
PROJECT REPORT

ON

# Skin Cancer Detection

SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENT FOR SEMESTER VI OF

**T.E. (Information Technology)**

*SUBMITTED BY*

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**2022-23**

# *Certificate*

This is to certify that project entitled

**"Skin Cancer Detection"**

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# *Declaration*

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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# Abstract

One of the most quickly spreading diseases in the world is considered to be skin cancer. Skin cancer is a dangerous and widespread disease. It is one of the most active types of cancer in the present decade. As the skin is the body's largest organ, the point of considering skin cancer as the most common type of cancer among humans is understandable. Each year there are approximately 5.4 million new cases of skin cancer recorded in the USA alone. The global statistics are equally alarming. It is generally classified into two major categories: melanoma and nonmelanoma skin cancer. Melanoma is a hazardous, rare, and deadly type of skin cancer.

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# Chapter 1

# Introduction

## 1.1 Introduction

One of the most quickly spreading diseases in the world is considered to be skin cancer. Skin cancer is a disease in which abnormal skin cells develop out of control. Skin cancer is a dangerous and widespread disease. It is one of the most active types of cancer in the present decade. As the skin is the body's largest organ, the point of considering skin cancer as the most common type of cancer among humans is understandable. Each year there are approximately 5.4 million new cases of skin cancer recorded in the USA alone.

The doctor's diagnosis is reliable, but this procedure takes lots of time, effort. These routines can be automated. It could save lots of doctors' time and could help to diagnose more accurately. Besides using computerized means there are good opportunities to store information with diagnostic information to use for further investigations or the creation of new methods of diagnosis.

In order to determine potential cancer therapies, early detection and accurate diagnosis are essential. The visibility of the skin diseases increases the chances of early detection and diagnosis.

## 1.2 Aim and Objectives

The main objective of the skin cancer detection project is to develop a framework to analyze the risk of skin cancer and diseases using Image Processing and to detect them before it causes any severe harm.

Also our one of the main objective will be to achieve a good accuracy and to obtain precise detection solutions by using a data set licensed by Harvard Data verse.

Our project will be a web based application which will allow user to access the detection system. Initially it will require image of the lesion part of the skin which will be furthermore matched with the data. Hence predicting the result.

**Specific Objectives:**

- To provide solutions for skin cancer diagnostic problems with state-of-the-art methods and technologies.
- A Reliable source with no misleading information.

- To reduce the complexity of the process by which any person can take advantage of the technology with ease.
- To create a system that handles the evolving nature and which always has room for improvement.
- To deliver the results very fast, within three seconds.
- To ensure privacy Uploaded image does not go to an external server

## 1.3 Motivation for the Work

The biggest motivation for us to get the idea of this project and work on this was seeing how people are suffering badly only because of late detection of skin cancer which is harmful for one's life. Early detection helps in prevention of the cancer easily. Doctor treatment sometimes is difficult since not everyone gets appointment on time. Thus our project provides an online platform for the same which can be used anytime anywhere giving reliable result. Thus this idea was brought into action by us.

## 1.4 Scope of Project

Skin cancer is a serious and potentially life-threatening disease that affects millions of people worldwide. Early detection of skin cancer can greatly increase the chances of successful treatment in future, and image processing techniques can play an important role in achieving this goal. The scope of a project involves collecting a large data set of medical images of skin lesions, developing algorithms to analyze and classify these images, and testing the accuracy and effectiveness of these algorithms. The project requires collaboration with medical professionals and institutions to obtain access to patient data, and could have a significant impact on improving the diagnosis and treatment of skin cancer.

## 1.5 Contribution

Skin cancer detection is one of the most crucial point. Early detection of cancer helps in prevention of the cancer. But Doctor treatment sometimes is difficult since not everyone gets appointment on time. Late detection of skin cancer is harmful for the person's life and it also leads to costly and time consuming treatments. Thus our project provides an online platform for the same which can be used anytime anywhere giving reliable result. Thus this idea will be more convenient and easier for people to use and once they get their result, they can further get it diagnosed respectively.

## 1.6 About Dataset

Our dataset was hosted by International skin imaging collaboration. Training of neural networks for automated diagnosis of pigmented skin lesions is hampered by the small size and lack of diversity of available dataset of dermatoscopic images. More than

50 percent of lesions are confirmed through histopathology (histo), confirmation by in-vivo confocal microscopy (confocal). The dataset includes lesions with multiple images, which can be tracked by the lesion id-column within the HAM10000 metadata file.

- Dataset Link: https://www.kaggle.com/datasets/kmader/skin-cancer-mnist-ham10000
- NV: Melanocytic nevi are benign neoplasms of melanocytes and appear in a myriad of variants, which all are included in our series. The variants may differ significantly from a dermatoscopic point of view.
- Mel: Melanoma is a malignant neoplasm derived from melanocytes that may appear in different variants. If excised in an early stage it can be cured by simple surgical excision. Melanomas can be invasive or non-invasive (in situ). We included all variants of melanoma including melanoma in situ but did exclude non-pigmented, subungual, ocular or mucosal melanoma.
- BKL: "Benign keratosis" is a generic class that includes seborrheic keratoses ("senile wart"), solar lentigo - which can be regarded as a flat variant of seborrheic keratosis - and lichen-planus like keratoses (LPLK), which corresponds to a seborrheic keratosis or a solar lentigo with inflammation and regression.
- bcc: Basal cell carcinoma is a common variant of epithelial skin cancer that rarely metastasizes but grows destructively if untreated. It appears in different morphologic variants (flat, nodular, pigmented, cystic, etc), which are all included in this set.
- apiece: Actinic Keratoses (Solar Keratoses) and intraepithelial Carcinoma (Bowen's disease) are common non-invasive, variants of squamous cell carcinoma that can be treated locally without surgery. Some authors regard them as precursors of squamous cell carcinomas and not as actual carci- nomas.
- Vasc: Vascular skin lesions in the dataset range from cherry angiomas to angiokeratomas and pyogenic granulomas. Haemorrhage is also included in this category.
- df: Dermatofibroma is a benign skin lesion regarded as either a benign proliferation or an inflammatory reaction to minimal trauma. It is brown often showing a central zone of fibrosis dermatoscopically."

The final dataset consists of 10015 dermatoscopic images which can serve as a training set for academic machine learning purposes. Cases include a representative collection of all important diagnostic categories in the realm of pigmented lesions: Actinic keratoses and intraepithelial carcinoma / Bowen's disease (akiec), basal cell carcinoma (bcc), benign keratosis-like lesions (solar lentigines / seborrheic keratoses and lichen-planus like keratoses, bkl), dermatofibroma (df), melanoma (mel), melanocytic nevi (nv) and vascular lesions (angiomas, angiokeratomas, pyogenic granulomas and hemorrhage, vasc).

## 1.7 Organization of the report

Title [1] - INTRODUCTION - It gives an overall idea of our project. It consists of Aim and objectives of our project,and motivation for our project and how we are contributing to the society.

Title [2] - LITERATURE SURVEY - In this, we have gone through multiple research papers such as "A. A. Adegun and S. Viriri, "Deep Learning-Based System for Automatic Melanoma Detection," in IEEE Access" and " R. Kasmi and K. Mokrani, "Classification of malignant melanoma and benign skin lesions: implementation of automatic ABCD rule,". We identified the problems in existing services and provided a solution for the same.

Title [3] - DESIGN IMPLEMENTATION - It consists an overall idea of our proposed system and how it works. Software and Hardware Requirements are specified. Idea of website is diagramatically represented such as:- Block diagram , Visualization of data , Accuracy graph , Confusion matrix and Timeline chart. Feasibility study and Cost estimation is covered.

Title [4] - RESULTS AND DISCUSSION - Important code and Screenshots of GUI is provided here. Testing of accuracy and precision is done.

Title [5] - CONCLUSION - Summary of the entire project with future scope is covered here.

# Chapter 2

# Literature Survey

## 2.1 Introduction

One of the most quickly spreading diseases in the world is considered to be skin cancer. Skin cancer is a disease in which abnormal skin cells develop out of control. Skin cancer is a dangerous and widespread disease. The doctor's diagnosis is reliable, but this procedure takes lots of time, effort. These routines can be automated. It could save lots of doctors' time and could help to diagnose more accurately. We studied different solutions proposed for this problem below. Our project provides an solution for the same providing reliable results.

## 2.2 Problem Definition

**[1] A. A. Adegun and S. Viriri, "Deep Learning-Based System for Automatic Melanoma Detection," in IEEE Access, vol. 8, pp. 7160-7172, 2020, doi: 10.1109/ACCESS.2019.2962812.**

Melanoma is a malignant tumour which develops from the pigment-containing cells known as melanocytes. It has the most rapidly increasing mortality rate among skin cancers. The American Cancer Society estimates that about 7,230 people are expected to die of melanoma and about 96,480 new melanomas is diagnosed in the United States in the year 2019. According to the statistics , the lifetime risk of getting melanoma is about 2.6 percent for whites, 0.1 percent for blacks, and 0.6 percent for Hispanics. Cutaneous melanoma is the most dangerous form of skin tumor that causes 90 percent of skin cancer mortality .

**[2] R. Kasmi and K. Mokrani, "Classification of malignant melanoma and benign skin lesions: implementation of automatic ABCD rule," In IET Image Processing, vol. 10, no. 6, pp. 448-455, 6 2016.**

The ABCD (asymmetry, blarity, corder irregular and dermoscopic structure) rule of dermoscopy is a scoring method used by dermatologists to quantify dermoscopy findings and effectively separate melanoma from benign lesions. Automatic detection of the ABCD features and separation of benign lesions from melanoma could enable earlier detection of melanoma. In this study, automatic ABCD scoring of dermoscopy lesions is implemented. Pre-processing enables automatic detection of hair using Gabor filters and lesion boundaries using geodesic active contours. Algorithms are implemented to

extract the characteristics of ABCD attributes. The experimental results, using 200 dermoscopic images, where 80 are malignant melanomas and 120 benign lesions, show that the algorithm achieves 91.25 percent sensitivity of 91.25 and 95.83 percent specificity. This is comparable to the 92.8 percent sensitivity and 90.3 percent specificity reported for human implementation of the ABCD rule.

**[3] A survey on automated melanoma detection Erdem Okur , Department of Software Engineering, Izmir University of Economics, Izmir, Turkey Received 30 October 2017 , Available online 25 May 2018**

The tissue that melanoma spreads then becomes a cancerous growth, which is difficult to deal with. Fortunately the malignant growth occurs on the skin surface, making detection through a simple visual inspection and a complete cure highly possible, if identified at an early stage. Unfortunately, the stage of a melanoma can only be determined after a suspected lesion (or mole) is excised or biopsied. To determine the stage, four basic features are considered: the tumor thickness (Breslow scale Marghoob et al., 2000), its ulceration, and its spread to lymph nodes or other parts of the body (PDQ Adult Treatment Editorial Board, 2018a). There are five main stages of melanoma, i.e., Stage 0, I (A/B), II (A/B/C), III and IV, and their definitions are summarized in Table .

**[4] Y. Yuan, M. Chao and Y. C. Lo, "Automatic Skin Lesion Segmentation Using Deep Fully Convolutional Networks With Jaccard Distance," in IEEE Transactions on Medical Imaging, vol. 36, no. 9, pp. 1876-1886, Sept. 2017**

Automatic skin lesion segmentation in dermoscopic images is a challenging task due to the low contrast between lesion and the surrounding skin, the irregular and fuzzy lesion borders, the existence of various artifacts, and various imaging acquisition conditions. In this paper, a fully automatic method for skin lesion segmentation by leveraging 19-layer deep convolutional neural networks that is trained end-to-end and does not rely on prior knowledge of the data. We propose a set of strategies to ensure effective and efficient learning with limited training data. We evaluated the effectiveness, efficiency, as well as the generalization capability of the proposed framework on two publicly available databases. One is from ISBI 2016 skin lesion analysis towards melanoma detection challenge, and the other is the PH2 database. Experimental results showed that the proposed method outperformed other state-of-the-art algorithms on these two databases. This method is general enough and only needs minimum pre- and post-processing, which allows its adoption in a variety of medical image segmentation tasks.

**[5]Automatic Skin Lesion Segmentation Using Deep Fully Convolutional Networks With Jaccard Distance**

Melanoma spreads through metastasis, and therefore, it has been proved to be very fatal. Statistical evidence has revealed that the majority of deaths resulting from skin cancer are as a result of melanoma. Further investigations have shown that the survival rates in patients depend on the stage of cancer; early detection and intervention of melanoma implicate higher chances of cure. Clinical diagnosis and

prognosis of melanoma are challenging since the processes are prone to misdiagnosis and inaccuracies due to doctors' subjectivity. Malignant melanomas are asymmetrical, have irregular borders, notched edges, and colour variations, so analyzing the shape, colour, and texture of the skin lesion is important for the early detection and prevention of melanoma. This paper proposes the two major components of a noninvasive real-time automated skin lesion analysis system for the early detection and prevention of melanoma. The first component is a real-time alert to help users prevent skin burn caused by sunlight; a novel equation to compute the time for skin to burn is thereby introduced. The second component is an automated image analysis module, which contains image acquisition, hair detection and exclusion, lesion segmentation, feature extraction, and classification. The proposed system uses the PH2 Dermoscopy image database from Pedro Hispano Hospital for development and testing purposes. The image database contains a total of 200 dermoscopy images of lesions, including benign, atypical, and melanoma cases. The experimental results show that the proposed system is efficient, achieving classification of the benign, atypical, and melanoma images with an accuracy of 96.397.5

**[6] Mengistu, A. and Dagnachew Melesew Alemayehu. "Computer Vision for Skin Cancer Diagnosis and Recognition using RBF and SOM." (2015).**

A D Mengistu et.al. [6] proposed a digital image processing technique to recognize and predict the different types of skin cancers using digital image processing techniques. The classification system was supervised corresponding to the predefined classes of the type of skin cancer. Combining Self organizing map (SOM) and radial basis function (RBF) for recognition and diagnosis of skin cancer is by far better than KNN, Naïve Bayes and ANN classifier. It was also showed that the discrimination power of morphology and color features was better than texture features but when morphology, texture and color features were used together the classification accuracy was increased.

**[7] A. Masood, A. Al- Jumaily and K. Anam, "Self-supervised learning model for skin cancer diagnosis," 2015 7th International IEEE/EMBS Conference on Neural Engineering (NER), Montpellier, France, 2015, pp. 1012-1015, doi: 10.1109/NER.2015.7146798.**

Ammara Masood et.al. [7] presented a semi-supervised, self-advised learning model for automated recognition of melanoma using dermoscopic images. Deep belief architecture is constructed using labeled data together with unlabeled data, and fine tuning done by an exponential loss function in order to maximize separation of labeled data. In parallel a self-advised SVM algorithm is used to enhance classification results by counteracting the effect of misclassified data. To increase generalization capability and redundancy of the model, polynomial and radial basis function based SA-SVMs and Deep network are trained using training samples randomly chosen via a bootstrap technique. Then the results are aggregated using least square estimation weighting. The proposed model is tested on a collection of 100 dermoscopic images. The classification performance is compared with some popular classification methods and the proposed model using the deep neural processing outperforms most of the popular techniques including KNN, ANN, SVM and semi supervised algorithms like Expectation maximization and transductive SVM.

**[8] Shalu and A. Kamboj, "A Color-Based Approach for Melanoma Skin Cancer Detection," 2018 First International Conference on Secure Cyber Computing and Communication (ICSCC), Jalandhar, India, 2018, pp. 508-513, doi: 10.1109/ICSCCC.2018.8703309.**

Shalu et.al. [8] developed a system for the melanoma skin cancer detection that is developed by using a MED-NODE dataset of digital images. Raw images from the dataset contain various artifacts so firstly preprocessing is applied to remove these artifacts. Then to extract the region of interest Active Contour segmentation method is used. Various color features were extracted from the segmented part and the system performance is checked by using three classifiers (Naïve Bayes, Decision Tree, and KNN). The system achieves an accuracy of 82.35

**[9] S. Jain, V. Jagtap, and N. Pise, "Computer Aided Melanoma Skin Cancer Detection Using Image Processing," Procedia Computer Science, vol. 48, pp. 735–740, 2015, doi: 10.1016/j.procs.2015.04.209.**

In [9], it is stated that a dermatologist's accuracy when it comes to diagnosing melanoma using dermoscopy is 75accuracy. The overall methodology is similar to what was stated in [11], however, they differ in some pre-processing techniques and in the features to be extracted. In [12], the authors suggest enhancing the brightness, using automatic thresholding to segment the lesion from the surrounding skin, extracting the area of the lesion and perimeter, and using those data points to calculate the circularity and irregularity index. I was able to gain a thorough understanding of how such projects are carried out, which assisted me in developing my own methodology that is tailored to this specific capstone project.

**[10]] Z. Waheed, A. Waheed, M. Zafar and F. Riaz, "An efficient machine learning approach for the detection of melanoma using dermoscopic images," 2017 International Conference on Communication, Computing and Digital Systems (C-CODE), Islamabad, 2017, pp. 316-319, doi: 10.1109/C-CODE.2017.7918949**

Zahra Waheed et.al. [10] presented an efficient machine learning approach for the detection of melanoma from dermoscopic images. It detects melanoma skin lesions based upon their discriminating properties. In the first step of the proposed method, different types of color and texture features are extracted from dermoscopic images based on distinguished structures and varying intensities of melanocytic lesions. In the second step, extracted features are fed to the classifier to classify melanoma out of dermoscopic images. Paper also focuses on the role of color and texture features in the context of detection of melanomas. Proposed method is tested on publicly available PH2 dataset in terms of accuracy, sensitivity, specificity and Area under ROC curve (AUC). It is observed that good results are achieved using extracted features, hence proving the validity of the proposed system.

# Chapter 3

# Design Implementation

## 3.1 Proposed System

Our platform provides a way to detect the skin cancer. It helps us predict parameters such as Melanoma, Melanocytic nevi, Benign keratosis, Basal cell carcinoma, Actinic Keratoses, Dermatofibroma. It takes an image as an input, loads the model which internally classifies the image into those parameters, according to the training provided, it evaluates the result. The predict button gives us the predicted result from the model along with a bar chart which shows which parameter is present at what percentage. All the relevant information about Melanoma, Melanocytic nevi, Benign keratosis, Basal cell carcinoma, Actinic Keratoses, Dermatofibroma is provided into about section.

## 3.2 Requirement Gathering and Analysis

- Analyze the Current Service systems
- Gathered data about how patients are treating Skin Cancer At Initial Stages
- Divided the roles in the Team for finding the Dataset, Requirement Gathering, Training the model, Proposed Solution .
- We discussed about the problems that we may face during the project
- During Discussions following questions were put forward
- What are the major Machine learning techniques for skin cancer detection ?
- What are the main characteristics of datasets available for skin cancer ?
- What are various types of Skin Cancer to be Identified ?

## 3.3 Hardware Requirement

- Windows 7-11 with minimum 4 GB Ram
- i5 7th Gen + , AMD Ryzen 3

## 3.4 Software Requirement

- Interpreter Python 3.7 or above versions installed in their respective system.
- IDE(Visual Studio Code)
- Google Colab or Jupyter notebook or Kaggle
- Important Libraries like tenserflow, scikitlearn should be installed
- HTML, CSS, JavaScript should be configured

## 3.5 UML Diagrams

### 3.5.1 Block Diagram

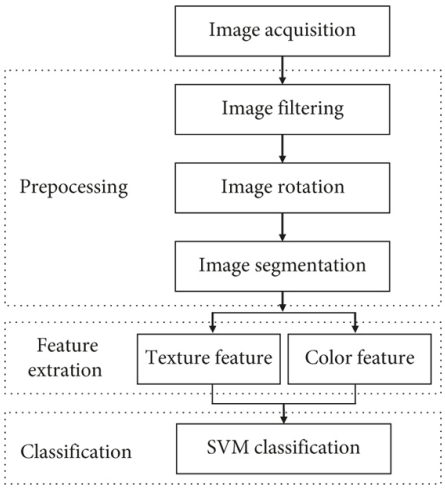



Figure 3.1: Block Diagram

### 3.5.2 Data Distribution Diagram

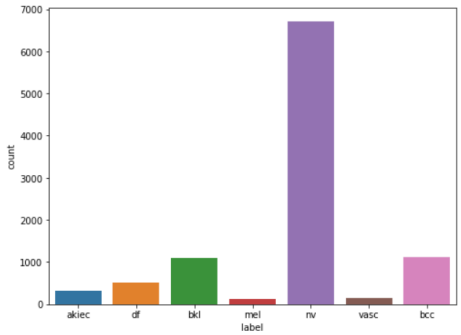



Figure 3.2: Data Distribution Diagram

### 3.5.3 Accuracy Diagram

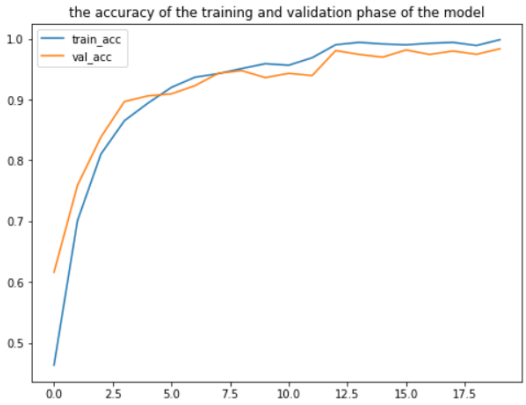



Figure 3.3: Accuracy of training and validation phase of model

### 3.5.4 Confusion Matrix

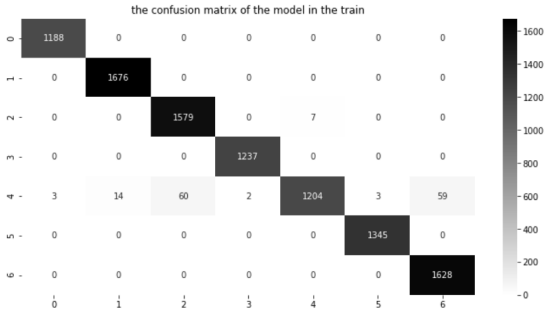



Figure 3.4: Confusion Matrix of model in training dataset

### 3.5.5 Timeline Chart

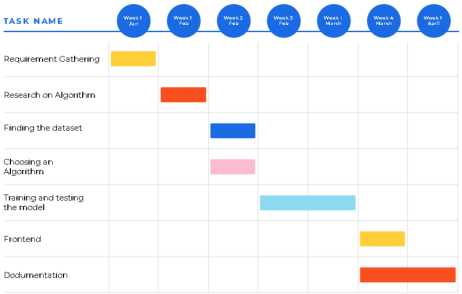



Figure 3.5: Timeline Chart

## 3.6 Feasibility Study

Our Project provides patients in the early stage of skin cancer or potential patients a platform to predict and detect the level of Cancerous and Non-Cancerous cells present in the lesion . The feasibility of the suggested system is determined by a thorough comparative evaluation using numerous assessment measurements, such as accuracy, recall, precision, confusion matrix, top 1 accuracy, top 2 accuracy, and the F-score.

Skin Cancer when detected in Early Stages has been proved useful in treatment of the lesion , as detected early it is in growing stages so can be removed or cured . As per "skincancer.org"

- 1 in 5 Americans will develop skin cancer by the age of 70.
- More than 2 people die of skin cancer in the U.S. every hour.
- Having 5 or more sunburns doubles your risk for melanoma.
- When detected early, the 5-year survival rate for melanoma is 99 percent.

More than 6 Million cases were Treated as Non-Melanoma in 2013 , The number would be significantly decreased if they had proper Skin Cancer Detection System to detect the lesion in Early Stages.

## 3.7 Cost Estimation

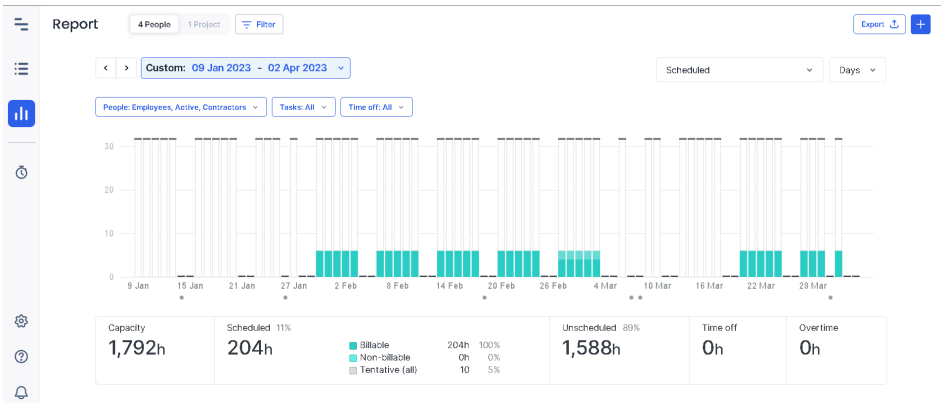



Figure 3.6: Cost Estimation

# Chapter 4

# Results and Discussion

## 4.1 Code

```
[1] Data Distribution

type_of_cancer = ['akiec','df','bkl','mel','nv','vasc','bcc']
counts = list(labels.value_counts())
plt.figure(figsize = (8,6))
ax = sns.countplot(x='label', data=df)
ax.set_xticklabels(type_of_cancer)

[2] Fitting The Model

epochs = 20
history = model.fit(X_train,
                    Y_train,
                    validation_split=0.2,
                    batch_size = 64,
                    epochs = epochs,
                    callbacks=[learning_rate_reduction])

[3] Data Augmentation with ImageDataGenerator

train_datagen = ImageDataGenerator(rescale = 1./255,
                                   rotation_range = 10,
                                   width_shift_range = 0.2,
                                   height_shift_range = 0.2,
                                   shear_range = 0.2,
                                   horizontal_flip = True,
                                   vertical_flip = True,
                                   fill_mode = 'nearest')
train_datagen.fit(X_train)
test_datagen = ImageDataGenerator(rescale = 1./255)
test_datagen.fit(X_test)
train_data = train_datagen.flow(X_train, Y_train,
batch_size = 64)
```

```
test_data = test_datagen.flow(X_test, Y_test,
batch_size = 64)
```

[4] Frontend

```
<title>Skin Cancer Detector</title>
    <link
      href="https://fonts.googleapis.com/css?family=Nunito"
      rel="stylesheet"
    />
    <link rel="stylesheet" type="text/css" href="css/app.css"
    />
    <link rel="stylesheet" href="css/w3.css" />
    <link rel="stylesheet" href="css/woza.css" />
    <script type="text/javascript" src="js/target_classes.js">
    </script>
    <script src="https://cdn.jsdelivr.net/npm/@tensorflow
    /tfjs@latest"></script>
    <script
      type="text/javascript"
      src="https://code.jquery.com/jquery-2.1.1.min.js"
    ></script>
    <script src="https://cdnjs.cloudflare.com/ajax/libs/
    Chart.js/3.6.0/chart.min.js"></script>
    <script type="text/javascript" src="js/mobile-net.js">
    </script>
  </head>
```

[5] Creating Prediction Function

```
async function predButton() {
  console.log("model loading..");

  if (model == undefined) {
    alert("Please load the model first.");
  }
  if (document.getElementById("predict-box").style.
  display == "none") {
    alert("Please load an image using 'Demo Image' or
    'Upload Image' button..");
  }
  console.log(model);
  let image = document.getElementById("test-image");
  let tensor = preprocessImage(image, modelName);

  let predictions = await model.predict(tensor).data();
  let results_all = Array.from(predictions)
    .map(function (p, i) {
```

```
      return {
        probability: p,
        className: TARGET_CLASSES[i],
        index: i,
      };
    })
    .sort(function (a, b) {
      return b.probability - a.probability;
    });
```

## 4.2 Software Results

The implementation of project resulted in working of site in following way.

1) The user has to upload an image of the skin cancer they want to detect. Demo image is also provided by us

2) After uploading the image , The user has to then load the model using the "load model" button

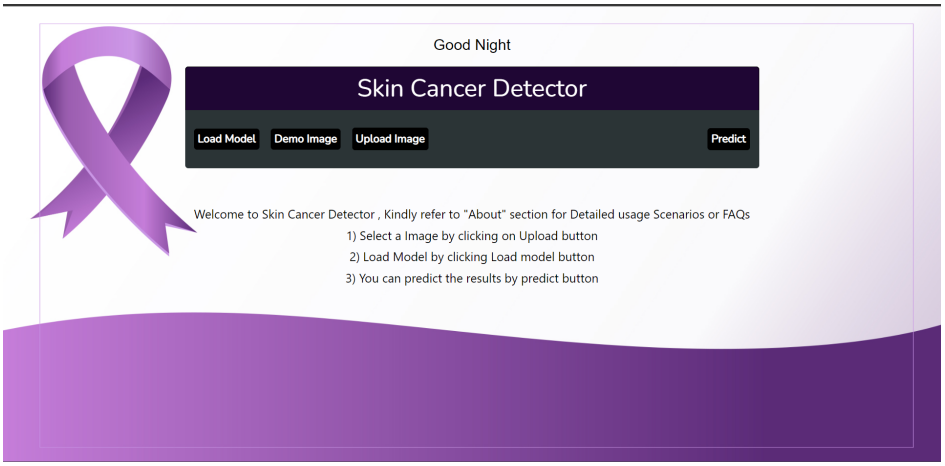
3) Once the model has been loaded, it shows "loaded model" then the user has to click the "predict" button to get the results.

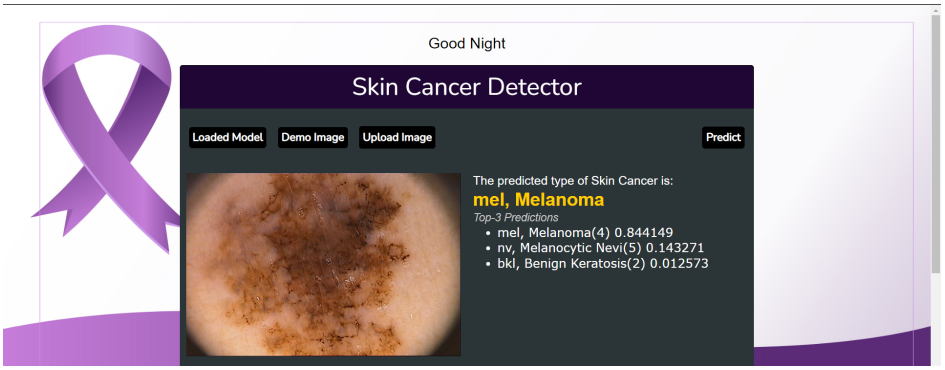
4) The result shows which type of skin cancer it is and also shows a bar chart presenting which skin cancer is present at what percentage.

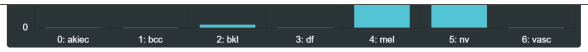
5) When the result is shown, information about skin cancer which was predicted result is shown which helps user to get to know about it.

6) The about section consists of crucial information related to skin cancer.

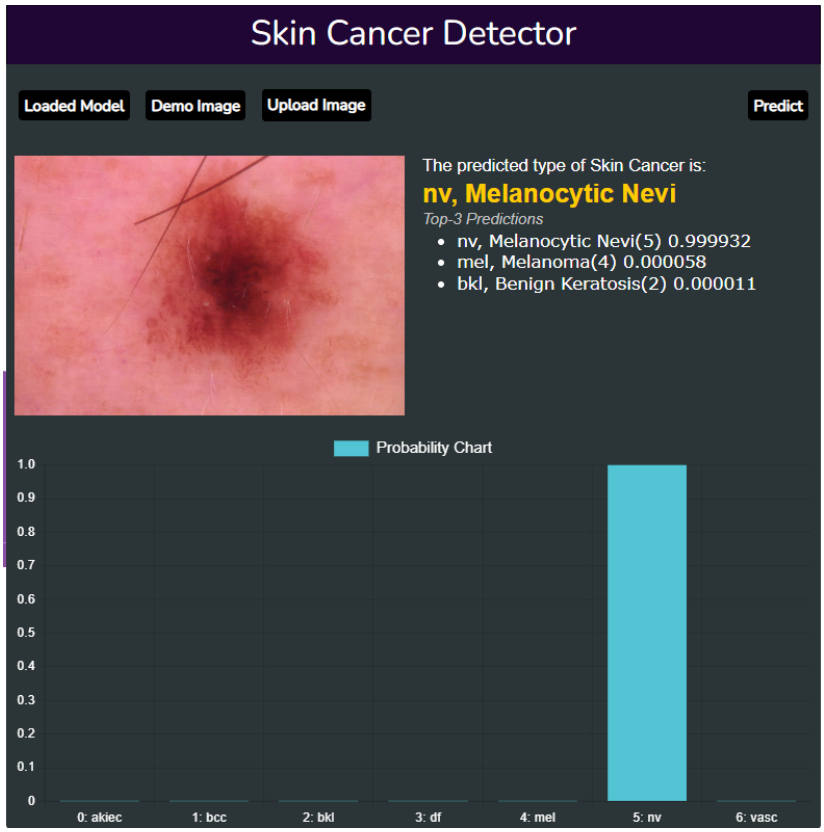
## 4.3 Screen Shots

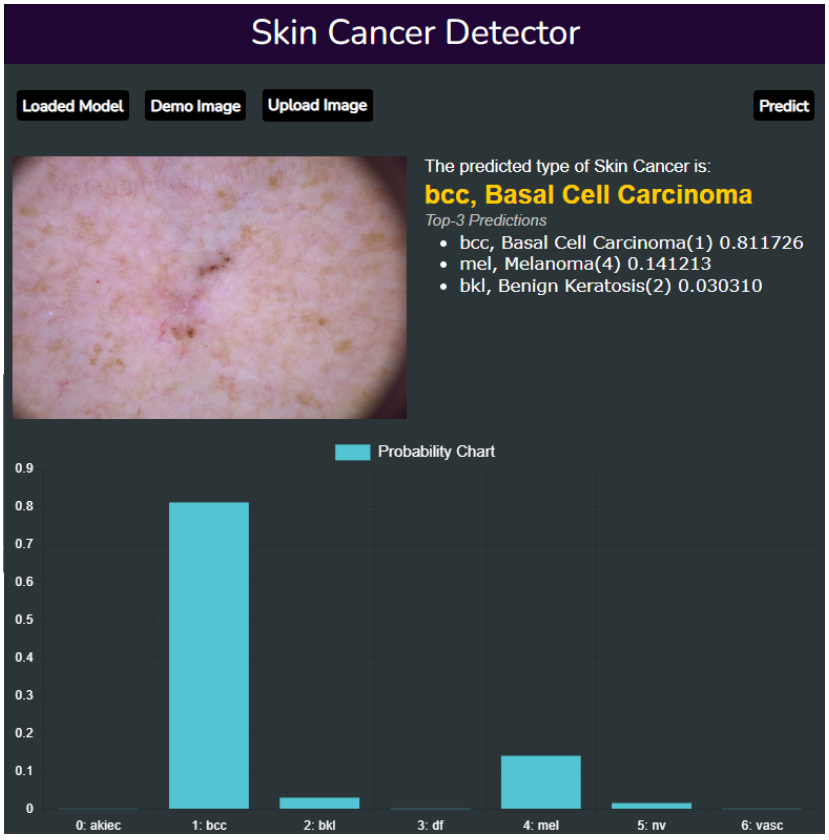


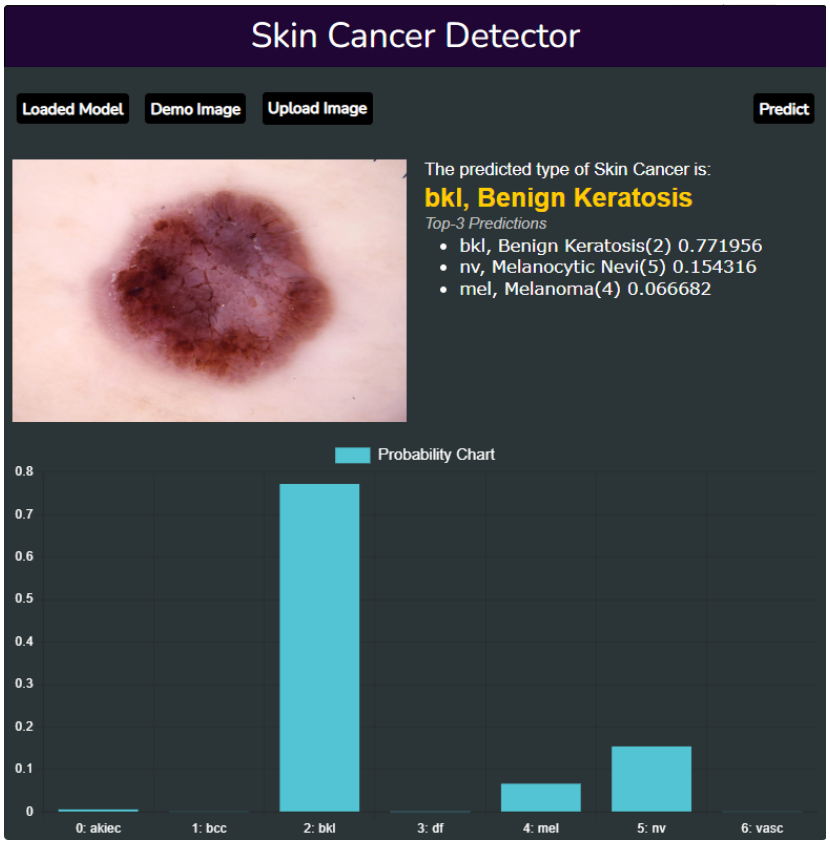



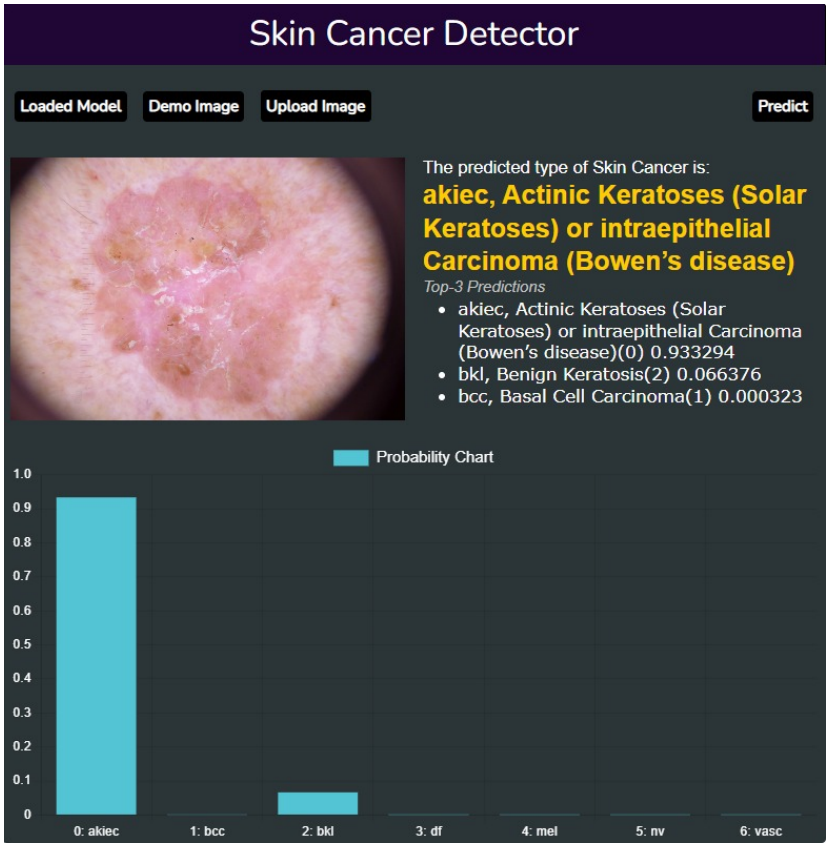




You've been Diagonised with Melanoma . Melanoma occurs when the pigment-producing cells that give colour to the skin become cancerous. Symptoms might include a new, unusual growth or a change in an existing mole . Melanomas can occur anywhere on the body. Treatment may involve surgery, radiation, medication or in some cases, chemotherapy . The first melanoma signs and symptoms often are: A change in an existing mole . The development of a new pigmented or unusual-looking growth on your skin . Melanoma doesn't always begin as a mole. It can also occur on otherwise normal-appearing skin... Treatment for early-stage melanomas usually includes ::: surgery to remove the melanoma. A very thin melanoma may be removed entirely during the biopsy and require no further treatment. Otherwise, your surgeon will remove the cancer as well as a border of normal skin and a layer of tissue beneath the skin. For people with early-stage melanomas, this may be the only treatment needed. Following can be done: Immunotherapy , Targeted therapy ,Radiation therapy ,Chemotherapy --- Top doctor to Consult for Melanoma ::: Prof. Dr. Suresh H. AdvaniMedical Oncologist, Mumbai, India , Senior Consultant, 43 years of experience , NANAVATI SUPER SPECIALTY HOSPITAL, MUMBAI https://www.practo.com/mumbai/doctors-for-melanoma-treatment

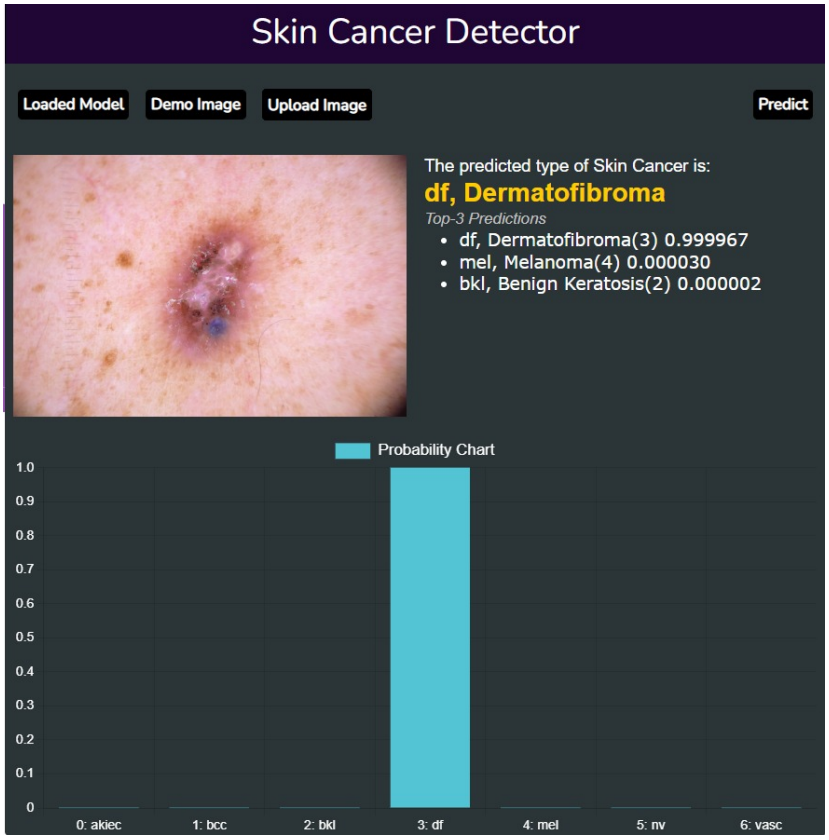

Skin Cancer Detector
Loaded Model
Demo Image
Upload Image
Predict
The predicted type of Skin Cancer is:
nv, Melanocytic Nevi
Top-3 Predictions
nv, Melanocytic Nevi(5) 0.999932
mel, Melanoma(4) 0.000058
bkl, Benign Keratosis(2) 0.000011
Probability Chart
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0: akiec
1: bcc
2: bkl
3: df
4: mel
5: nv
6: vasc


Skin Cancer Detector
Loaded Model
Demo Image
Upload Image
Predict
The predicted type of Skin Cancer is:
bcc, Basal Cell Carcinoma
Top-3 Predictions
bcc, Basal Cell Carcinoma(1) 0.811726
mel, Melanoma(4) 0.141213
bkl, Benign Keratosis(2) 0.030310
Probability Chart
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0: akiec
1: bcc
2: bkl
3: df
4: mel
5: nv
6: vasc


Skin Cancer Detector
Loaded Model
Demo Image
Upload Image
Predict
The predicted type of Skin Cancer is:
bkl, Benign Keratosis
Top-3 Predictions
bkl, Benign Keratosis(2) 0.771956
nv, Melanocytic Nevi(5) 0.154316
mel, Melanoma(4) 0.066682
Probability Chart
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0: akiec
1: bcc
2: bkl
3: df
4: mel
5: nv
6: vasc


Skin Cancer Detector
Loaded Model
Demo Image
Upload Image
Predict
The predicted type of Skin Cancer is:
akiec, Actinic Keratoses (Solar Keratoses) or intraepithelial Carcinoma (Bowen's disease)
Top-3 Predictions
akiec, Actinic Keratoses (Solar Keratoses) or intraepithelial Carcinoma (Bowen's disease)(0) 0.933294
bkl, Benign Keratosis(2) 0.066376
bcc, Basal Cell Carcinoma(1) 0.000323
Probability Chart
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0: akiec
1: bcc
2: bkl
3: df
4: mel
5: nv
6: vasc


Skin Cancer Detector
Loaded Model
Demo Image
Upload Image
Predict
The predicted type of Skin Cancer is:
vasc, Vascular skin lesion
Top-3 Predictions
vasc, Vascular skin lesion(6) 1.000000
nv, Melanocytic Nevi(5) 0.000000
mel, Melanoma(4) 0.000000
Probability Chart
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0: akiec
1: bcc
2: bkl
3: df
4: mel
5: nv
6: vasc


Skin Cancer Detector
Loaded Model
Demo Image
Upload Image
Predict
The predicted type of Skin Cancer is:
df, Dermatofibroma
Top-3 Predictions
df, Dermatofibroma(3) 0.999967
mel, Melanoma(4) 0.000030
bkl, Benign Keratosis(2) 0.000002
Probability Chart
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0: akiec
1: bcc
2: bkl
3: df
4: mel
5: nv
6: vasc

## 4.4 Testing Results

```
model_acc_test = model.evaluate(X_test, Y_test, verbose=0)[1]
print("the test model accuracy =",model_acc_test * 100)
```

```
the test model accuracy = 98.52073788642883
```

Figure 4.1: Accuracy

ACTUAL

| PREDICTION | Negative | Positive |
|---|---|---|
| Negative | 20 | 2 |
| Positive | 2 | 26 |

Confusion Matrix for Prediction

Figure 4.2: Confusion Matrix for Prediction

Precision: TP/(TP+FP) = 26/26+2 = 0.928

Accuracy: (TP +TN)/Total = 46/50 = 0.92

## 4.5 Test Case Report

Thus the precision of Prediction is 0.928 percent.

Thus the accuracy of Prediction is 92 percent.

Thus the accuracy of test model is 98.5 percent.

# Chapter 5

# Conclusion

## 5.1 Summary

Our project as a whole describes the scope of detecting various skin cancerlike Melanoma, Melanocytic nevi, Benign keratosis, Basal cell carcinoma, Actinic Keratoses, Dermatofibroma. Based on the research done, we found that how important it is to detect the skin cancer at early stages. Also Melanoma is a serious skin cancer, it's highly curable if caught early. Prevention and early treatment are critical, especially if you have fair skin, blonde or red hair and blue eyes.

Our project is able to use a good expert system as well as parts of machine learning and image processing. One of the main challenges faced were training the model, Processing of the images, finding an medically accurate data set.

Our project provides a way to detect the skin cancer. It helps us predict parameters such as Melanoma, Melanocytic nevi, Benign keratosis, Basal cell carcinoma, Actinic Keratoses, Dermatofibroma using image processing giving reliable data set.

## 5.2 Future Scope

In near future,

We will work on getting more precised data set from trusted medical sources.

We will work to improve the accuracy , precision and performance of the project.

We will make our project cross-platform.

# References


[1] *" https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8945133"*

[2] R. Kasmi and K. Mokrani, *"Classification of malignant melanoma and benign skin lesions: implementation of automatic ABCD rule," in IET Image Processing"*

[3] Automated melanoma Survey *"https://coek.info/download/a-survey-on-automated-melanoma-detection$_5$d993668097c4750538b45b2.html*"

[4] Y. Yuan, M. Chao and Y. C. Lo *"Automatic Skin Lesion Segmentation Using Deep Fully Convolutional Networks With Jaccard Distance)"* in IEEE Transactions on Medical Imaging

[5] J. Glaister, A. Wong and D. A. Clausi *"Segmentation of Skin Lesions from Digital Images Using Joint Statistical Texture Distinctiveness,"* in IEEE Transactions on Biomedical Engineering

[6] N. C. F. Codella et al. *"Deep learning ensembles for melanoma recognition in dermoscopy images,"* in IBM Journal of Research and Development.

[7] L. Bi, J. Kim, E. Ahn, A. Kumar, M. Fulham and D. Feng *"Dermoscopic Image Segmentation via Multistage Fully Convolutional Networks,"* in IEEE Transactions on Biomedical Engineering

[8] L. Yu, H. Chen, Q. Dou, J. Qin and P. A. Heng *"Automated Melanoma Recognition in Dermoscopy Images via Very Deep Residual Networks"* in IEEE Transactions on Medical Imaging

[9] Al-Masni, M.A.; Al-Antari, M.A.; Choi, M.-T.; Han, S.-M.; Kim, T.-S. *"Skin lesion segmentation in dermoscopy images via deep full resolution convolutional networks"*

[10] Dataset Reference *"https://www.kaggle.com/datasets/kmader/skin-cancer-mnist-ham10000"*

[11] Dataset Reference *"https://challenge.isic-archive.com/landing/2018/"*