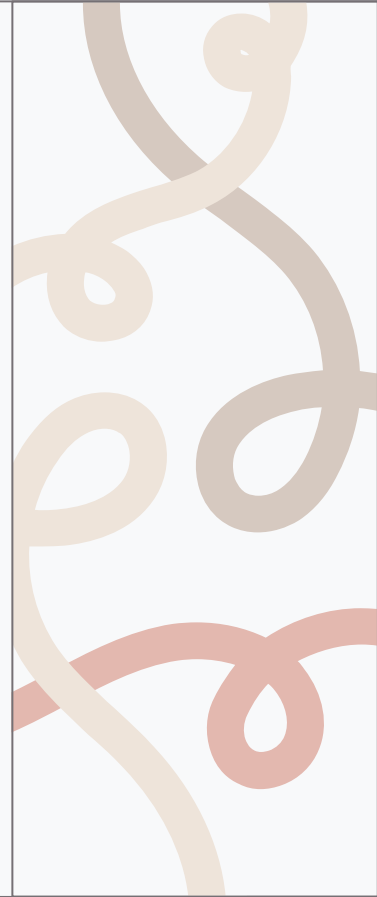


# Skin Cancer Classification using Deep Learning



Jonah Devoy



# Who Are you?

Dermatologists play a crucial role in assisting patients in regions with high UV exposure and a higher percentage of elderly population. As a dermatologist, you will need to analyze the patient's skin lesions prior to their initial visit. By utilizing the software provided, you can input the image of the skin lesion and upload it to the patient's portal, along with the classification results. This valuable tool ensures that during the patient's visit, the proper course of action can be promptly determined based on the accurate diagnosis, aiding in early detection and timely treatment of potential skin conditions, including skin cancer.



# Seven Skin Diseases

## What are we testing?

- Actinic keratoses
- Basal cell carcinoma
- Benign keratosis-like lesions
- Dermatofibroma
- Melanoma
- Melanocytic nevi
- Vascular lesions

## Diagnosed by:

- Clinical Examination
- Dermoscopy:
- Biopsy
- Imaging

## Causes

- Unprotected exposure to the sun's UV rays
- Tanning Beds
- Fair skin, light hair, and light-colored eyes
- Certain genetic disorders, such as xeroderma pigmentosum
- Exposure to Radiation



# How to Prevent Skin Cancer?

- Apply Sunscreen
- Seek Shade
- Wear Protective Clothing
- Avoid Tanning Beds
- Perform Regular Skin Checks



# PREVIEW OF IMAGES

## TYPES OF SKIN CANCER



Basal Cell  
Carcinoma (BCC)



Squamous Cell  
Carcinoma (SCC)



Melanoma



Bowen's  
Disease (BD)



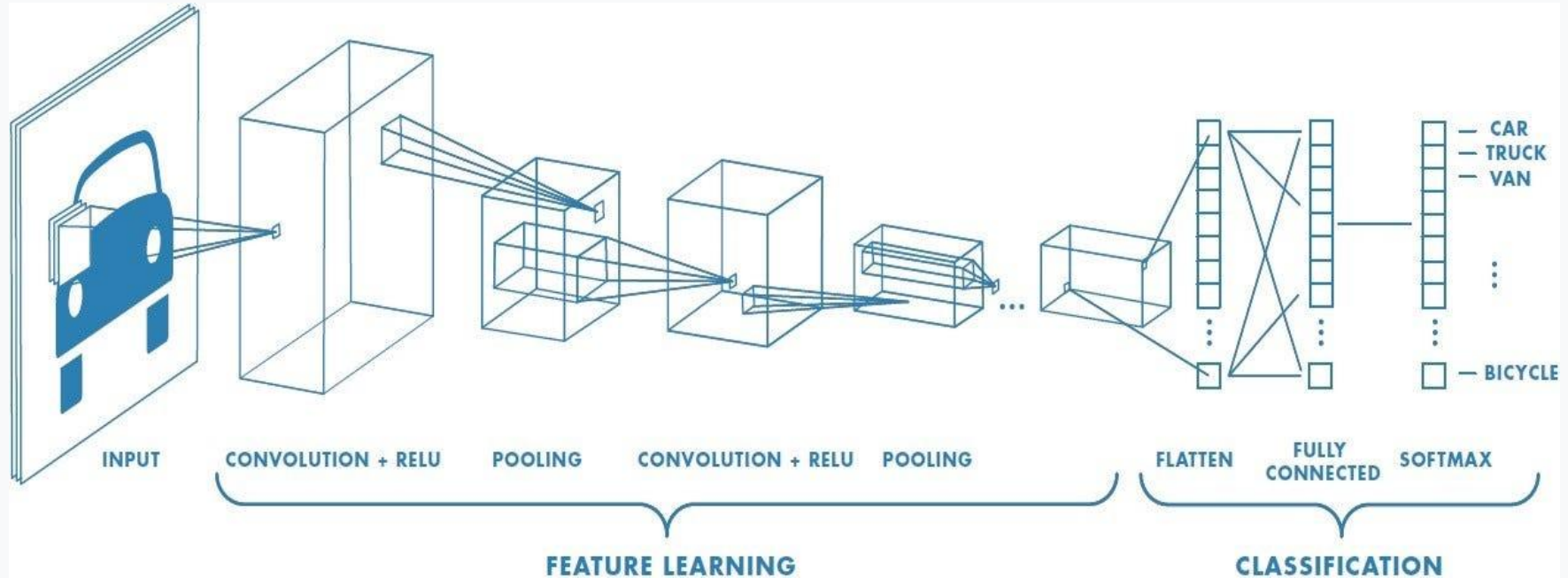
Keratoacanthoma

miiskin.com



Actinic  
Keratosis (AK)

# Using a convolutional neural network



# How can you help your patients

**Data Collection:** The images uploaded by patients contribute to a larger dataset, which can be used for research, training, and improving the effectiveness of the image classification system.

**Early Analysis:** By examining the image beforehand, the dermatologist may identify potentially concerning lesions or conditions, enabling them to focus on specific areas during the patient's examination.

**Convenience:** The patient can conveniently upload images from the comfort of their home, reducing the need for additional visits solely for image examination.

**Resource Allocation:** The dermatology organization can allocate resources more efficiently by identifying patients who need urgent attention based on image classification results.





Overall, implementing image classification in the patient portal benefits all stakeholders involved by streamlining the diagnostic process, improving patient care, and enhancing the organization's overall efficiency and data management.





# About the data:

**Harvard Dataverse:** The data used in this summary comes from two locations: the HAM10000 dataset from Harvard Dataverse. This dataset is designed to aid in training neural networks for automated diagnosis of pigmented skin lesions. It comprises 10015 dermatoscopic images from diverse populations, acquired and stored using various modalities. It serves as a valuable training set for academic machine learning purposes and covers different diagnostic categories of pigmented lesions, such as actinic keratoses, basal cell carcinoma, melanoma, and more. Over 50% of the lesions in the dataset have been confirmed through histopathology, and the remaining cases are verified through follow-up examinations, expert consensus, or in-vivo confocal microscopy.

	<a href="#">HAM10000_images_part_1.zip</a> ZIP Archive - 1.3 GB Published Jun 4, 2018 22,883 Downloads MD5: 463...e46 
	<a href="#">HAM10000_images_part_2.zip</a> ZIP Archive - 1.3 GB Published Jun 4, 2018 17,771 Downloads MD5: da4...84b 



Huge Class Imbalance!

Melanocytic nevi: 5954

Melanoma: 1074

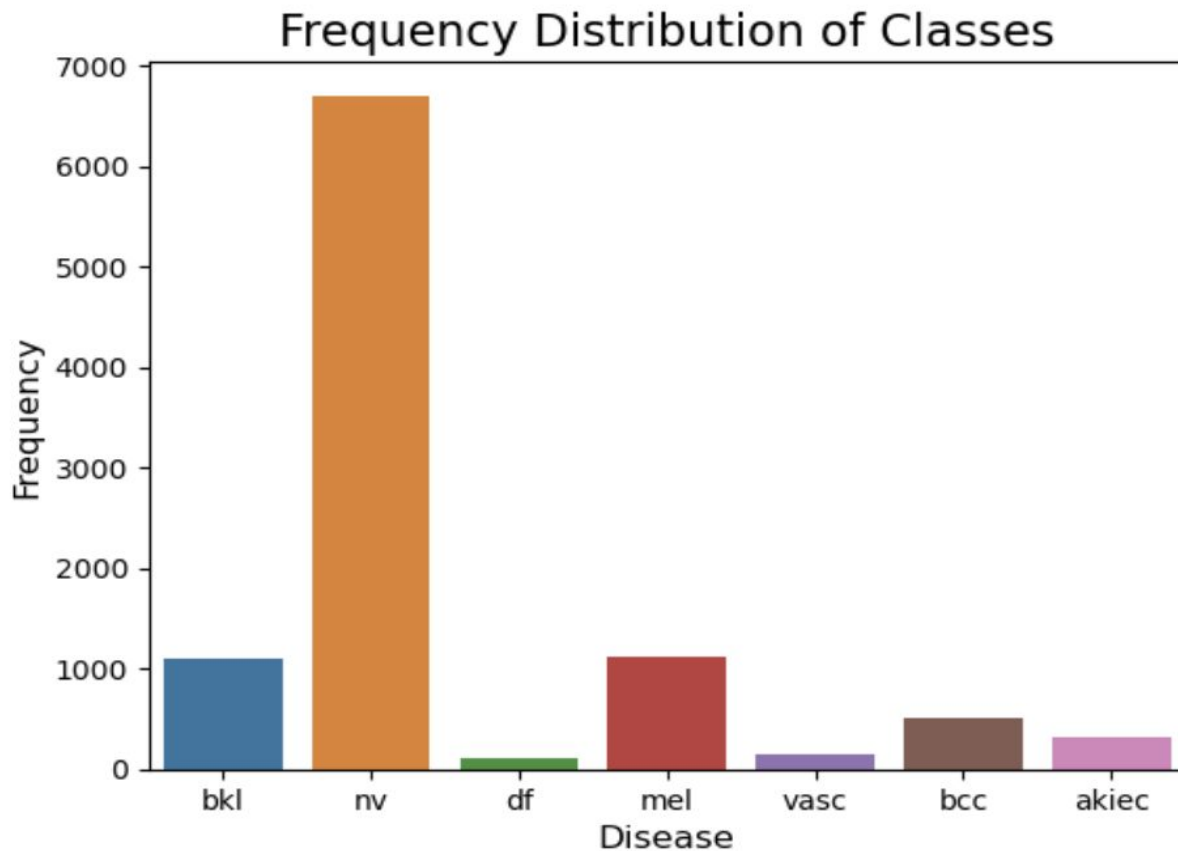
Benign keratosis-like lesions: 1024

Basal cell carcinoma: 484

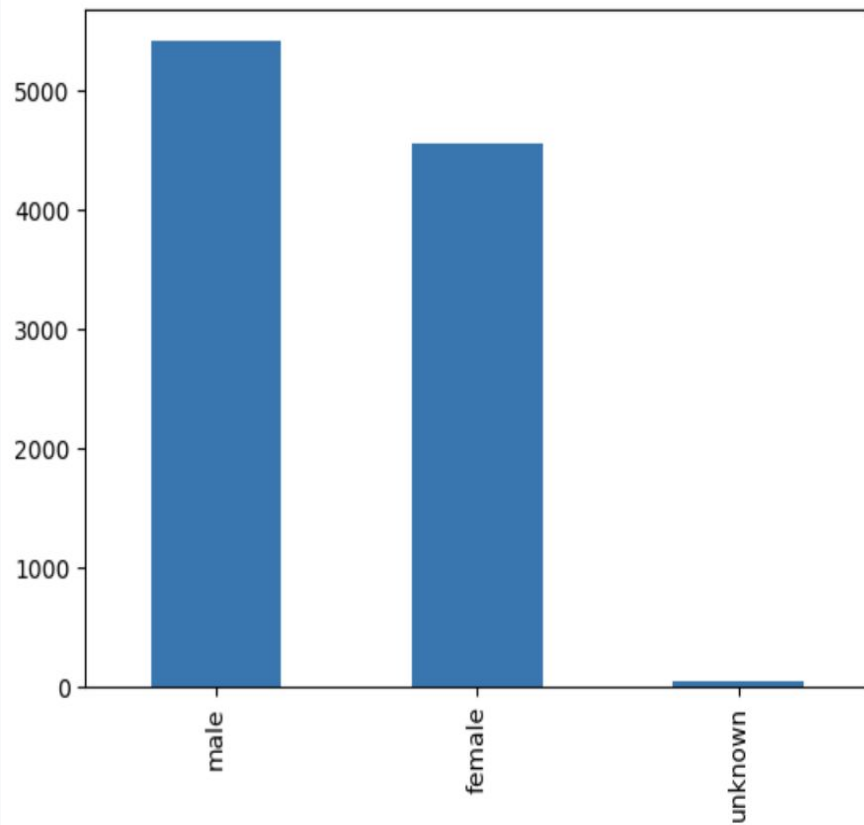
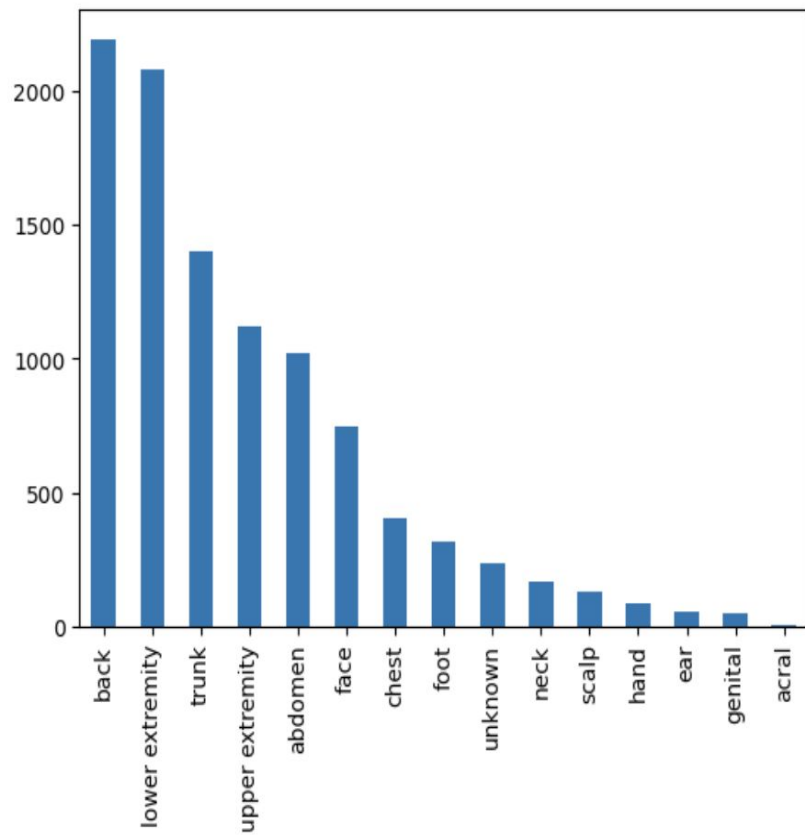
Actinic keratoses: 301

Pyogenic granuloma: 131

Dermatofibroma: 109

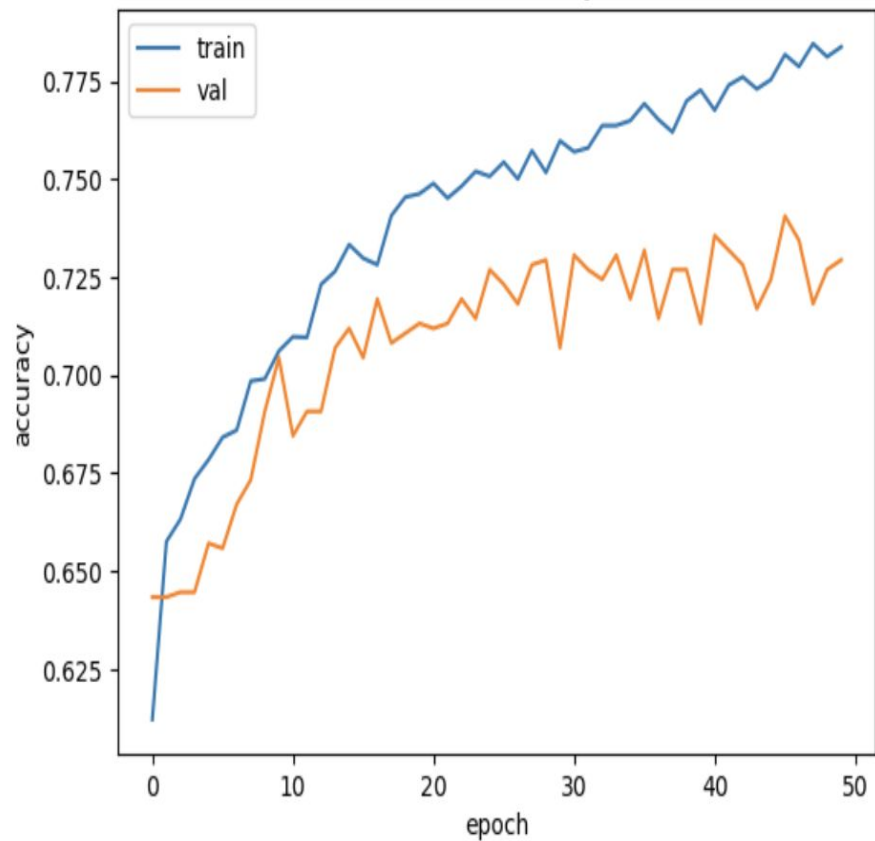


## LOCATION AND DEMOGRAPHICS

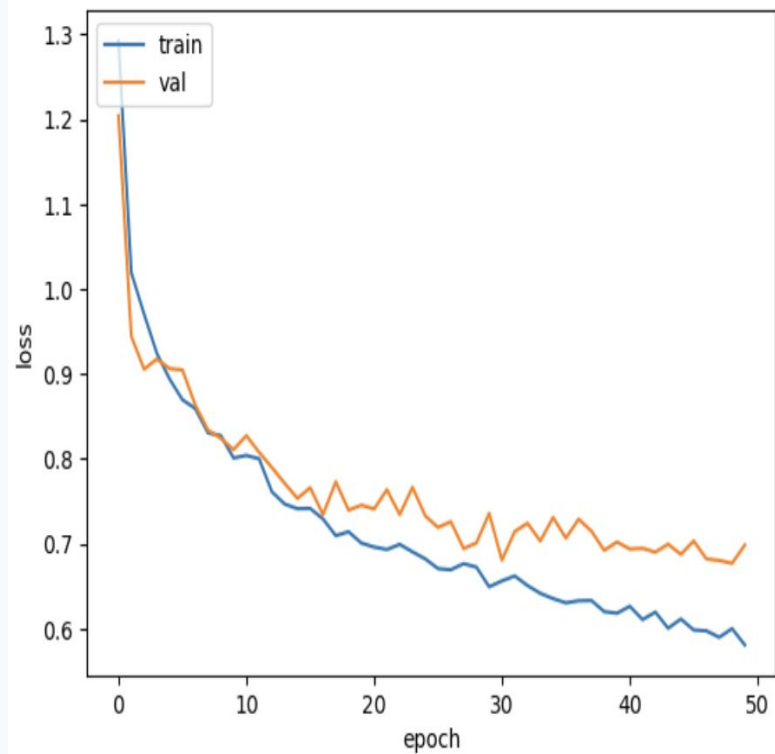


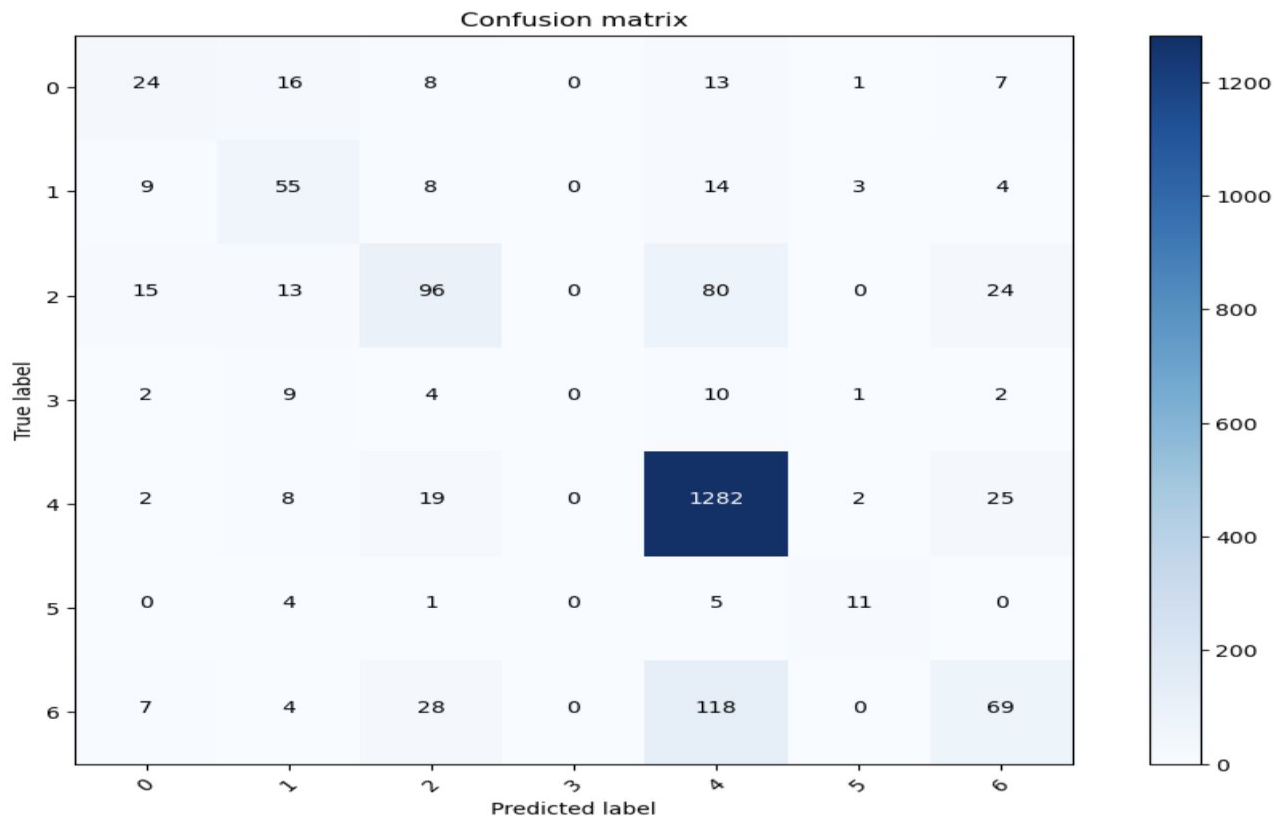
Performance of Model		precision	recall	f1-score	support	
		0.0	0.41	0.35	0.38	69
		1.0	0.50	0.59	0.54	93
	Actinic keratoses: 0,	2.0	0.59	0.42	0.49	228
	Basal Cell Carcinoma': 1	3.0	0.00	0.00	0.00	28
	Benign Keratosis-like Lesions: 2	4.0	0.84	0.96	0.90	1338
		5.0	0.61	0.52	0.56	21
	Dermatofibroma: 3	6.0	0.53	0.31	0.39	226
	Melanocytic Nevi: 4					
	Pyogenic Granulomas: 5	accuracy			0.77	2003
	macro avg	0.50	0.45	0.47	2003	
Melanoma: 6	weighted avg	0.73	0.77	0.74	2003	

model accuracy



model loss





- TP: Correctly predicted positive instances.
- FP: Incorrectly predicted positive instances.
- TN: Correctly predicted negative instances.
- FN: Incorrectly predicted negative instances.

# Web Application With Heroku

## Skin Cancer Detector

Prediction: **Melanoma**

Lesion type	Confidence
Melanoma	26.5%
Vascular lesions	13.0%
Benign keratosis	12.3%
Dermatofibroma	12.2%
Basal cell carcinoma	12.1%
Melanocytic nevi	12.0%
Actinic keratoses	11.9%



## Skin Cancer Detector

# Benign or Malignant

Find out if the skin lesion is normal or not. Upload image or specify URL.

Select image to upload and press Detect:

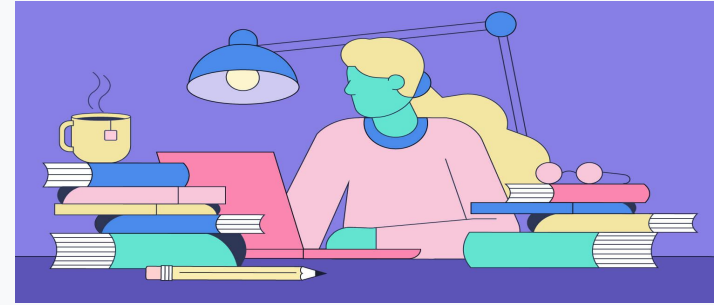
OR

Enter image URL and press Detect:



## Where to find more info on skin cancer

- Centers for Disease Control and Prevention (CDC): The CDC offers resources on skin cancer prevention and provides data and statistics related to skin cancer incidence and mortality.
- Skin Cancer Foundation: This nonprofit organization focuses on skin cancer awareness and education. Their website provides information on prevention, early detection, treatment, and support resources.
- Mayo Clinic: Mayo Clinic's website offers expert-authored articles on various medical conditions, including skin cancer. You can find valuable information on symptoms, diagnosis, treatment options, and prevention.



Website:

<https://www.cdc.gov/cancer/skin/index.htm>

Website:

<https://www.skincancer.org/>

Website:

<https://www.mayoclinic.org/diseases-conditions/skin-cancer/symptoms-causes/syc-20377605>

# Conclusion and Recommendations

- Include external data to address the large class imbalance
- Target each of these classes separately rather than all at once.
- Resize the images to 224x224 pixels before utilizing them as input for the model or use further image augmentation
- Create a model to focus solely on Dermatofibroma
- Melanocytic Nevi had a much higher rate of accuracy than the other classes especially compared to Dermatofibroma which was not detected at all.
- This can be useful tool for dermatologists in detecting skin cancers since the model accuracy reached 76% with a auc score of 96%.



# Thanks

**Do you have any questions?**

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