

MULTI-CLASS SKIN CANCER IMAGE CLASSIFICATION



BRITTNEY HOSAC

PUBLIC SERVICE ANNOUNCEMENT: MEDICAL IMAGES AHEAD





GENERAL SKIN CANCER STATISTICS

- ❖ MORE PEOPLE ARE DIAGNOSED WITH SKIN CANCER EACH YEAR IN THE U.S. THAN **ALL OTHER CANCERS COMBINED**
- ❖ IN THE U.S., MORE THAN 9,500 PEOPLE ARE DIAGNOSED WITH SKIN CANCER EVERY DAY.
 - MORE THAN TWO PEOPLE DIE OF THE DISEASE **EVERY HOUR**.
- ❖ THE ANNUAL COST OF TREATING SKIN CANCERS IN THE U.S. IS ESTIMATED AT \$8.1 BILLION



IS THERE A FIGHTING CHANCE?

- ❖ 99% OF ALL SKIN CANCER CASES ARE CURABLE IF THEY ARE DIAGNOSED AND TREATED EARLY ENOUGH.
- ❖ MONTHLY SELF EXAMINATIONS AND YEARLY CHECK-UPS ARE IMPORTANT BUT MANY PEOPLE DON'T FOLLOW THIS RECOMMENDATION.

HOW CAN WE ENSURE EARLY DETECTION?



HOW CAN WE ENSURE EARLY DETECTION?

SKIN CANCER IS THE CANCER YOU CAN SEE

GIVE THE POWER TO THE PUBLIC TO **DETECT CANCER EARLY** WHEN IT'S EASIEST TO CURE, BEFORE IT CAN BECOME DANGEROUS, DISFIGURING OR DEADLY.

THE GOAL IS TO CREATE AN ONLINE TOOL THAT CAN NOTIFY EVERYDAY PEOPLE THE THREE HIGHEST PROBABILITY DIAGNOSES FOR A GIVEN SKIN LESION.

IN AN ATTEMPT TO MAKE THIS A TRUE POSSIBILITY, PIGMENTED SKIN LESION IMAGES WERE GATHERED FROM HARVARD DATAVERSE

SKIN CANCER DIAGNOSTIC APP FOR ACCESSIBLE EARLY DETECTION

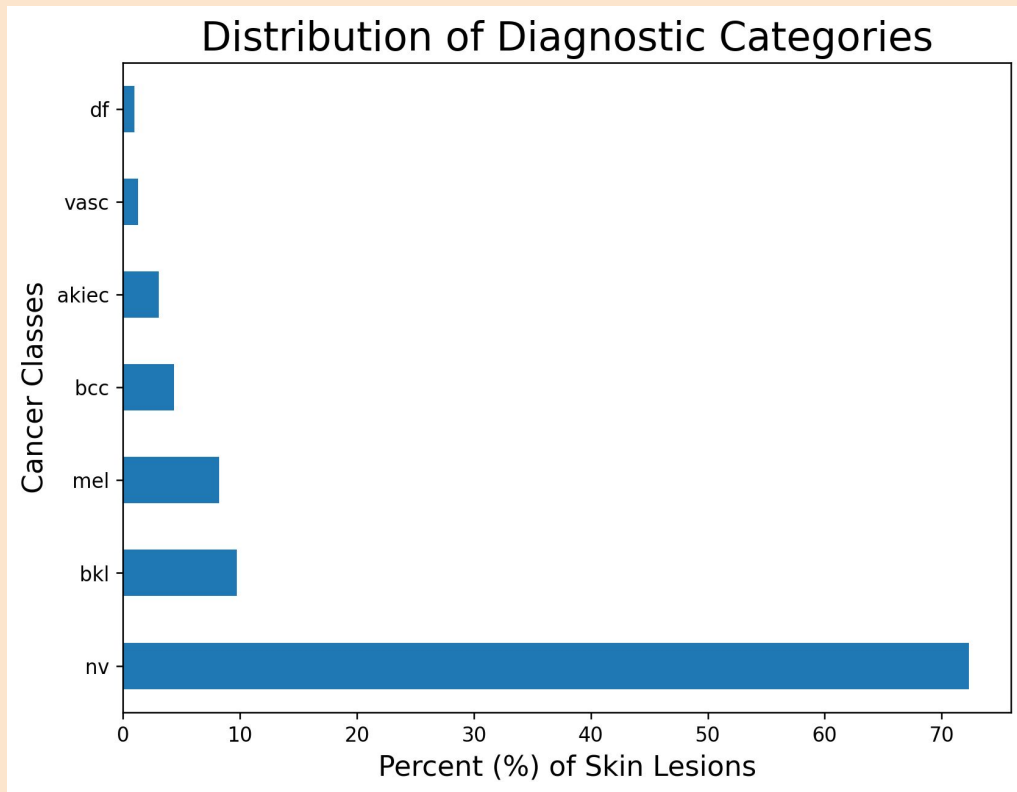




CHALLENGES

TRAINING NEURAL NETWORKS FOR
AUTOMATED DIAGNOSIS OF PIGMENTED SKIN
LESIONS IS RESTRAINED BY SMALL SIZE AND
LACK OF DIVERSITY OF AVAILABLE DATASETS OF
DERMATOSCOPIC IMAGES.

10,015 IMAGES = 7470 UNIQUE SKIN LESIONS



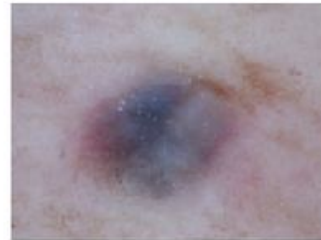
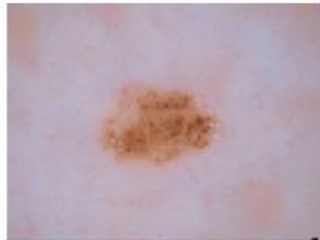


DATA OVERVIEW / BASICS ON SKIN CANCER CLASSES

NV: MELANOCYTIC NEVI

- ◆ A DISORDER OF PIGMENT-PRODUCING SKIN CELLS COMMONLY CALLED BIRTH MARKS OR MOLES THAT RARELY BECOME CANCEROUS.

Melanocytic nevi



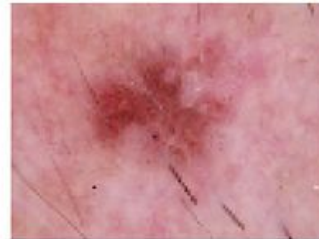
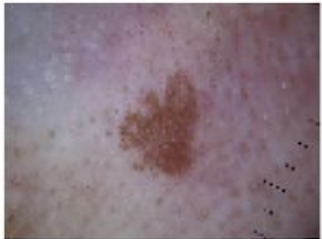


DATA OVERVIEW / BASICS ON SKIN CANCER CLASSES

BKL: BENIGN KERATOSIS-LIKE LESIONS

- ❖ ONE OF THE MOST COMMON BENIGN SKIN GROWTHS IN OLDER ADULTS
 - APPEARS AS A WAXY BROWN, BLACK, OR TAN GROWTH

Benign keratosis-like lesions



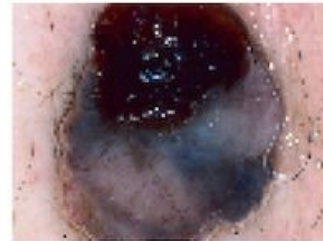
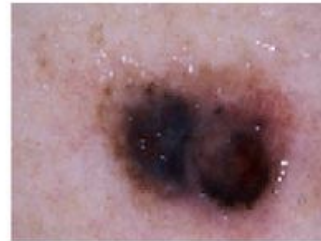


DATA OVERVIEW / BASICS ON SKIN CANCER CLASSES

MEL: MELANOMA

- ❖ WHEN DETECTED EARLY, THE 5-YEAR SURVIVAL RATE FOR MELANOMA IS 99%
- ❖ AN ESTIMATED 6,850 PEOPLE WILL DIE OF MELANOMA IN 2020.
 - OF THOSE, 67% WILL BE MEN AND 33% WILL BE WOMEN.

Melanoma



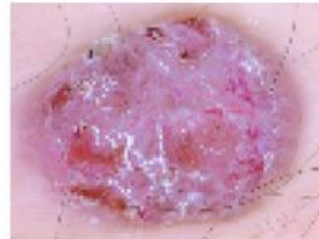


DATA OVERVIEW / BASICS ON SKIN CANCER CLASSES

BCC: BASAL CELL CARCINOMA

- ❖ THE MOST COMMON FORM OF SKIN CANCER.
 - AN ESTIMATED 4.3 MILLION CASES OF BCC ARE DIAGNOSED IN THE U.S. EACH YEAR.

Basal cell carcinoma



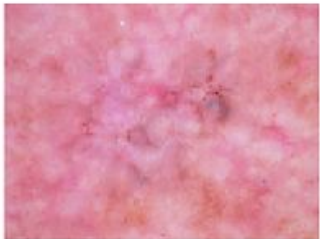


DATA OVERVIEW / BASICS ON SKIN CANCER CLASSES

AKIEC: ACTINIC KERATOSES AND INTRAEPITHELIAL CARCINOMA / BOWEN'S DISEASE

- ❖ THE MOST COMMON PRECANCER (3 MILLION US CASES PER YEAR)
- ❖ BECAUSE IT CAN BECOME CANCEROUS, IT'S USUALLY REMOVED AS A PRECAUTION
- ❖ PROGRESSES TO SQUAMOUS CELL CARCINOMA (SCC), WHICH IS THE SECOND MOST COMMON FORM OF SKIN CANCER.
 - MORE THAN 1 MILLION CASES OF SCC ARE DIAGNOSED IN THE U.S. EACH YEAR

Actinic keratoses

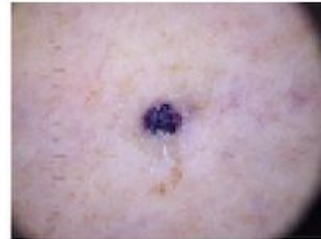
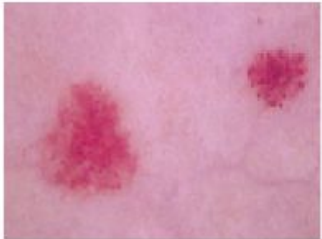


DATA OVERVIEW / BASICS ON SKIN CANCER CLASSES

VASC: VASCULAR LESIONS

- ❖ RELATIVELY COMMON ABNORMALITIES OF THE SKIN AND UNDERLYING TISSUES, MORE COMMONLY KNOWN AS BIRTHMARKS

Vascular lesions



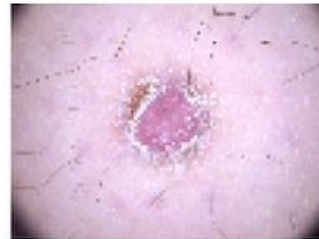
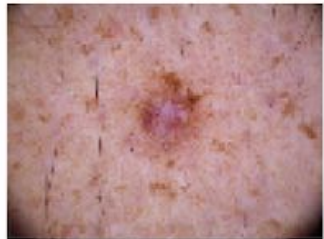


DATA OVERVIEW / BASICS ON SKIN CANCER CLASSES

DF: DERMATOFIBROMA

❖ A COMMON BENIGN FIBROUS NODULE THAT MOST OFTEN ARISES ON THE SKIN OF THE LOWER LEGS.

Dermatofibroma



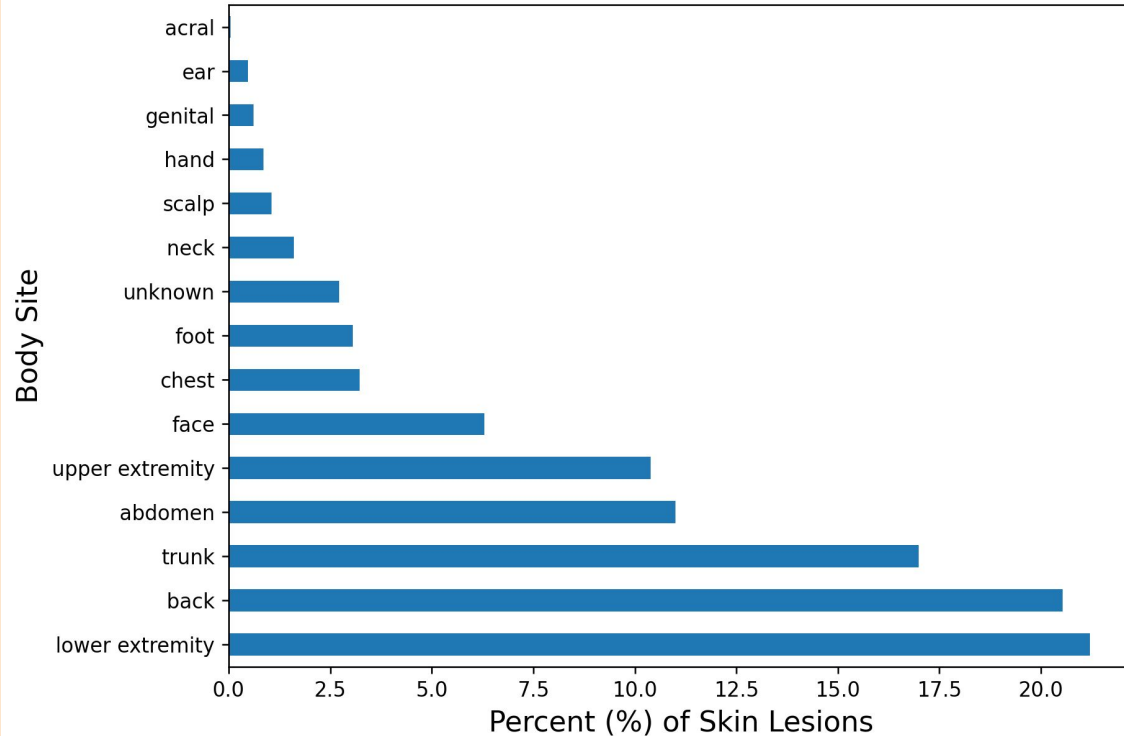


DATA OVERVIEW

THE IMPORTANCE OF SUNSCREEN:

- ❖ ULTRAVIOLET (UV) RADIATION IS A PROVEN HUMAN CARCINOGEN
- ❖ HAVING 5 OR MORE SUNBURNS DOUBLES YOUR RISK FOR MELANOMA
- ❖ ABOUT 90 PERCENT OF NONMELANOMA SKIN CANCERS ARE ASSOCIATED WITH EXPOSURE TO ULTRAVIOLET (UV) RADIATION FROM THE SUN.

Distribution of Lesion Localization

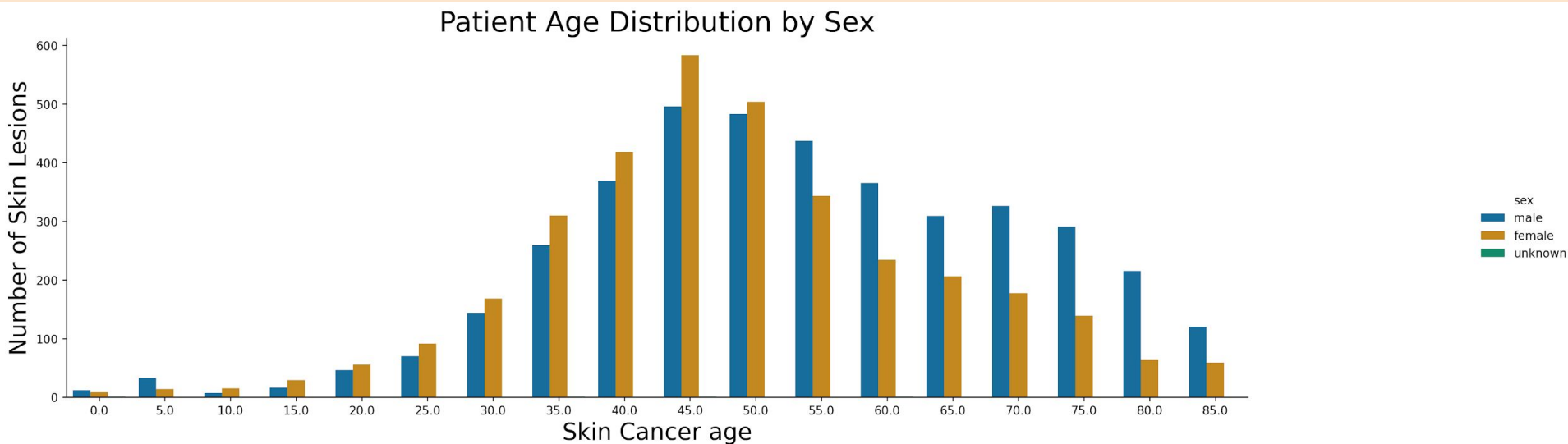




DATA OVERVIEW

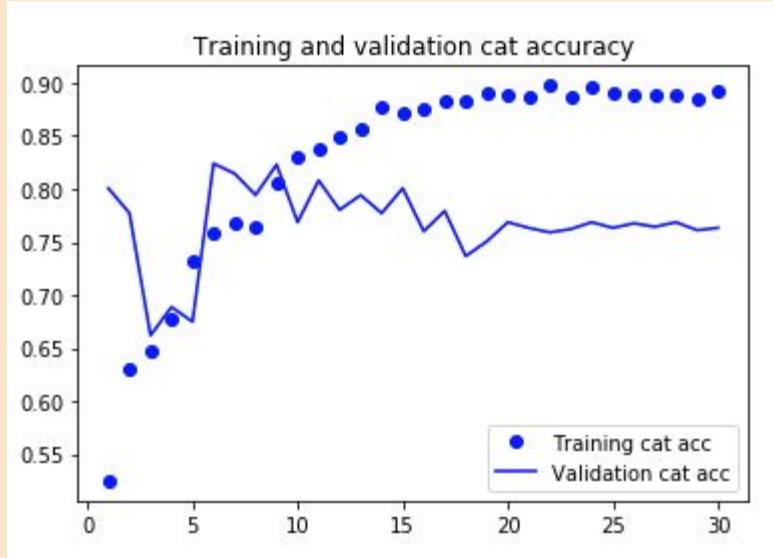
1 IN 5 AMERICANS WILL DEVELOP SKIN CANCER BY THE AGE OF 70

SUN DAMAGE IS CUMULATIVE. ONLY ABOUT 23 PERCENT OF LIFETIME EXPOSURE OCCURS BY AGE 18





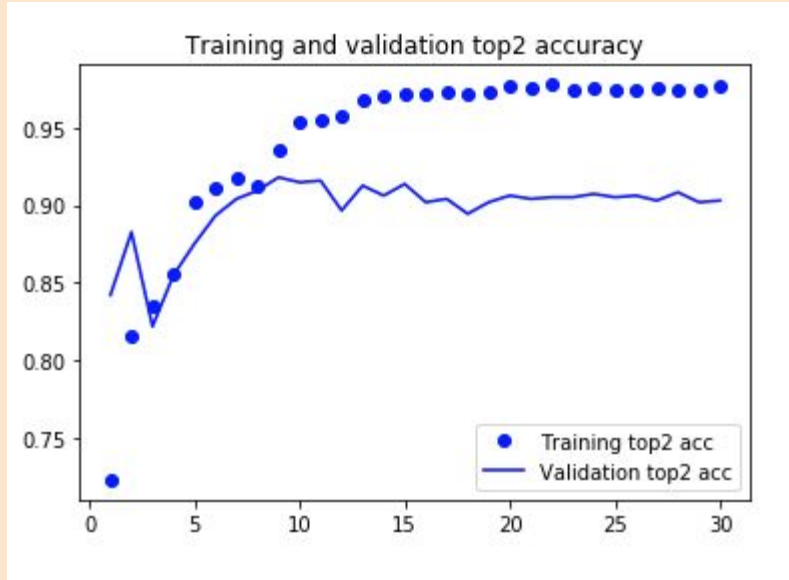
MODELING: MOBILENET CONVOLUTIONAL NEURAL NETWORK



ACCURACY CLASSIFYING NEW IMAGES = 0.82



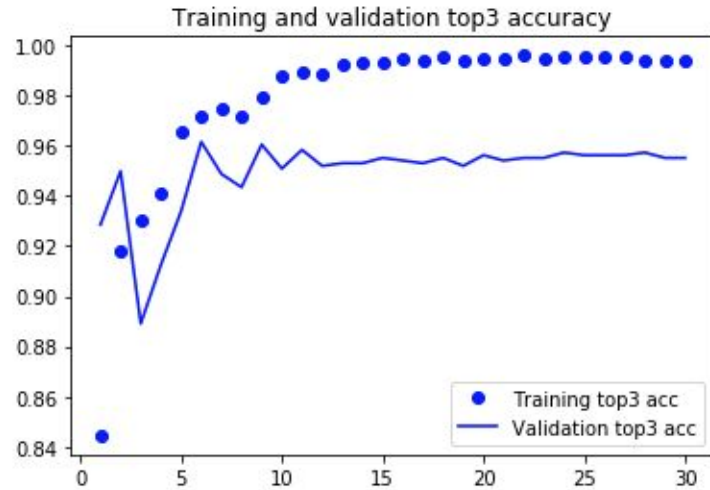
MODELING: MOBILENET CONVOLUTIONAL NEURAL NETWORK



ACCURACY CLASSIFYING NEW IMAGES = 0.89



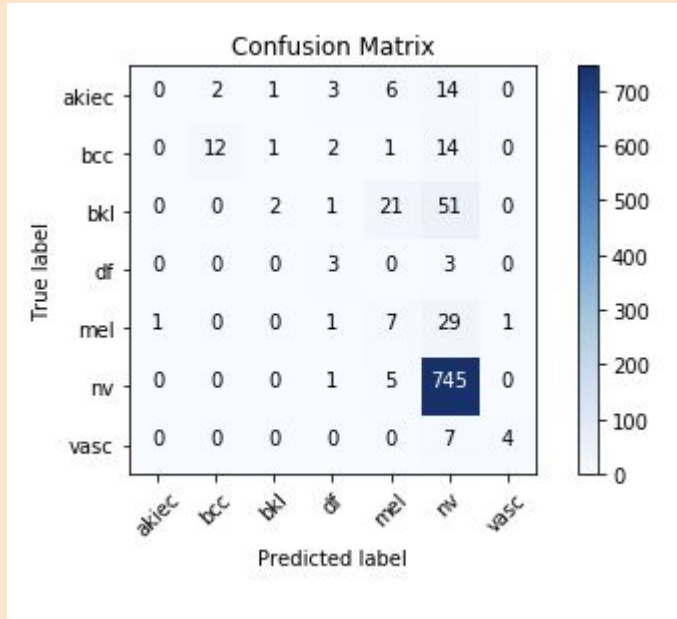
MODELING: MOBILENET CONVOLUTIONAL NEURAL NETWORK



ACCURACY CLASSIFYING NEW IMAGES = 0.96



MODELING: MOBILENET CONVOLUTIONAL NEURAL NETWORK



	precision	recall	f1-score
akiec	0.00	0.00	0.00
bcc	0.86	0.40	0.55
bkl	0.50	0.03	0.05
df	0.27	0.50	0.35
mel	0.17	0.18	0.18
nv	0.86	0.99	0.92
vasc	0.80	0.36	0.50
avg / total	0.78	0.82	0.78



GOALS / NEXT STEPS

- ❖ CONTINUE TO TRAIN VARIOUS NN FOR HIGHER ACCURACY
- ❖ MAKE SKINSCREEN A REALITY
 - DEPLOY WEBSITE OR MOBILE APP FOR GENERAL PUBLIC
 - USERS ARE ABLE TO SUBMIT A PICTURE OF A SKIN LESION AND GET AN INSTANT DIAGNOSTIC PREDICTION



CONCLUSIONS AND RECOMMENDATIONS

- ❖ DEPENDING ON THE TYPE, SKIN CANCER CAN GROW RAPIDLY AND BECOME LIFE-THREATENING IF NOT TREATED EARLY.
- ❖ EXAMINE YOUR SKIN ONCE A MONTH AND SEE YOUR DERMATOLOGIST ANNUALLY
- ❖ WEAR SUNSCREEN EVERYDAY AND AS AN EXTRA PRECAUTION, DON'T FORGET **SKINSCREEN**
 - NOT INTENDED FOR FINAL DIAGNOSTIC CONCLUSION: PLEASE SEEK MEDICAL FOLLOW UP WITH DERMATOLOGIST TO CONFIRM THE RESULTS OF SKIN LESION CLASSIFICATION BY SKINSCREEN.

SOURCES: [THE SKIN CANCER FOUNDATION](#)