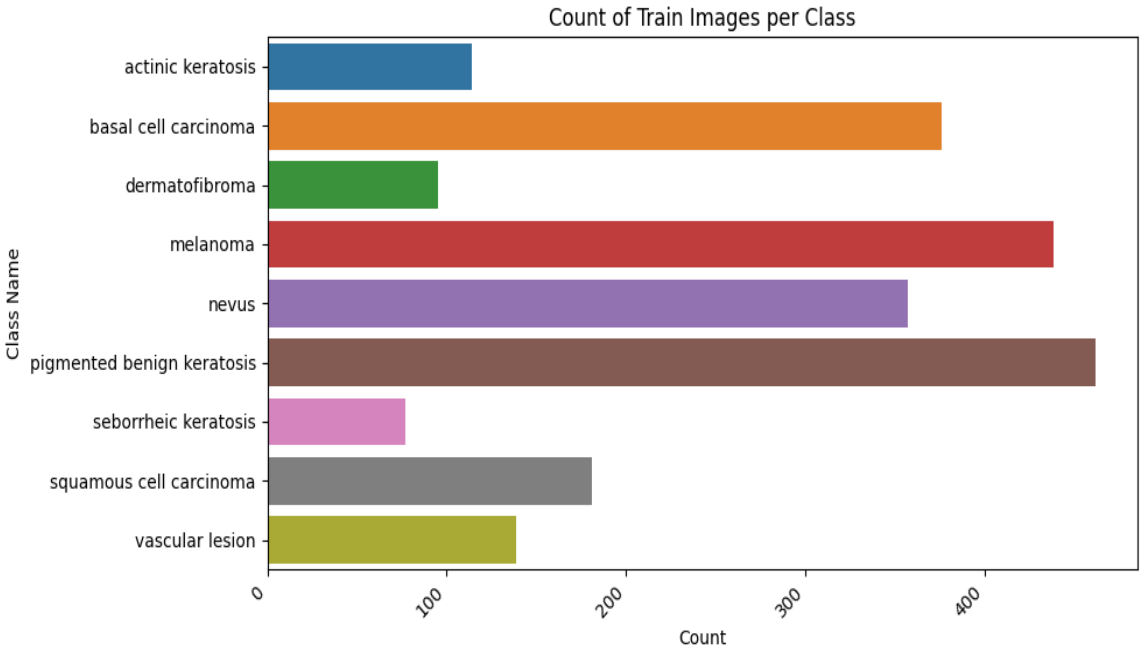
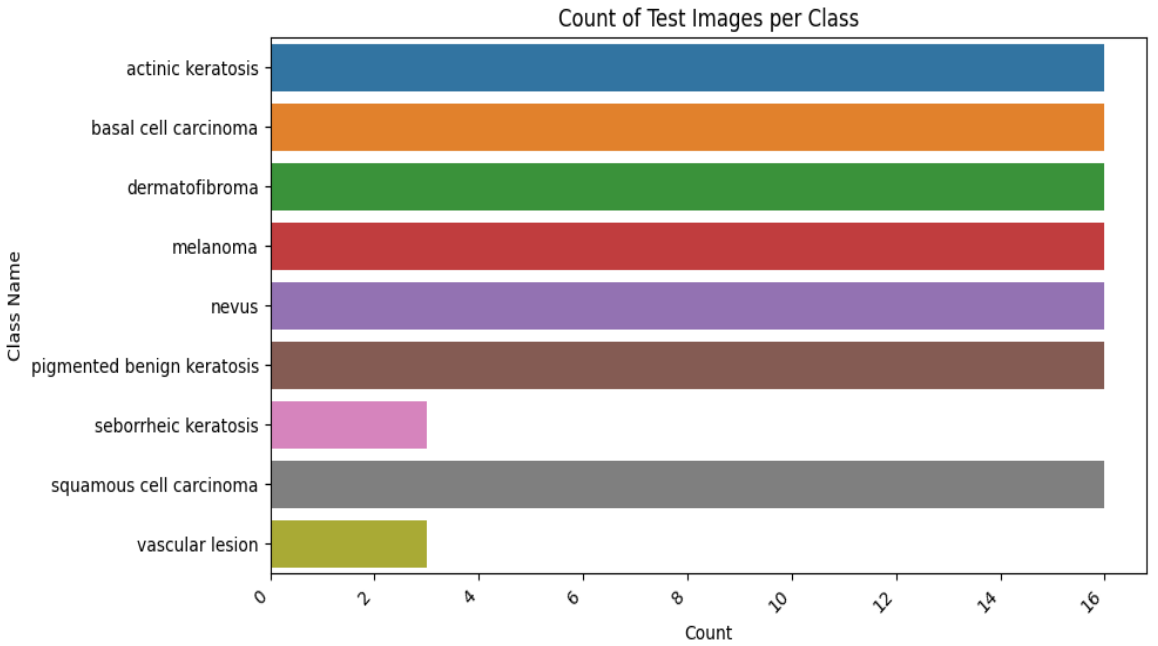


Image sample per class

- 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**.

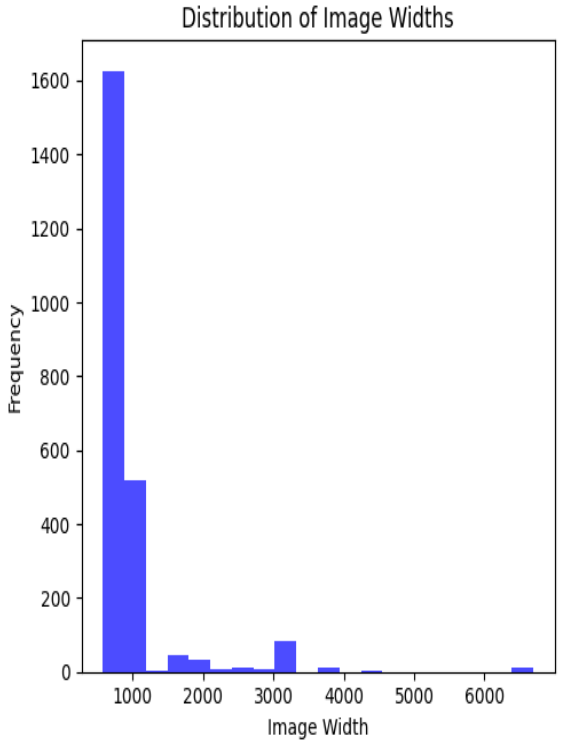


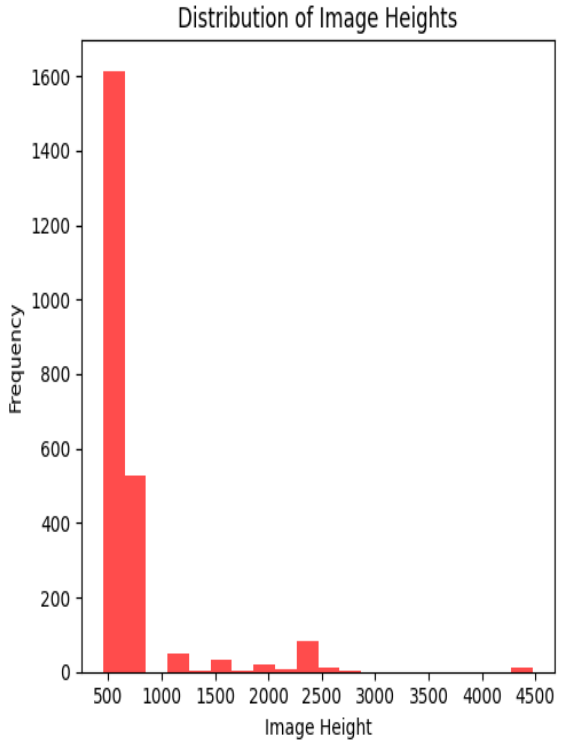


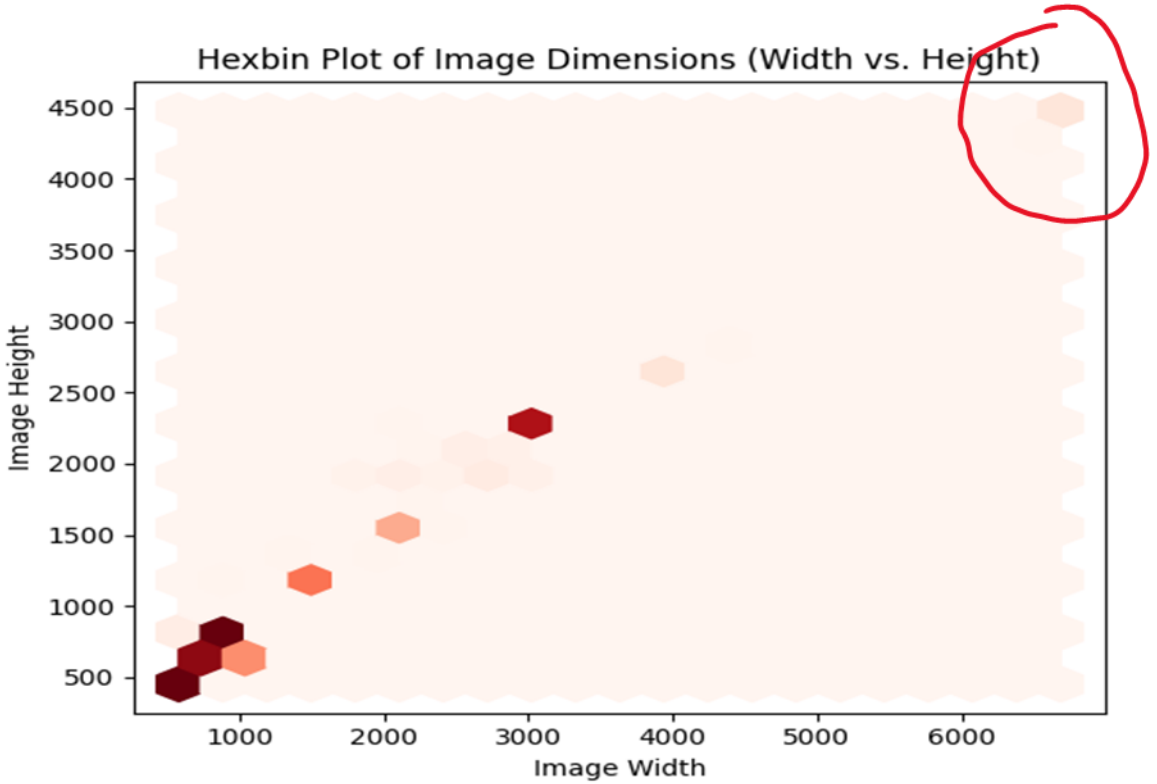


Class distribution

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

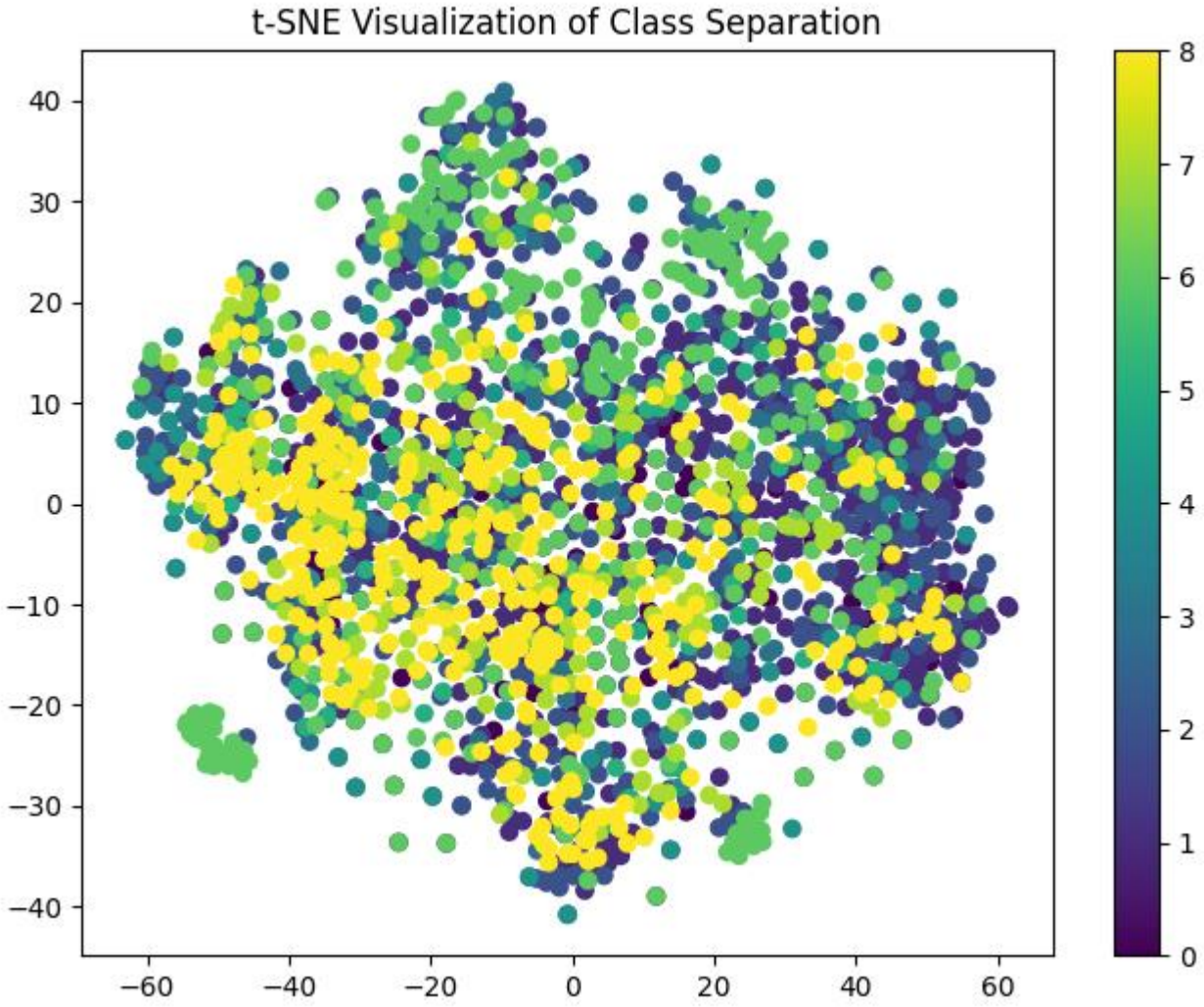






Height and Width Dimensions

- 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.



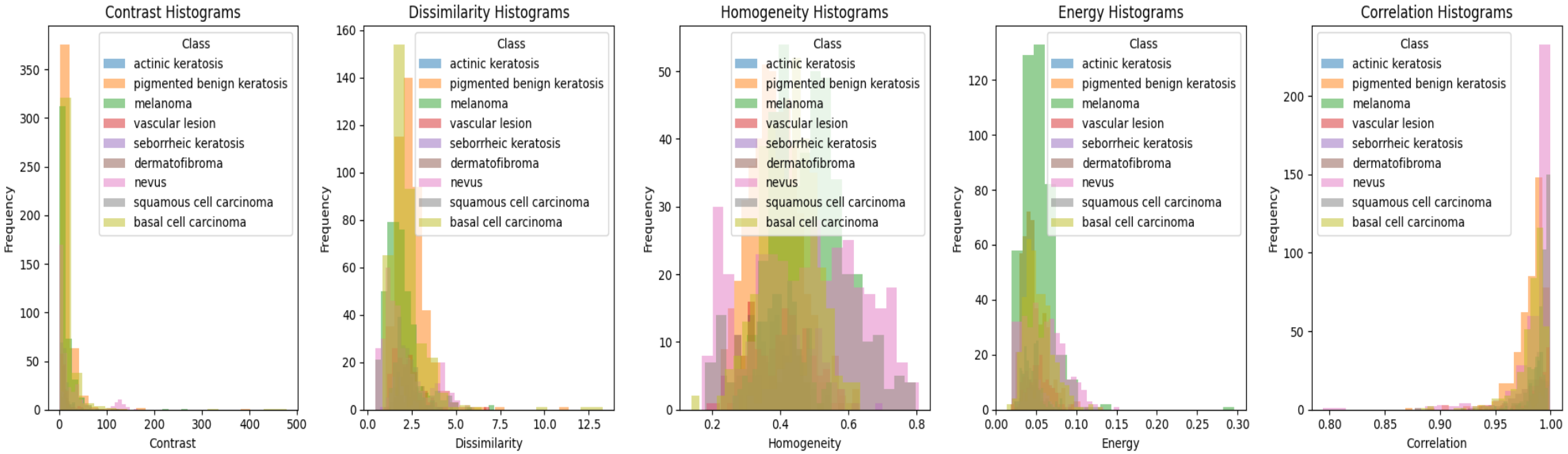
Class Separation

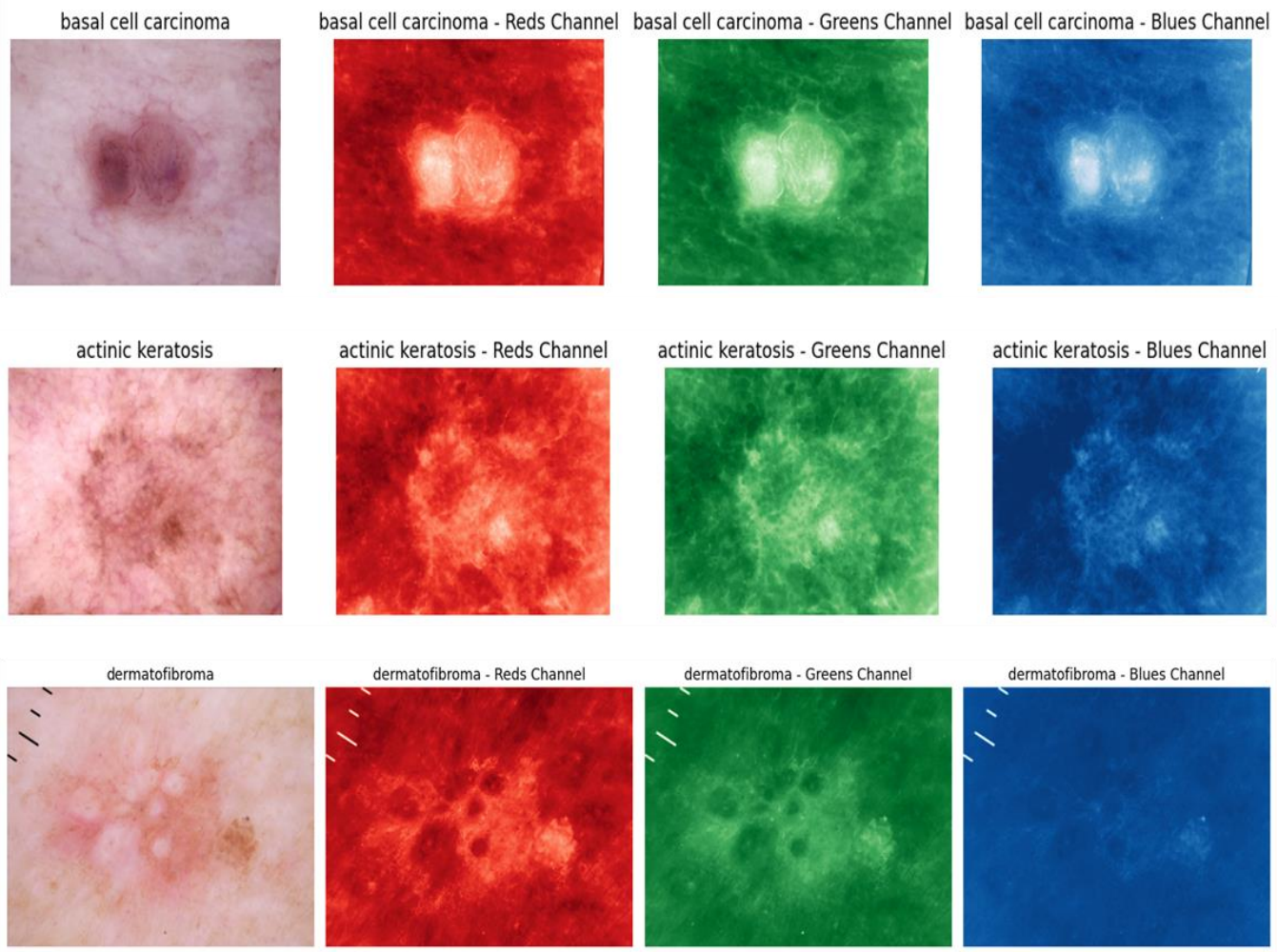
- Absence of clear class separation - images either **have complex visual characteristics** or **share visual similarities**.

- 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





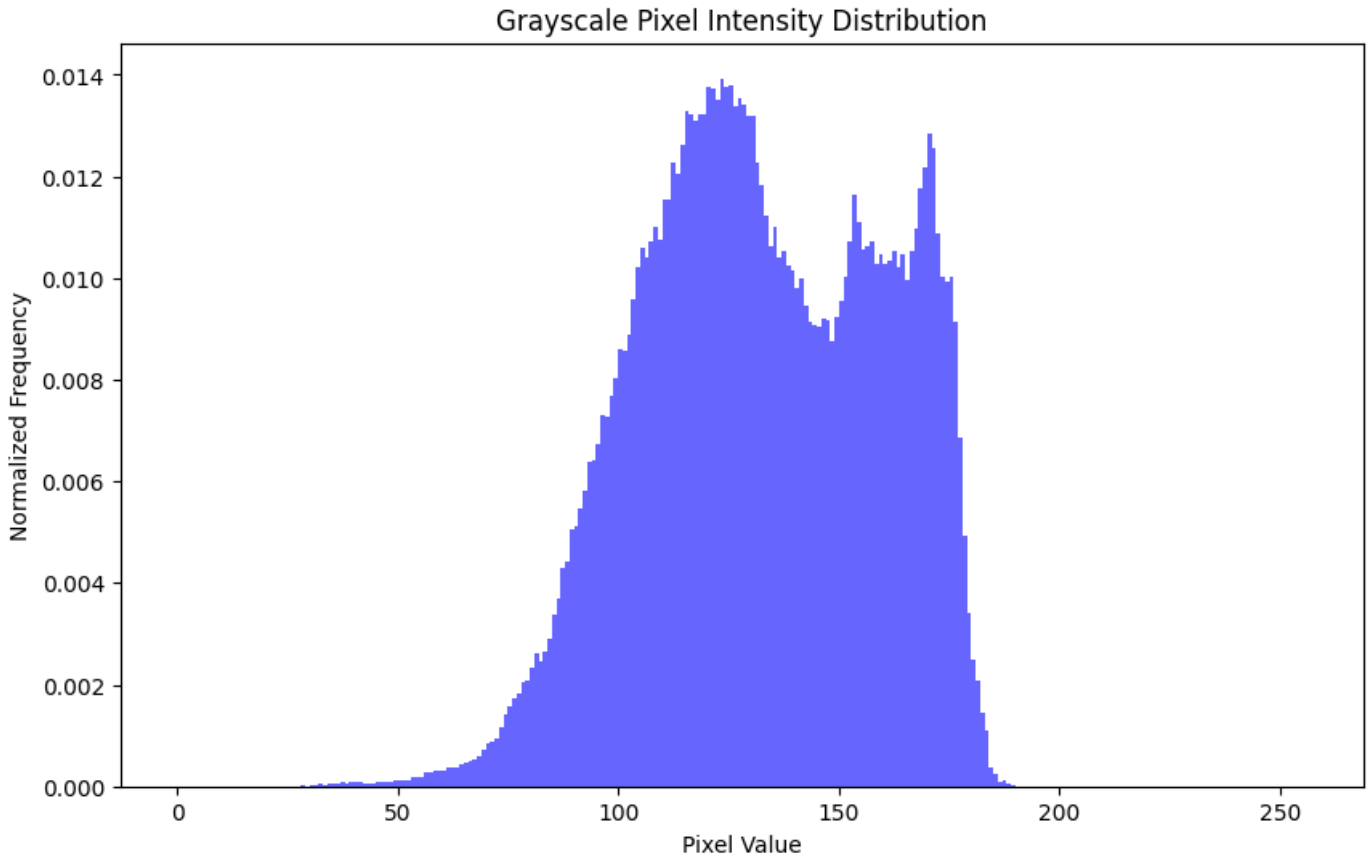
RGB Color Channels

- Class images as they appears in **original, red, blue and green color channels**.

- The images seem to be **clearer on the red color channel.**

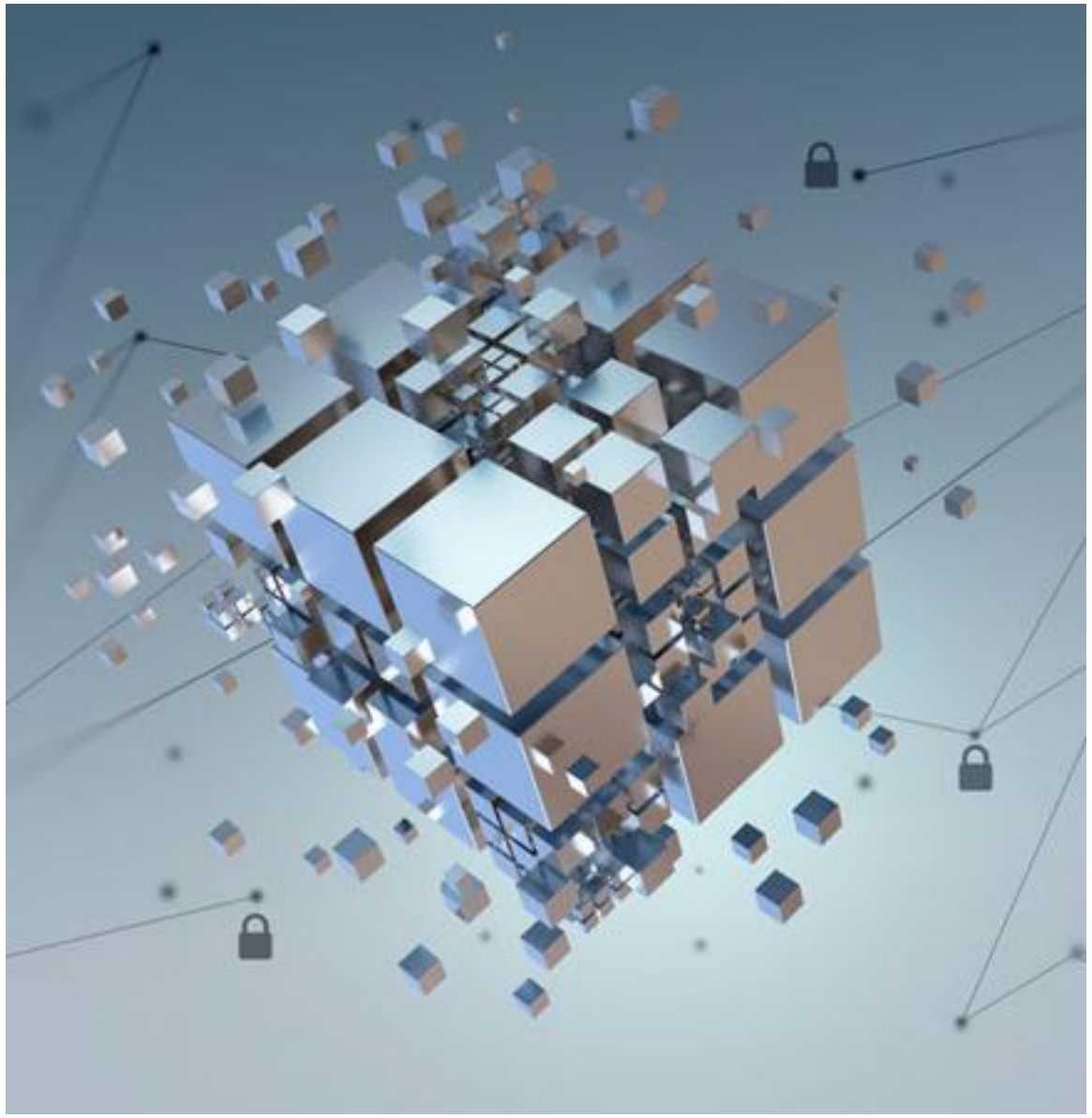
Pixel Intensity

- 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.



Modeling

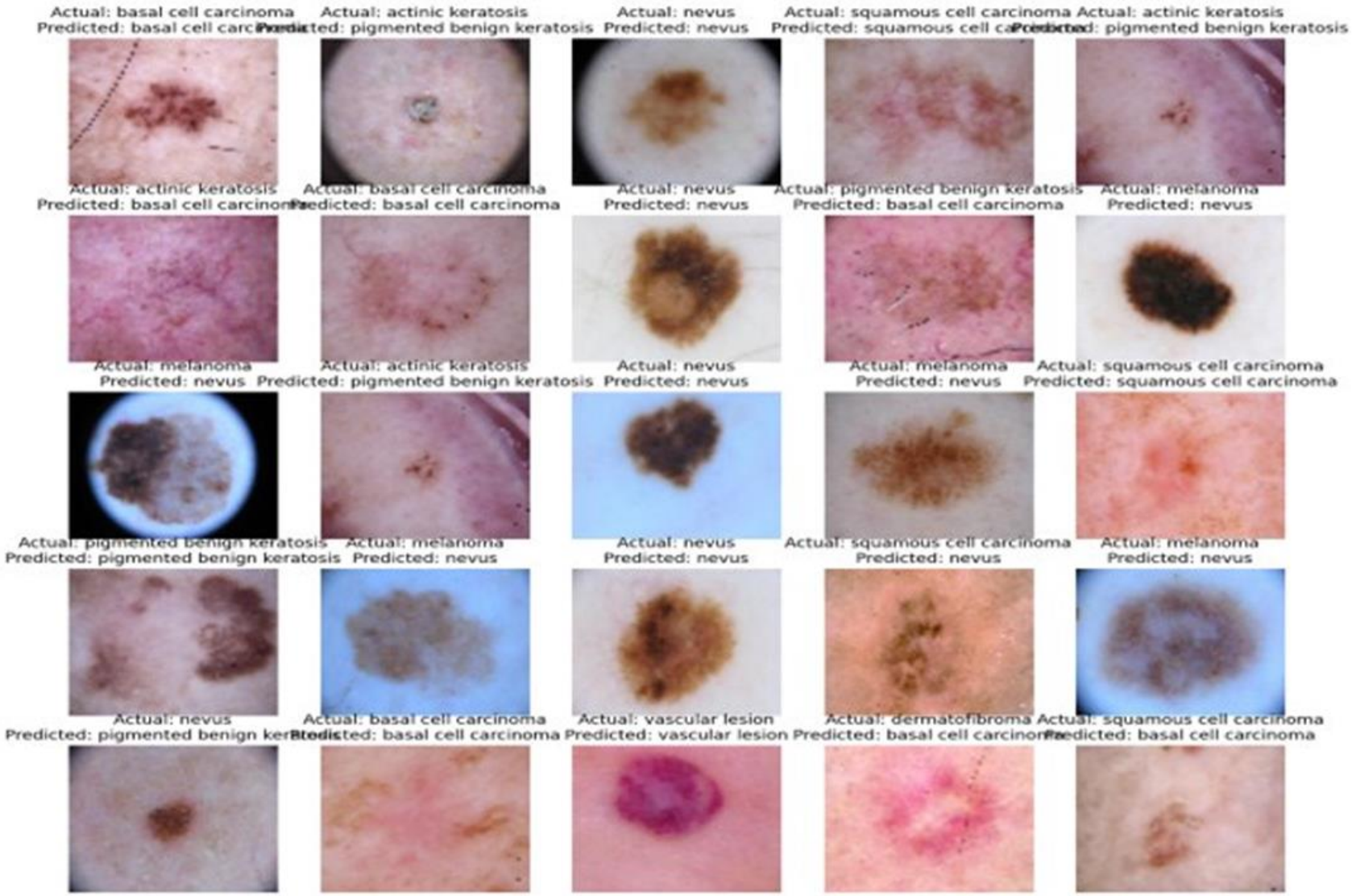
- Among the four models , the best performer was **VGG16**, a pre-trained model originally trained on a large dataset.
- Model performance Improvement - **Enhanced the sample size** by **transforming images**, creating a more diverse set of samples and addressing class imbalance.
- Model Evaluation –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

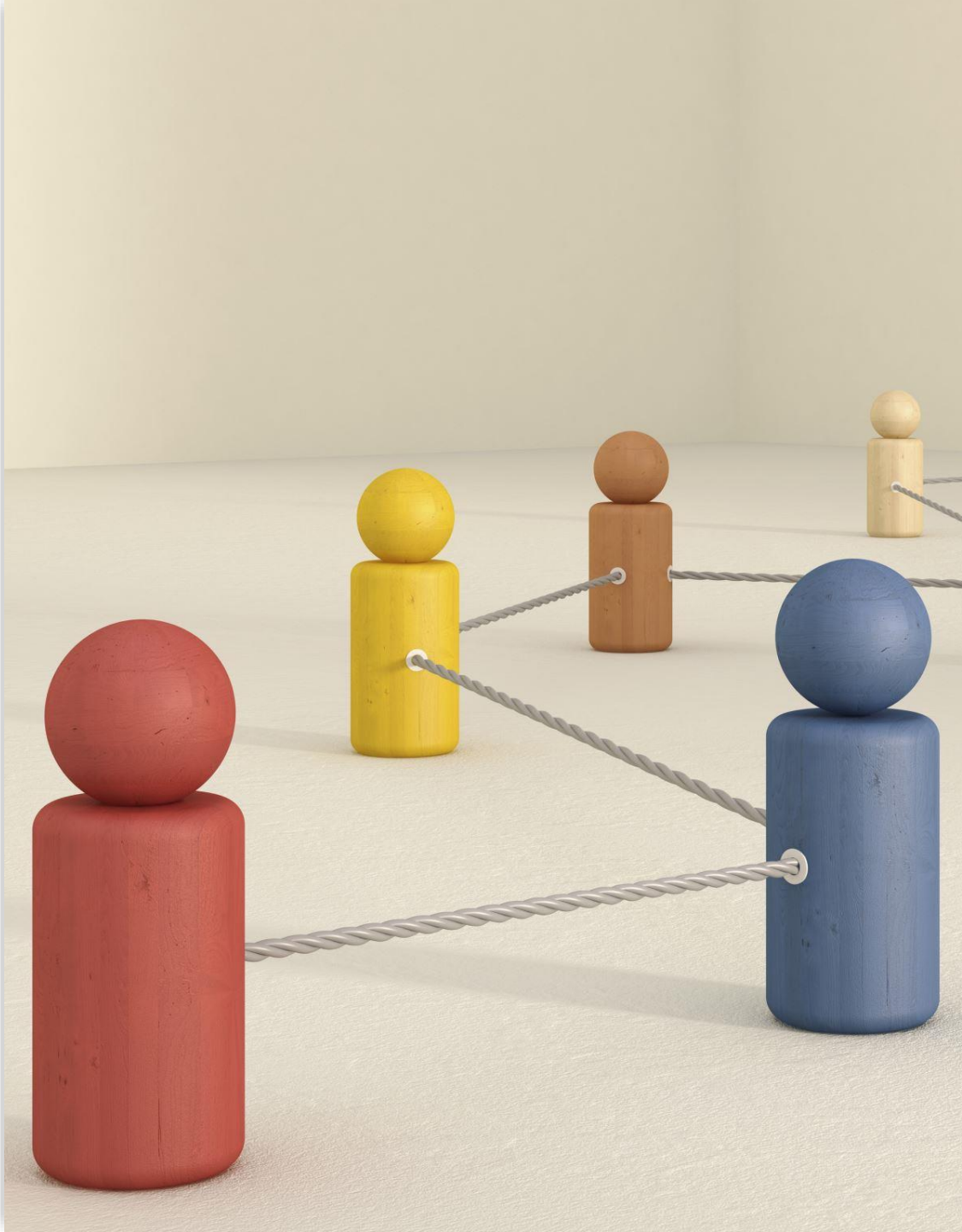
Conclusions and Recommendations

- A validation precision of 73% implies that our model can predict correct classes of the nine classes with a 73% probability of success.

- Precision of 73% demonstrates the potential of our model in enhancing dermatological diagnostics and ultimately improving patient care.

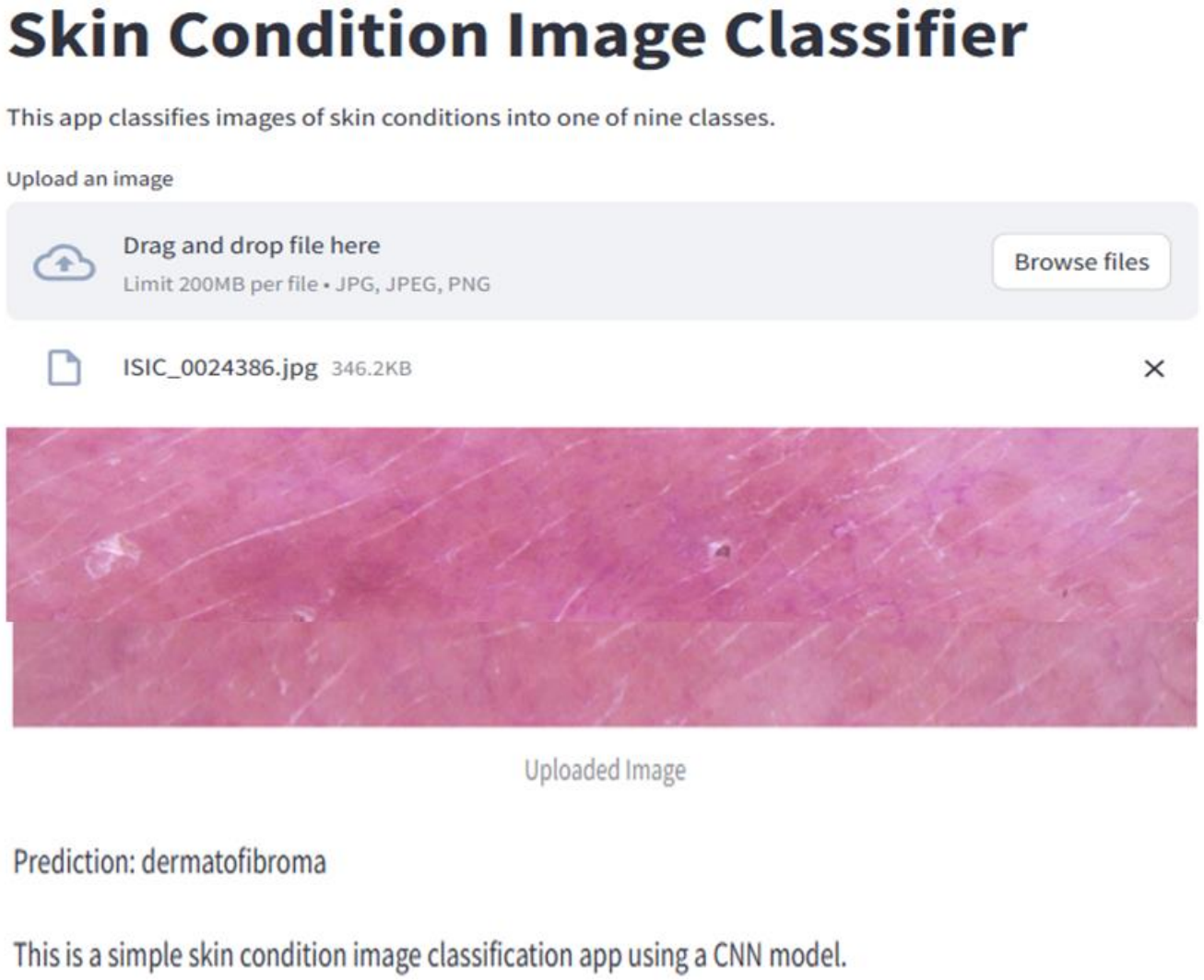
Recommendations

- To build upon our success and advance the model, we recommend the following:
  - Utilize the model's proficiency in predicting **Basal cell carcinoma** and N**evus.**
  - 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**.



Model Deployment

- Model deployment was done using stream lit.
- Link to upload images: CNN · Stream lit




Thank
you