

# **SKIN LESIONS CLASSIFICATION WITH CNN AND TRANSFER LEARNING ALGORITHMS**

**A FINAL YEAR CAPSTONE DESIGN PROJECT  
(Phase-I)**

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*in partial fulfillment for the award of the degree*

*of*

**BACHELOR OF TECHNOLOGY**

**IN**

**COMPUTER SCIENCE AND ENGINEERING**



**SCHOOL OF COMPUTING  
COMPUTER SCIENCE AND ENGINEERING  
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## DECLARATION

We affirm that the project work titled “**Skin Lesion Classification With CNN and Transfer Learning Algorithm**” being submitted in partial fulfillment for the award of the degree of **Bachelor of Technology in Computer Science and Engineering** is the original work carried out by us. It has not formed the part of any other project work submitted for award of any degree or diploma, either in this or any other University.

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## BONAFIDE CERTIFICATE

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# KALASALINGAM

## ACADEMY OF RESEARCH & EDUCATION

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### School of Computing

### Department of Computer Science and Engineering

### Project Summary

Project Title	Skin Lesion Classification With CNN and Transfer Learning Algorithm		
Project Team Members (Name with Register No)	1. N.LIYAZ (9919004188) 2. P.DADAVAL (9919004204) 3. J.NARAYANA (9919004118) 4. D.BADRI (9919004060)		
Guide Name/Designation	Dr. R.Sumathi, Assistant Professor, Department of Computer Science and Engineering		
Program Concentration Area	Skin Classification detection		
Technical Requirements	PyCharm, Jupyter notebook, Numpy, IO, OS, Flask, Keras, pandas, tensorflow to complete thi sproject		
Engineering standards and realistic constraints in these areas: (Refer Appendix in page 4 of this doc.)			
Area	Codes & Standards / Realistic Constraints		Tick ✓
Economic			
Environmental			
Social			
Ethical			

Health and Safety	This project is mainly used to support the radiologist for better identification of tumor using neural networks	✓
Manufacturability		
Sustainability		

### **Realistic Constraints:**

#### **Health and Safety:**

In the research of medical, various segmentation methods have been proposed to identify the lesions in the beginning stage to save the millions of human being. Still it is challenging for find out the complex tumors present in the MR brain image. Deep learning neural networks is used to analyze the various complex tumors in deeply. The main focus of this project is to locate the various tumors present in the magnetic resonance (MR) brain image using deep learning neural networks. Because of multifaceted structure of brain, better examination and study is required by a radiologist to identify the various tumors. With the support of neural networks identification of the various tumors is effectively performed. These processes support the radiologist extensively to perform better diagnosis identifying the various types of tumors in the early stages.

#### **Engineering standards:**

This project is based on IEEE 3333.2.1-2015 –Medical modeling and visualization

This standard focuses on the project demands arising when scientific results in the field of medical visualization are applied for the construction of a software system. It is targeted to aid the clinical work of medical professionals. This standard includes visualization techniques by the automated medical shape detection and reconstruction of three-dimensional (3D) models from two-dimensional (2D) medical images. When the MR image is given as input, automatically the tumors and tissue portion will be demarcated separately. Finally the region of lesions are segmented by the optimization techniques are compared with the gold standard image obtained by the radiologist to check the efficiency of the suggested methodologies and the segmented results can be reconstructed for further analysis to get better visualization of tumors.

## **ABSTRACT**

Skin cancer is one of the three tumours that have the greatest risk for DNA-damaged death. This damaged DNA causes cells to begin growing out of control, which is what is happening right now. In-depth research has been done on the computerised detection of cancer in images of skin lesions. However, it can be challenging to analyse these photos because of certain problematic factors, including light reflections from the skin's surface, variations in colour illumination, and different shapes and sizes of the lesions. The development of automatic evidential skin cancer recognition is crucial for enhancing pathologists' proficiency and accuracy in the early stages. Using deep learning, we present a deep convolutional neural network (DCNN) model in this paper. a process for accurately separating benign from malignant skin tumours. To eliminate noise and artefacts during preprocessing, we first apply a filter or kernel; next, we normalise the input pictures and extract features; next, we supplement the data with more pictures to improve classification accuracy. Our suggested DCNN model is contrasted with a few transfer learning models, such as AlexNet, ResNet, VGG-16, DenseNet, MobileNet, etc. to evaluate its performance. Finally, we were able to achieve accuracy for both training and testing. The results of our proposed DCNN model demonstrate that it is more reliable and robust than existing transfer learning algorithms.

# CONTENTS

## ABSTRACT

## LIST OF FIGURES

## LIST OF ABBREVIATION

<b>CHAPTER I</b>	<b>INTRODUCTION.....</b>	<b>10</b>
1.1.	Convolutional Neural Network And Transfer Learning	
1.2.	System Analysis and Feasibility Study	
1.3.	Block Diagram	
1.4.	Software Development Life Cycle , Technologies and Algorithms	
1.5.	Feasibility Study	
1.6.	Collaboration Diagram	
<b>CHAPTER II</b>	<b>LITERATURE REVIEW .....</b>	<b>15</b>
<b>CHAPTER III</b>	<b>PROBLEM DEFINITION.....</b>	<b>19</b>
<b>CHAPTER IV</b>	<b>PROJECT OBJECTIVES</b>	<b>20</b>
<b>CHAPTER V</b>	<b>REQUIREMENTS .....</b>	<b>21</b>
5.1	Requirement Description	
5.2	Hardware requirements	
5.3	Software requirements	
<b>CHAPTER IV</b>	<b>PROPOSED SYSTEM/ SYSTEM DESIGN.....</b>	<b>23</b>
6.1	Proposed algorithm	
6.2	component Diagram	
<b>CHAPTER VII</b>	<b>CONCLUSION.....</b>	<b>24</b>
<b>CHAPTER VIII</b>	<b>REFERENCES.....</b>	<b>25</b>
<b>Plagiarism Report</b>		<b>27</b>



## LIST OF FIGURES

FIGURES	DETAILS
Figure 1	Figure 1: Proposed System
Figure 2	Figure 2: Software Development Life Cycle
Figure 3	Figure 3: Collaboration
Figure 4	Figure 4: Block Diagram
Figure 5	Figure 5: System diagram

## LIST OF ABBREVIATIONS

Abbreviation	Full form
CNN	Convolutional Neural Network
TRA	Transfer Learning Algorithm
SDCL	Software Development Life Cycle
H/W & S/W	Hardware and software Specifications

## CHAPTER 1

### INTRODUCTION

#### **Convolutional Neural Network And Transfer Learning:**

Skin diseases are more common than other ailments. Skin disorders can be caused by a variety of things, including viruses, bacteria, allergies, and fungi. The tone or texture of the skin might change due to a skin disorder. Skin disorders are frequently chronic, infectious, and cancer-causing. Early diagnosis is therefore essential to stop the development and spread of skin disorders. Skin conditions take longer to diagnose and cure, and they cost the sufferer more both physically and financially. The majority of everyday individuals frequently do not know the kind and stage of a skin condition. Some skin disorders take many months to show symptoms, which permits the sickness to progress and spread. The general public's lack of knowledge about medicine is the cause of this. A dermatologist, a doctor who specialises in skin problems, may occasionally struggle to make a diagnosis and may require extensive laboratory tests to determine the kind and stage of the condition. The advancement of photonics- and laser-based medical technology has made it possible to diagnose skin conditions much more quickly and precisely. However, the cost of such a diagnosis remains exorbitant and prohibitive. Therefore, we advise applying image processing to spot skin issues. By taking a digital picture of the damaged skin area, this technology analyses the image to identify the kind of illness. Our recommended approach is simple, efficient, and doesn't require any expensive tools other than a camera and a computer.

The epidermis, dermis, and subcutaneous tissues make up the skin, the largest organ in the human body. It has muscles, nerves, lymphatic vessels, and blood vessels that can sweat, feel the temperature outside, and defend the body. The skin, which covers the whole body, may protect a number of human structures and organs from external threats such chemical toxins, unintentional infections, artificial skin damage, and people's immune systems. Additionally, by halting the loss of lipids and water from the epidermis and dermis, skin can maintain the function of the skin barrier. Despite its protective and barrier roles, skin is not impervious to damage since it is constantly modified by a variety of environmental and genetic factors. At this time, there are three main groups of skin problems that afflict people: viral, fungal, and allergic skin conditions. Doctors still frequently diagnose patients based mostly on their subjective judgements or years of

experience, which can lead to misdiagnosis and a delay in treatment despite the fact that many types of skin ailments are currently treatable. Therefore, understanding how to identify symptoms of different skin illnesses using modern research and technology is extremely theoretically relevant and useful. The many sorts of skin diseases may be successfully and precisely identified in this circumstance, and the patients can receive therapies based on their symptoms. In the last several years, the use of image processing has evolved fast in medicine. Computed tomography (CT), digital subtraction angiography (DSA), and magnetic resonance imaging are three examples of digital imaging technology-based equipment that are commonly used in people's daily lives (MRI). Researchers from different parts of the world have done more in-depth study in this field. For instance, Oyola and Arroyo were successful in diagnosing varicella by employing image processing techniques such edge detection, equalisation, and colour alteration. The Hough transform was then used to compile and categorise the image of varicella. Final empirical results demonstrated a more accurate diagnostic for varicella detection, and on the basis of those results, preliminary tests for varicella and herpes zoster were also conducted. To identify skin lesions in photographs, Chung and Sapiro proposed a partial differential equation (PDE)-based method. Using this method, a contour model of the lesions was generated based on its morphological filtering of the images.

## **SYSTEM ANALYSIS & FEASIBILITY STUDY**

### **Existing Method:**

This model demonstrates an existing method that was developed using specific deep learning methods. Although ANN methods, one of the machine learning techniques, are used in this procedure, the accuracy was not very good.

### **Disadvantages:**

- Less feature compatibility
- Low accuracy

### **Proposed System:**

Utilizing the purposed strategy, the classification of either Skin Disease Identification or Convolution Neural Network (CNN) of Deep Learning along with the Transfer Learning

Techniques is done. as techniques based on image analysis for categorising skin conditions. Since the proper nourishment would be made possible by using the method we have given, precise categorization is essential. A block diagram of the recommended method may be found below.

**Block Diagram:**

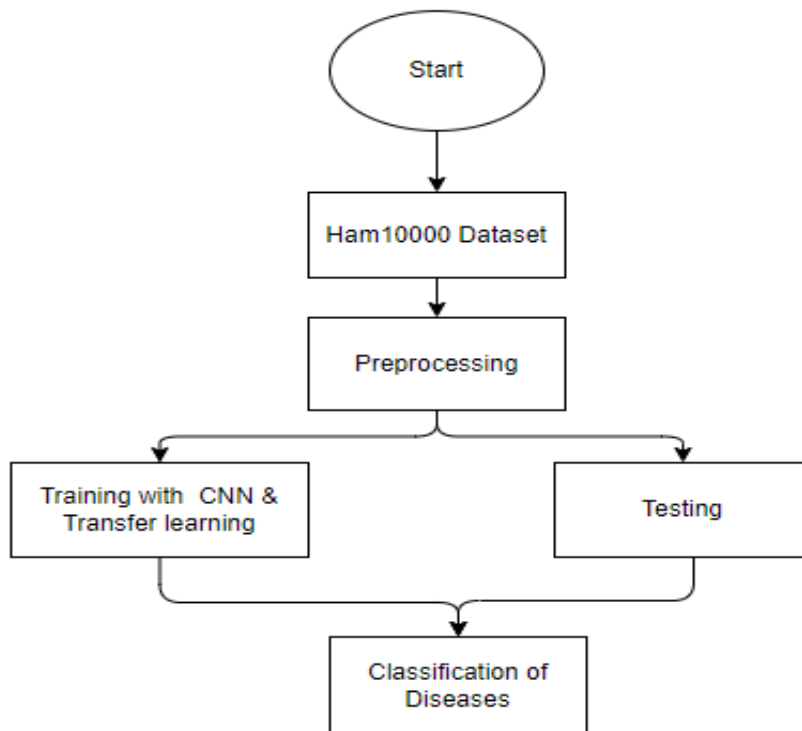


Fig 1 – Flow Chart

## Software Development Life Cycle:

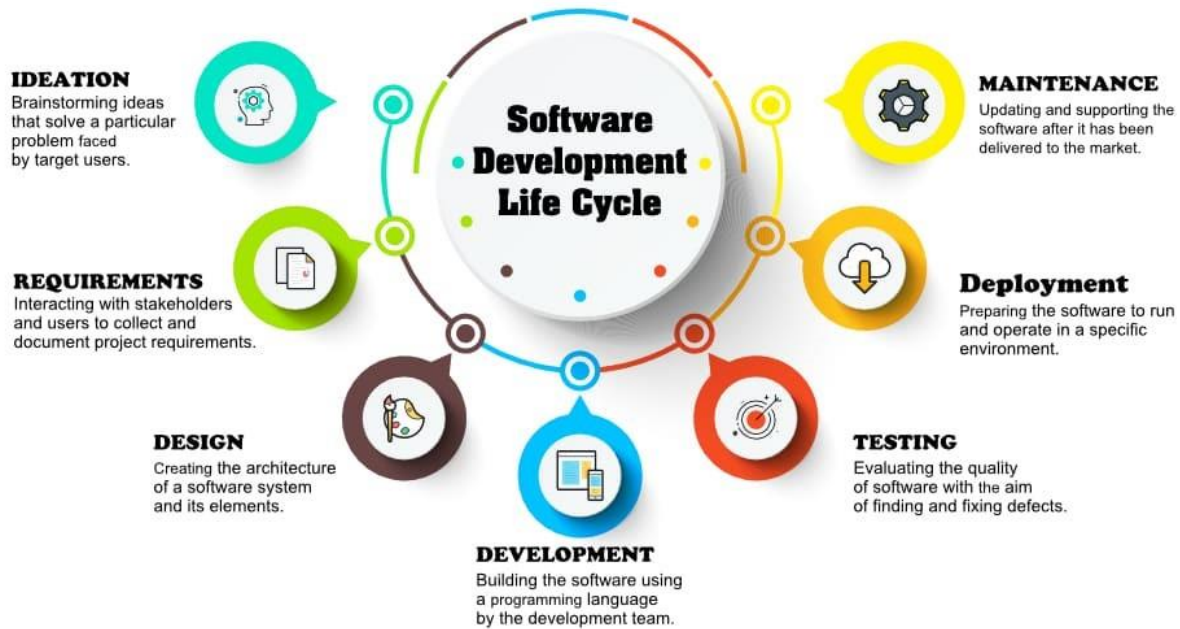


Fig 2 - SDCL

## Technologies and Algorithms:

What types of technologies versions is used:

- Working of Tensor Flow
- Implementation of Deep Learning techniques
- Working of CNN algorithm
- Working of Transfer Learning methods
- Building of model creations

## Feasibility Study:

This stage involves assessing the project's viability and presenting a business proposal that includes a very basic project design and some cost estimates. During system analysis, the viability of the

suggested system must be examined. This will ensure that the suggested solution won't put a strain on the company. It's essential for the feasibility study to comprehend the primary system requirements.

Three key considerations involved in the feasibility analysis are

- ◆ ECONOMICAL FEASIBILITY
- ◆ TECHNICAL FEASIBILITY
- ◆ SOCIAL FEASIBILITY

### **Collaboration :**

The order in which the procedures are invoked is depicted by numbers in the cooperation diagram that follows. The sequence in which the methods are called is indicated by the number. The same order management system is used to explain the collaboration diagram. The calls to the methods are akin to a sequence diagram. However, whereas the sequence diagram simply explains the item arrangement, the collaboration diagram really shows it. A deployment diagram illustrates a system's deployment view. The component diagram is related to this. because the components are deployed using deployment diagrams. A deployment diagram has nodes. Only the physical hardware used to distribute the application is referred to as a node.

## CHAPTER II

### LITERATURE REVIEW

[1] **Rahman, M. A.,** Yasir, and N. Ahmed Skin illness is one of the most common health problems in the globe. In this research, we proposed a methodology based on computer vision for the detection of different forms of dermatological skin diseases. We have used several image processing techniques for feature extraction and feed-forward artificial neural network training and testing. The system operates in two stages: first, it pre-processes colour skin photos to extract important traits, and then it diagnoses illnesses. Nine distinct forms of dermatological skin problems may be reliably identified by the system with 90% accuracy. The branch of medicine known as dermatology deals with conditions affecting the skin, hair, and nails. It includes both surgical and pharmacological elements. A dermatologist addresses diseases as well as certain cosmetic problems with the skin, scalp, hair, and nails in the widest sense. Human skin is one of the most surprising and difficult terrains to automatically synthesise and analyse due to its complexity of jaggedness, tone, hairiness, and other mitigating variables. In a developing country like Bangladesh, many people find it expensive to see a dermatologist for a skin condition problem. Each year, numerous skin problems cause a tremendous lot of agony for many individuals in developing countries like Bangladesh. Therefore, having an automated method for diagnosing skin diseases is essential for both patients and dermatologists, especially in developing countries. The use of computer vision-based methods to identify dermatological skin disorders has been studied, however only a small number of those studies were effective in identifying more than two or three diseases. Our attention has been drawn to nine different skin conditions. They are Eczema, Leprosy, Psoriasis, Scabies, Tinea Corporis, and Pityriasis Rosea. In order to prepare the pictures, we used 8 different types of algorithms (YCbCr, grey image, sharpening filter, median filter, smooth filter, binary mask, and histogram).

[2] **ALKolifi ALEnezi, N. S.:** More people have skin disorders than other ailments. Skin disorders can be caused by a variety of things, including viruses, bacteria, allergies, and fungi. Thanks to advancements in laser and photonics-based medical technology, skin diseases may now be detected much more quickly and precisely. However, the cost of such a diagnosis remains exorbitant and prohibitive. As a result, image processing techniques help with the early stages of

creating an automated dermatological screening system. Extraction of features has a significant role in the categorization of skin conditions. Computer vision is used in a variety of ways to identify various skin diseases. Due to its deserts and hot environment, Saudi Arabia has a high prevalence of skin diseases. The investigation of skin disease detection is advanced by this effort. We proposed an image-based approach to diagnosing skin disorders. In this method, the diseased skin area is digitally photographed and image analysis is used to determine the kind of sickness. The only expensive tools required for our simple, rapid procedure are a camera and a computer. The approach is based on the inputs of a colour picture. After that, crop the image and extract features using a convolutional neural network that has already been trained. The feature was then classified using a multiclass SVM after that. The results are then displayed to the user, together with information on the disease's kind, distribution, and severity. The system can properly differentiate between three different sorts with a 100% accuracy rate. A skin disease's type and stage are typically unknown to the majority of everyday people. Some skin disorders take many months to show symptoms, which permits the sickness to progress and spread. The general public's lack of knowledge about medicine is the cause of this. A dermatologist, a doctor who specialises in skin problems, may occasionally struggle to make a diagnosis and may require extensive laboratory tests to determine the kind and stage of the condition. The advancement of photonics- and laser-based medical technology has made it possible to diagnose skin conditions much more quickly and precisely. However, the cost of such a diagnosis remains exorbitant and prohibitive. Therefore, we advise applying image processing to spot skin issues. By taking a digital picture of the damaged skin area, this technology analyses the image to identify the kind of illness. Our recommended approach is simple, efficient, and does not require expensive tools beyond a camera and a computer.

**[3] Wu, H., Yin, H., Chen, H., Sun, M., Liu, X., Yu, Y. Lu, Q.:** Inflammatory skin diseases are abnormalities of the skin characterised by the increase and infiltration of inflammatory cytokines. Over 15% of the world's population has inflammatory skin disorders. Inflammatory skin diseases include psoriasis, eczema, and atopic dermatitis (AD). Typically, pathological investigations and laboratory tests support the "first impression" diagnosis of these disorders that dermatologists first make. However, younger dermatologists and those with less experience are particularly prone to making errors since Pso, Ecz, and AD are commonly misdiagnosed. In order to solve this problem and assist dermatologists, we built an end-to-end deep learning model based on clinical skin



images for automated diagnosis of Pso, Ecz, and AD. Convolutional neural networks (CNNs) have proven to be highly successful in processing clinical images, and an increasing number of studies have found that CNNs are efficient at treating a variety of illnesses. CNNs have been used to diagnose breast nodules and lesions from ultrasound images, segment multiple sclerosis lesions from multichannel 3D MRIs, aid in the early diagnosis and detection of Alzheimer's disease from brain electroencephalogram (EGG) spectral images and MRIs, predict the risk of osteoarthritis from knee cartilage MRIs, and detect diabetic retinopathy from retinal fundus photographs, among other applications. CNNs in dermatology were created as a result of the creation of ground-breaking tools to aid in the detection of melanoma. The use of histological pictures from skin biopsy samples and data input from dermoscopes to facilitate the detection of cancer is now widely used. To the best of our knowledge, however, we are not aware of any uses of AI tools to aid in the diagnosis of skin conditions other than cancers.

**[4] T. Swapna<sup>1</sup> , D.A. Vineela , M. Navyasree , N. Sushmtha ,P. Bhavana:** Millions of people worldwide suffer from a variety of different skin conditions, making them a common disease in people. Typically, these disorders carry unacknowledged dangers that raise the possibility of getting skin cancer, as well as psychological discomfort and a decline in self-esteem. Certain skin problems must be diagnosed by medical specialists using cutting-edge equipment due to the low visual resolution of skin sickness photographs. The suggested system combines deep learning techniques like CNN architecture with three current models, Alex Net, ResNet, and InceptionV3. An image collection covering seven illnesses has been compiled for the categorization of skin conditions. They include illnesses like melanoma, nevus, and seborrheic keratosis, among others. . Images of burns and cuts, which the majority of the current systems categorised as skin diseases, were added to the dataset to expand it. The use of Deep Learning algorithms has decreased the need for manual data reconstruction and feature extraction, both of which are necessary for classification. One of the most significant and rapidly growing bodily tissues is the skin. The term "burden of skin disease" refers to a multifaceted concept that takes into account the psychological, social, and economic impact that skin diseases have on patients, their families, and society as a whole. It is an infection that affects people of all ages. Skin injury is common since it is a fragile body part. There are more than 3000 distinct types of skin problems. A disease that negatively affects one's looks will have an enormous effect and may inflict excruciating agony and irreparable injury. The majority of chronic skin conditions, including atopic eczema, psoriasis, vitiligo, and

leg ulcers, are no longer life-threatening, but they may still be considered a severe problem on fitness popularity with negative effects on one's physical, psychological, and economical well-being. However, skin cancers have the potential to be lethal, and because of their temporal nature, they are more difficult to treat.

## **CHAPTER III**

### **PROBLEM DEFINITION**

Skin conditions are the most common worldwide due to genetic features and environmental factors. People typically ignore skin disorders' early symptoms. The biopsy procedure is used in the present method to identify skin problems, which are then physically evaluated and treated by the specialists. To avoid this manual review and immediately provide promising results, we advise a hybrid method integrating computer vision and machine learning techniques. The input images for this would be histopathological microscope images, from which characteristics like colour, shape, and texture would be collected and fed to transfer learning and convolutional neural network (CNN) for classification and sickness diagnosis. The project's objective is to provide the best, most thorough medical advice while rapidly and precisely identifying the type of skin ailment. skin condition significantly more quickly and precisely. However, the cost of such a diagnosis remains exorbitant and prohibitive. As a result, image processing techniques help with the early stages of creating an automated dermatological screening system. Extraction of features has a significant role in the categorization of skin conditions. Computer vision is used in a variety of ways to identify various skin diseases. Due to its deserts and hot environment, Saudi Arabia has a high prevalence of skin diseases. The investigation of skin disease detection is advanced by this effort. We proposed an image-based approach to diagnosing skin disorders.

## **CHAPTER IV**

### **PROJECT OBJECTIVES**

This investigation has shown that skin issues affect people often. Some of the internal and external factors that frequently aid in the development of diseases include the hierarchical genetic group of cells, hormones, and immune system. Other elements include various food types, separate organism cells, and other internal and exterior elements. Skin problems can be brought on by these factors alone or in combination. Both chronic, incurable conditions like eczema and psoriasis as well as cancerous disorders like malignant melanoma exist. Recent studies have shown that there are therapies for these illnesses if they are identified early enough. Atopic dermatitis, or eczema, is a chronic skin ailment characterised by dry, itchy skin, as well as rashes on the hands, feet, elbows, and behind the knees. Melanoma is a dangerous and potentially deadly form of skin cancer. Moles that are visible on the skin have the "ABCD's" of Asymmetry, Border, Color, and Diameter. Asymmetry occurs when the forms of the two halves are not equal. The mole's border is defined as its ragged, uneven, or fuzzy borders. There may be varied degrees of black, brown, and tan tones. A mole's diameter implies a change in size.

## **CHAPTER V**

### **REQUIREMENTS**

#### **Requirement Description:**

#### **Functional and non-functional requirements:**

An essential first step in determining the viability of a system or software project is the analysis of the requirements. The two main types of requirements are functional and non-functional requirements.

#### **Functional Requirements:**

The system must adhere to these requirements in order to suit the demands of the end user. All of these characteristics must be incorporated into the system as per the contract's specifications. These are represented or described as the system's required input, the action taken, and the anticipated result. These are essentially the user-stated criteria that are evident in the completed product, as opposed to non-functional requirements.

#### **Non-functional requirements:**

They are essentially the standards of quality that the system must fulfil in order to comply with the project contract. These criteria may be given a different order of importance or utilised to a different extent depending on the project. Likewise referred to as non-behavioral requirements.

They basically deal with issues like:

- Portability
- Security
- Maintainability
- Reliability
- Scalability
- Performance
- Reusability
- Flexibility

**Hardware requirements:**

- Processor : I5/Intel Processor
- RAM : 8GB (min)
- Hard Disk : 128 GB

**Software requirement:**

- Operating System : Windows 10
- Server-side Script : Python 3.6
- IDE : PyCharm, Jupyter notebook
- Libraries Used : Numpy, IO, OS, Flask, Keras, pandas, tensorflow

## CHAPTER VI

### PROPOSED SYSTEM

#### Proposed Algorithm:

This project's goal is to develop a system for classifying road photos into those with and without potholes (normal). Convolutional neural networks, a type of deep learning technique, are useful for categorising and analysing images. We used a convolutional neural network (CNN) and transfer learning to train the input photographs of potholes and non-potholes (normal), which were manually collected and images available on the internet resource from kaggle. Several pre-trained neural network models, including Mobile Net, are evaluated in order to compare the results.

#### Advantages:

- Accurate classification
- Less complexity
- High performance
- Easy Identification

#### COMPONENT DIAGRAM:

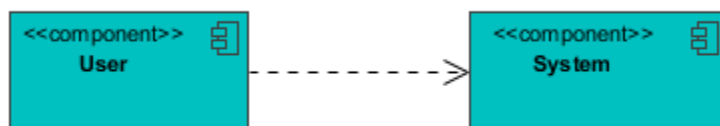


Fig-3 System diagram

## **CHAPTER VII**

### **CONCLUSION**

We were able to accurately categorise the images of skin illnesses in this study with the use of deep learning and transfer learning. Here, we have considered the dataset of ham10000 images, which will be trained with CNN and certain ResNet50 transfer learning methods. After the training, we uploaded an image and classified it to test the system.

In the future, this can be used to classify different disease types and warn patients of possible risks.



## CHAPTER VIII

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