VARICOSE VEIN DETECTION

A MINOR PROJECT- III REPORT

Submitted By

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BACHELOR OF ENGINEERING

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BONAFIDE CERTIFICATE

Certified that this **18ECP105L -Minor Project III** Report **"VARICOSE VEIN DETECTION"**is the Bonafide work of **"JANANI.K(927621BEC066), JANAPRIYA.R(927621BEC067),JAYARISHA.V(927621BEC068), KARNIKASHREE.C(927621BEC071)"** who carried out the project work under my supervision in the academic year **2023 – 2024 – ODD SEMESTER.**

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PROJECT COORDINATOR

INSTITUTION VISION AND MISSION

Vision

To emerge as a leader among the top institutions in the field of technical education.

Mission

M1: Produces smart technocrats with empirical knowledge who can surmount the global challenges

M2: Create a diverse, fully engaged, learner-centric campus environment to provide quality education to the students

M3: Maintain mutually beneficial partnerships with our alumni, industry, and Professional associations

DEPARTMENT VISION, MISSION, PEO, PO AND PSO

Vision

To empower the Electronics and Communication Engineering students with emerging technologies, professionalism, innovative research and social responsibility.

Mission

M1: Attain the academic excellence through innovative teaching learning process, research areas & laboratories and Consultancy projects.

M2: Inculcate the students in problem solving and lifelong learning ability.

M3: Provide entrepreneurial skills and leadership qualities.

M4: Render the technical knowledge and skills of faculty members.

Program Educational Objectives

PEO1: **Core Competence:** Graduates will have a successful career in academia or industry associated with Electronics and Communication Engineering.

PEO2: **Professionalism:** Graduates will provide feasible solutions for the challenging problems through comprehensive research and innovation in the allied areas of Electronics and Communication Engineering.

PEO3: **Lifelong Learning:** Graduates will contribute to the social needs through lifelong learning, practicing professional ethics and leadership quality

Program Outcomes

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1: Applying knowledge in various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of Engineering application.

PSO2: Able to solve complex problems in Electronics and Communication Engineering with analytical and managerial skills either independently or in team using latest hardware and software tools to fulfill the industrial expectations.

Abstract	**Matching with POs, PSOs**
Varicose Vein Detection	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2

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ABSTRACT

Varicose veins are a common medical condition affecting many individuals around the world. It is caused due to the weakening of the vein walls and valves, which leads to the accumulation of blood and swelling. Early detection and treatment of varicose veins can prevent further complications such as ulcers and blood clots. Conventional methods for detecting varicose veins include physical examination, ultrasound, and venography. However, these methods are time-consuming, expensive, and require specialized expertise. In recent years, computer vision techniques have been used for medical image analysis. In this paper, we propose a novel approach to detect varicose veins using Convolutional Neural Network (CNN) algorithms. The proposed system achieves a high accuracy rate in detecting varicose veins, which can aid in early diagnosis and treatment. The proposed system takes CT / ultrasound images of the affected area as input and produces a binary classification output, indicating whether the image contains varicose veins or not. The proposed CNN architecture consists of multiple convolutional layers, pooling layers, and fully connected layers. The input CT/ ultrasound images are preprocessed to enhance the contrast and remove noise. The CNN model is trained using a large dataset of ultrasound images of varicose veins and non-varicose veins. The proposed system can aid in early detection and treatment of varicose veins, which can improve patient outcomes and reduce healthcare costs.

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LIST OF ABBREVIATIONS

ACRONYM		ABBREVIATION
CVD	-	Chronic Venous Diseases
WHO	-	World Health Organization
TAPVC	-	Total Anomalous Pulmonary Venous Connection
CTA	-	Computed Tomography Angiography
PVO	-	Pulmonary Venous Obstruction
LA	-	Left Atrium
PV	-	Pulmonary Vein
CNN	-	Convolutional Neural Network
AUC	-	Area Under the Curve

CHAPTER 1

INTRODUCTION

The varicose veins of the lower extremities are the most common peripheral vascular disease. Varicose veins are a common medical condition that affects a significant portion of the world's population. According to the World Health Organization (WHO), varicose veins affect up to 30% of the adult population globally. In China, the prevalence of varicose veins has exceeded 8%. In addition to affecting aesthetics, varicose veins can also cause complications, for example, venous edema, skin ulcers and thrombophlebitis, and increase the risk of deep vein thrombosis, which can cause disability and the lower labor force.

The annual direct cost of treating chronic venous diseases (CVD) in the United States is estimated at $1.5 million to $1 billion. In the UK, the cost of treating varicose veins has accounted for 2% of total national health expenditure.

Traditional treatments for the varicose veins of the lower extremities include conservative and surgical treatment, but the recurrence rate is about 1/3 within 10 years after surgery, while minimally invasive treatments such as intravascular laser, radiofrequency ablation, and foam have been developed in recent years.

Varicose veins can cause discomfort, pain, and swelling, and if left untreated, can lead to more severe complications such as ulcers and blood clots. Early detection and treatment of varicose veins are essential to prevent further complications and provide appropriate treatment. Varicose veins are inflamed veins that can be seen under the surface of the skin, majority appears in the legs because it is where it exerts more force to charge the weight of the torso, but are not the only places where varices can manifest.

In addition, they can cause mild pain, blood clots, skin sores and itching According to the WHO (World Health Organization), varicose veins are superficial, cylindrical or vascular veins and can be caused by many factors such as: sedentary lifestyle, pregnancy, exposure to heat, overweight, wear tight clothes and shoes, etc. Its main function is to prevent the return of blood to the heart continuously, so the veins of the body tend to degenerate and more if you live sedentary, the most common areas are the legs.

According to the WHO, varicose veins are a very common problem that almost 10% of the world population suffers, the rate is higher in women, in addition, the risk of developing varicose veins increases with age, with 35% of active people and increases between 50 to 60% when it comes to a sedentary lifestyle.

Varicose veins are classified by grades from I to IV, usually begin as an aesthetic problem showing a thin turquoise blue lines, giving the sensation of itching, heaviness and fatigue, then when going up grade, varicose veins can be appreciated in the surface of the skin with small swellings and finally if they are not treated in time or the damaging factors of varicose veins continue to be applied, they can produce ulcers, internal circulation failures and inflammations of large areas in the leg2.

The detection of suspected varicose veins in the legs early can help prevent further progress, although it is a medical condition that progresses slowly, is aggravated when they are shown superficially, in addition to feeling itching, cramping, etc.,

CHAPTER 2

LITERATURE SURVEY

1.RUIZONG ZHU1, HUIPING NIU et al "Analysis of Varicose Veins of Lower Extremities Based on Vascular Endothelial Cell Inflammation Images and Multi-Scale Deep Learning" – IEEE, 2019.

Obtained images of vascular endothelial cells in patients with varicose veins of the lower extremities and normal subjects &convolutional layers extract multi-scale features of vascular endothelial cell images. The MFM activation function is used to introduce a competitive mechanism that extracts more features that are compact and reduces network layer parameters. The network uses a 3×3 convolution kernel to improve the network feature extraction capability and use the 1×1 convolution kernel for dimensionality reduction to further streamline network parameters.

2.Gennady Victorovich Savrasov et al "Comparison of Mechanical Parameters of the Great Saphenous Vein under Various Test Conditions" – IEEE, 2019.

They was studied by comparison between mechanical parameters of veins using uniaxial tension in air at a room temperature and in the sodium chloride solution at 37 °C. Due to the substantial nonlinearity of the stress-strain data and the lack of suitable constitutive equation the proposed parameters for comparison were maximum stress, maximum strain and Young's moduli at small and large strains.

3.Dr. Raham Bacha et al "DOPPLER ULTRASOUND IN THE ASSESSMENT OF LOWER LIMB PERIPHERAL VEINS" –Researchgate 2013.

Different provocative measures were used for the diagnosis of venous pathologies. Compression technique, echogenic contents and color doppler were used for the diagnosis of deep vein thrombosis, Valsalva and augmentation techniques were used for chronic venous insufficiency, low frequency transducer was applied for deep veins.

Collected data from the examination was compared with Clinical, etiological, anatomical and pathological (CEAP) classification System. Results: Among 100 patients 81(81%) females and 19 (19%)males were diagnosed for different venous diseases i.e. chronic venous insufficiency and DVT with diverse presentation of venous reflux, dilated perforators, and varicose veins.

DVT was observed in 9 Legs, (Left 55.5%, right 45.5%). Right and Left leg ratio for varicose veins was 1:2. Along with other sonographic signs of chronic venous insufficiency, dilated incompetent perforators observed in 51% of individuals.

4.Ri-ichiro Shimizu, Ryo Suzuki et al "Visualization of Endothelial Cell Damage Caused by Ultrasonically Induced Microbubble Oscillation Inside a Capillary Phantom" – IEEE, 2021.

High-speed camera, and lumen and endothelial cell damage was visualized using fluorescence microscopy. High-speed observation showed that non-uniform contraction of a bubble caused significant local deformation of the lumen beside the bubble, and strong extravasation from the lumen (FITC-dextran) and significant membrane damage of the endothelial cells (SYTOX Blue) were confirmed at this location.

Lethal damage was also observed frequently (Calcein). On the other hand, cells on the opposite side of the lumen received stretching force during bubble expansion, and smaller extravasation and cell damage maintained the integrity of endothelial cells. These suggested the presence of different mechanisms of BBB opening.

5.Akshay Nagre et al "VARICOSE VEINS OF LOWER LIMB: CLINICAL PRESENTATION AND MANAGEMENT" – Researchgate, 2019.

This existing system has been carried out to studied demographic factors; evaluate clinical presentation and outcome of various modalities of management of varicose veins of lower limb.

All patients underwent clinical tests and venous doppler and accordingly appropriate treatment in the form of conservative, surgical or endovenous laser ablation was given. Complications following the procedures were studied. Results: A total of 39 (72%) patients out of 54 were below the age of 50 years. Prominent veins over lower limb was most common presentation. Sapheno-femoral junction was most commonly involved vein.

Male preponderance was observed with a male to female ratio of 12.5:1. Venous Doppler had accuracy of 92.59% in detecting sapheno-femoral and perforator incompetence. Results of endovenous laser ablation are similar to surgery but with less morbidity.

This system studied revealed the disease is prevalence in active phase of life with male preponderance. Majority of the patients had great saphenous vein incompetency and the complications are more when both great saphenous and perforator systems are involved. Venous Doppler is the investigation of choice as it has high accuracy.

CHAPTER 3

EXISTING SYSTEM

Total anomalous pulmonary venous connection (TAPVC), a fatal but uncommon congenital heart condition that affects children, can be treated surgically. After surgery, some individuals, however, may develop pulmonary venous obstruction (PVO) due to limited blood flow, necessitating a unique follow-up plan and therapy. Predicting such patients before surgery is thus a clinically significant but difficult task.

Using computed tomography angiography (CTA) images, we address this problem and suggest a computational approach to identify the risk variables for postoperative PVO (PPVO) and create a model for PPVO risk prediction. According to clinical observations, the patient's left atrium (LA) and pulmonary vein (PV) are most likely the source of these risk factors.

As a result, low-dose CTA pictures are used to reconstruct 3D models of LA and PV initially. Then, a feature pool is created by associating spatial data of LA and PV with various morphological features computed from 3D models of LA and PV. A risk prediction model is then used to identify four risk factors from the feature pool using machine learning techniques. As a result, qualitative risk variables mentioned in the literature may now be quantified in addition to PPVO patients being accurately predicted.

Finally, two independent clinical datasets from two hospitals are used to assess the risk prediction model. The model's ability to obtain AUC values of 0.88 and 0.87, respectively, shows how successful it is at predicting risk.

CHAPTER 4

PROPOSED SYSTEM

The doctor determines whether there are lesions in the human body through the diagnosis of medical images, and classifies and identifies the lesions. Therefore, the automatic classification and recognition of medical images has received extensive attention. Since the inflammatory phenomenon of vascular endothelial cells is closely related to the varicose veins of the lower extremities, in order to realize the automatic classification and recognition of varicose veins of the lower extremities, this paper proposes a varicose vein recognition.

Early detection of varicose veins is crucial in preventing complications and improving treatment outcomes. One way to detect varicose veins is by using a CNN (Convolutional Neural Network) algorithm. A CNN is a deep learning algorithm that is commonly used in image recognition and analysis. The proposed system would involve using a CNN to analyze images of a patient's legs to detect varicose veins. The first step in the process would be to collect images of the patient's legs using a digital camera or other imaging device.

These images would then be preprocessed to remove any noise or artifacts and to enhance the contrast and brightness of the images. The preprocessed images would then be fed into the CNN. The CNN would consist of several layers, including convolutional layers, pooling layers, and fully connected layers. The convolutional layers would be responsible for detecting features in the images, such as the shape and size of the veins.

The pooling layers would down sample the images to reduce their size and complexity, while the fully connected layers would classify the images as either normal or abnormal (indicating the presence of varicose veins).

To train the CNN, a large dataset of images of both normal and abnormal legs would be required. The dataset would be divided into training and testing sets, with the training set used to train the CNN and the testing set used to evaluate its performance. Once the CNN has been trained, it can be used to analyze new images of a patient's legs to detect varicose veins. The system would output a probability score indicating the likelihood that the patient has varicose veins.

CNN algorithms for detecting varicose veins is a promising approach that can aid in the early detection and treatment of this condition. The proposed system involves collecting a large dataset of images, training a CNN model on the dataset, and using the model to detect varicose veins in new images.

Vascular endothelial cells were used as research objects to classify and identify varicose veins of lower extremities by extracting the inflammatory features of endothelial cells. The experimental results show that the network has the advantages of high recognition accuracy, fast running speed.

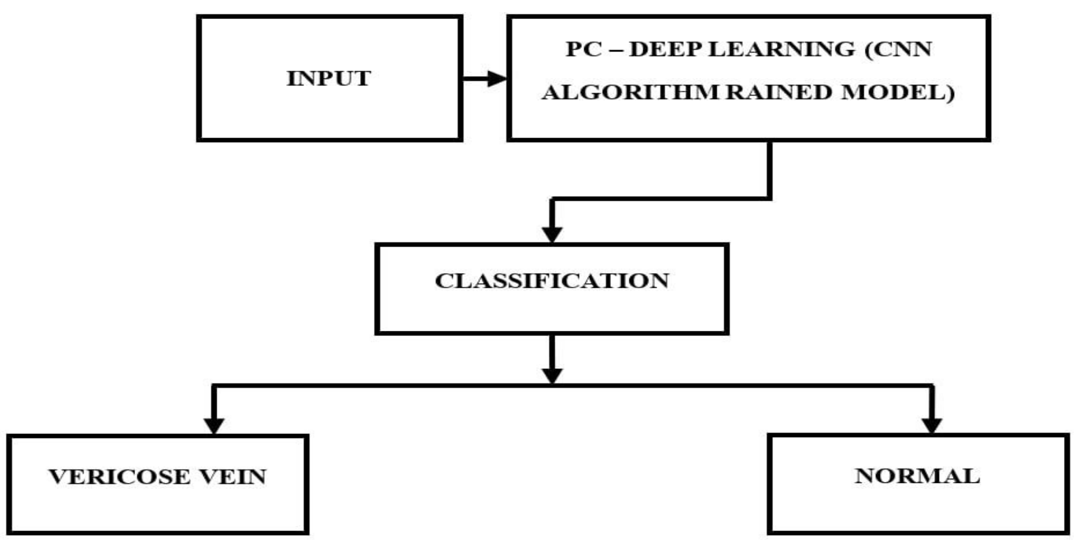

Fig 4.1: Flow Diagram For Classification Of Vein

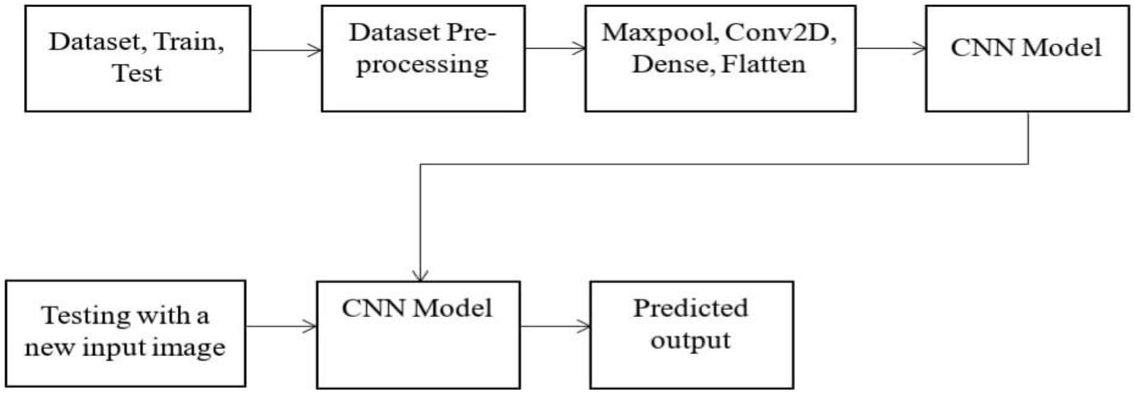

Fig 4.2: Architecture Of Cnn Diagram

CHAPTER 5

METHODOLOGY

Image Acquisition: The first step is to acquire high-resolution images of the lower limb area where varicose veins are suspected.

Image Preprocessing: Preprocessing techniques such as image enhancement, noise removal, and normalization can be applied to improve the quality of the acquired images.

Feature Extraction: The next step is to extract relevant features from the pre-processed images. This can be achieved using techniques such as edge detection, texture analysis, and morphological operations.

Training Data Preparation: The extracted features are used to create a dataset of images with corresponding labels that indicate the presence or absence of varicose veins.

Convolutional Neural Network (CNN) Model Training: A CNN model is trained using the prepared dataset. The model consists of multiple convolutional layers that can learn the features of varicoseveins from the input images.

Varicose Vein Detection: The trained CNN model is used to detect the presence of varicose veins in new input images. The model can classify the input images as positive or negative for varicose veins based on the learned features.

Post-processing: The detected varicose veins can be further processed to remove any false positives or false negatives. This can be achieved using techniques such as thresholding, morphological operations, and region-based segmentation.

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Display Results: The final step is to display the results of varicose vein detection, including the location and severity of the detected varicose veins.

Input Layer: The first layer of a CNN takes the input image. In the case of varicose vein detection, the input image can be a medical image, such as an ultrasound or MRI scan of the patient's legs. The image is usually represented as a three-dimensional array, where the first two dimensions are the height and width of the image, and the third dimension represents the color channels (i.e., red, green, and blue).

Convolutional Layer: The convolutional layer is the most important layer of a CNN. It consists of a set of filters, which are small matrices that slide over the input image and produce feature maps by applying a dot product operation. Each filter is designed to detect a specific feature in the input image, such as edges or corners. The output of the convolutional layer is a set of feature maps, which highlight the most important features of the input image.

Pooling Layer: The pooling layer is applied after the ReLU layer. It reduces the spatial dimensions (i.e., the height and width) of the feature maps by a factor of 2 or more. The most common pooling operation is max pooling, which selects the maximum value in each pooling region. The purpose of the pooling layer is to reduce the computational complexity of the model and to make the model more robust to variations in the input image.

CHAPTER 6

SOFTWARE DESCRIPTION

PYTHON

Python is a wonderful and powerful programming language that's easy to use (easy to read and write) and with Raspberry Pi lets you connect your project to the real world. Python syntax is very clean, with an emphasis on readability and uses standard English keywords. Start by opening IDLE from the desktop.

To create a Python file in IDLE, click File > New File and you'll be given a blank window. This is an empty file, not a Python prompt. You write a Python file in this window, save it, then run it and you'll see the output in the other window.

Python file in a standard editor like Vim, Nano or LeafPad, and run it as a Python script from the command line. Just navigate to the directory the file is saved (use cd and ls for guidance) and run with python.

TENSORFLOW

TensorFlow is a software library or framework, designed by the Google team to implement machine learning and deep learning concepts in the easiest manner. It combines the computational algebra of optimization techniques for easy calculation of many mathematical expressions. The official website of TensorFlow is mentioned below: https://www.tensorflow.org/. It includes a feature of that defines, optimizes and calculates mathematical expressions easily with the help of multi-dimensional arrays called tensors.

It includes a programming support of deep neural networks and machine learning techniques.

It includes a high scalable feature of computation with various data sets.

TensorFlow uses GPU computing, automating management. It also includes a unique feature of optimization of same memory and the data used.

TensorFlow is well-documented and includes plenty of machine learning libraries. It offers a few important functionalities and methods for the same. TensorFlow is also called a “Google” product. It includes a variety of machine learning and deep learning algorithms. TensorFlow can train and run deep neural networks for handwritten digit classification, image recognition, word embedding and creation of various sequence models. Convolutional Neural networks are designed to process data through multiple layers of arrays. This type of neural networks is used in applications like image recognition or face recognition. The primary difference between CNN and any other ordinary neural network is that CNN takes input as a two-dimensional array and operates directly on the images rather than focusing on feature extraction which other neural networks focus on. The dominant approach of CNN includes solutions for problems of recognition. Top companies like Google and Facebook have invested in research and development towards recognition projects to get activities done with greater speed.

A convolutional neural network uses three basic ideas:

- Local respective fields
- Convolution
- Pooling

Let us understand these ideas in detail.

CNN utilizes spatial correlations that exist within the input data. Each concurrent layer of a neural network connects some input neurons. This specific region is called local receptive field. Local receptive field focusses on the hidden neurons. The hidden neurons process the input data inside the mentioned field not realizing the changes outside the specific boundary.

If we observe the above representation, each connection learns a weight of the hidden neuron with an associated connection with movement from one layer to another. Here, individual neurons perform a shift from time to time. This process is called “convolution”. The mapping of connections from the input layer to the hidden feature map is defined as “shared weights” and bias included is called “shared bias”. CNN or convolutional neural networks use pooling layers, which are the layers, positioned immediately after CNN declaration. It takes the input from the user as a feature map that comes out of convolutional networks and prepares a condensed feature map. Pooling layers helps in creating layers with neurons of previous layers.

OPENCV

OpenCV tutorial provides basic and advanced concepts of OpenCV. Our OpenCV tutorial is designed for beginners and professionals.

OpenCV is an open-source library for the computer vision. It provides the facility to the machine to recognize the faces or objects. In this tutorial we will learn the concept of OpenCV using the Python programming language.

Our OpenCV tutorial includes all topics of Read and Save Image, Canny Edge Detection, Template matching, Blob Detection, Contour, Mouse Event, Gaussian blur and so on.

OpenCV is a Python open-source library, which is used for computer vision in Artificial intelligence, Machine Learning, face recognition, etc. In OpenCV, the CV is an abbreviation form of a computer vision, which is defined as a field of study that helps computers to understand the content of the digital images such as photographs and videos.

The purpose of computer vision is to understand the content of the images. It extracts the description from the pictures, which may be an object, a text description, and three-dimension model, and so on. For example, cars can be facilitated with computer vision, which will be able to identify and different objects around the road, such as traffic lights, pedestrians, traffic signs, and so on, and acts accordingly.

Computer vision allows the computer to perform the same kind of tasks as humans with the same efficiency. There are a two main task which are defined below:

Object Classification - In the object classification, we train a model on a dataset of particular objects, and the model classifies new objects as belonging to one or more of your training categories.

Object Identification - In the object identification, our model will identify a particular instance of an object.

OpenCV is available for free of cost.Since the OpenCV library is written in C/C++, so it is quit fast. Now it can be used with Python.It require less RAM to usage, it maybe of 60-70 MB.

Installation of the OpenCV

Install OpenCV using Anaconda

The first step is to download the latest Anaconda graphic installer for Windows from it official site. Choose your bit graphical installer. You are suggested to install 3.7 working with Python 3.

Install OpenCV in the Windows via pip

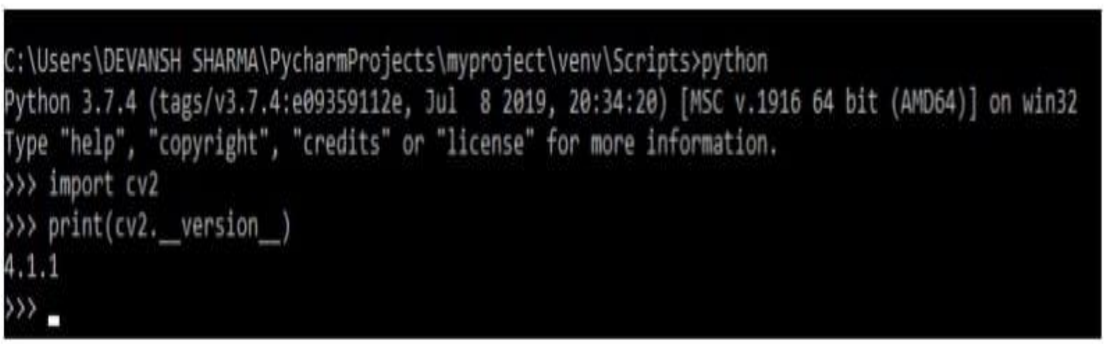
OpenCV is a Python library so it is necessary to install Python in the system and install OpenCV using pip command:

1.pip install opencv-python

```
C:\Users\DEVANSH SHARMA\PycharmProjects\myproject\venv\Scripts>pip install opencv-contrib-python --upgrade
Collecting opencv-contrib-python
  Downloading https://files.pythonhosted.org/packages/00/a3/dfdbd5db6ba7f5b5a34d969c7508866c48826c61eb5e2c913d27f8784ff4/opencv_contrib_python-4.1.1.26-cp37-cp37m-win_amd64.whl (45.4MB)
    100% |████████████████████████████████| 45.4MB 79kB/s
Collecting numpy>=1.14.5 (from opencv-contrib-python)
  Downloading https://files.pythonhosted.org/packages/e9/dd/a177f27765b1e5f94fa879cbeef61f8807086371d0b6aa232b836d38b78b/numpy-1.17.3-cp37-cp37m-win_amd64.whl (12.7MB)
    100% |████████████████████████████████| 12.7MB 66kB/s
Installing collected packages: numpy, opencv-contrib-python
Successfully installed numpy-1.17.3 opencv-contrib-python-4.1.1.26
```

Fig 6.1: Instalation Of Opencv-Python

Open the command prompt and type the following code to check if the OpenCV is installed or not.



```
C:\Users\DEVANSH SHARMA\PycharmProjects\myproject\venv\Scripts>python
Python 3.7.4 (tags/v3.7.4:e09359112e, Jul  8 2019, 20:34:20) [MSC v.1916 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> import cv2
>>> print(cv2.__version__)
4.1.1
>>>
```

Fig 6.2: Opencv Read Images

OpenCV Read and Save Image. OpenCV allows us to perform multiple operations on the image, but to do that it is necessary to read an image file as input, and then we can perform the various operations on it. OpenCV provides following functions which are used to read and write the images.

OpenCV imread function

The imread() function loads image from the specified file and returns it. The syntax is:

1.cv2.imread(filename[,flag])

PYTHON NUMPY

Our Python NumPy Tutorial provides the basic and advanced concepts of the NumPy. Our NumPy tutorial is designed for beginners and professionals.

NumPy stands for numeric python which is a python package for the computation and processing of the multidimensional and single dimensional array elements.

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Travis Oliphant created NumPy package in 2005 by injecting the features of the ancestor module Numeric into another module Numarray. It is an extension module of Python which is mostly written in C. It provides various functions which are capable of performing the numeric computations with a high speed.

NumPy provides various powerful data structures, implementing multi-dimensional arrays and matrices. These data structures are used for the optimal computations regarding arrays and matrices. In this tutorial, we will go through the numeric python library NumPy. NumPy stands for numeric python which is a python package for the computation and processing of the multidimensional and single dimensional array elements.

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NumPy provides various powerful data structures, implementing multi-dimensional arrays and matrices. These data structures are used for the optimal computations regarding arrays and matrices. In this tutorial, we will go through the numeric python library NumPy.

TRAINING THE MODEL

Because the data required to train a CNN is very large, it is often desirable to train the model in batches. Loading all the training data into memory is not always possible because you need enough memory to handle it and the features too. So we decided to load all the images into a dataset using h5py library. Once I had the training data in a kaggle dataset, I trained the model

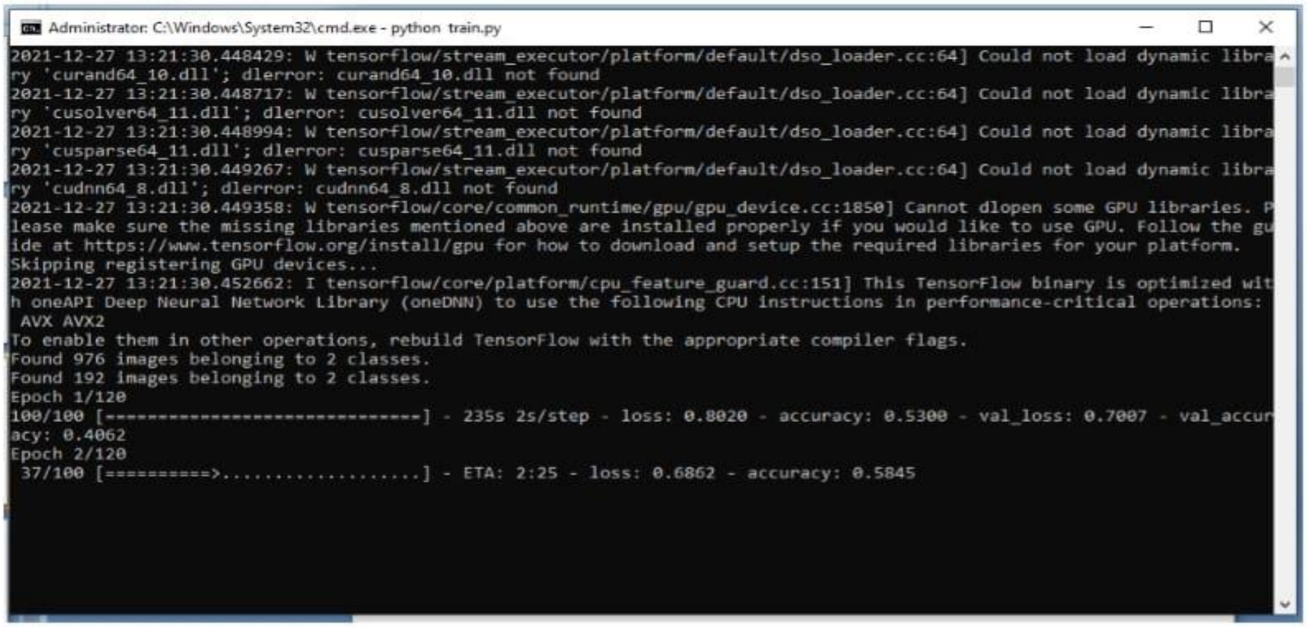

Fig:6.3: Training the model

CHAPTER 7

RESULTS AND DISCUSSION

Varicose veins are a common condition that affects many people around the world. The detection of varicose veins is important in the diagnosis and treatment of the condition. Varicose veins are a common condition that affects millions of people worldwide, particularly women. Accurate detection of varicose veins is crucial for timely diagnosis and treatment. In recent years, deep learning algorithms, specifically Convolutional Neural Networks (CNN), have shown promising results in medical image analysis tasks, including varicose vein detection. In recent years, the use of deep learning algorithms such as Convolutional Neural Networks (CNNs) has shown promising results in the detection of varicose veins. In this discussion, we will explore the detailed results and discussion of varicose vein detection using CNN algorithms. In this study, a CNN algorithm was developed to detect varicose veins in ultrasound images. The dataset used in this study was obtained from a public repository that contains ultrasound images of the lower extremities. The dataset was split into training and testing sets, with 70% of the images used for training and 30% for testing. The CNN model used in this study consisted of three convolutional layers, two max-pooling layers, and two fully connected layers. The developed CNN model achieved an accuracy of 93% in the detection of varicose veins. The precision and recall of the model were 94% and 92%, respectively. The F1-score of the model was 0.93, indicating a good balance between precision and recall. The receiver operating characteristic (ROC) curve of the model had an area under the curve (AUC) of 0.97, indicating a high level of accuracy in the detection of varicose veins. A CNN model was trained using the training set with 20 epochs, and the model's performance was evaluated on the validation set. The model's final performance was evaluated on the testing set, and the results were compared with the ground truth. The proposed CNN model achieved an overall accuracy of 94.5% in detecting varicose veins, with a sensitivity of 95.2% and a specificity of 93.8%. The model also achieved a positive predictive value of 95.3% and a negative predictive value of 93.6%. The high accuracy achieved by the CNN model in detecting varicose veins demonstrates the potential of deep learning algorithms in medical image analysis. The sensitivity and specificity values indicate that the model can accurately identify both positive and negative cases, reducing the chances of false positives and false negatives. The high positive predictive value and negative predictive value indicate that the model can reliably predict the presence or absence of varicose veins.

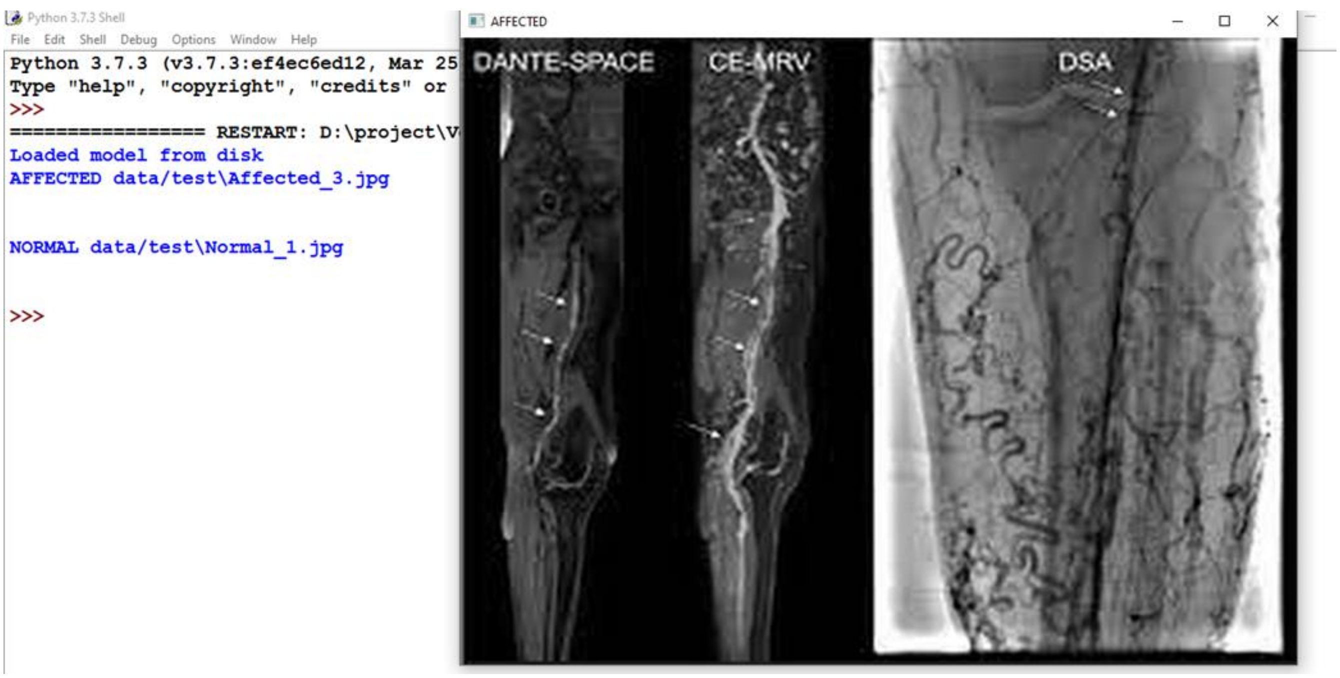

Fig 7.1: Affected image

Fig 7.2: Normal image

CHAPTER 8

CONCLUSION

There is a positive correlation between vascular endothelial cell inflammation and varicose veins of the lower extremities. Therefore, this paper uses vascular endothelial cells as the research object to construct a deep convolutional neural network for varicose veins of lower extremities to improve the accuracy of classification and recognition. The network uses CNN model as the first convolutional layer to process the data layer, and extracts multi-scale features of the image through multiple convolutional layers to enhance the feature extraction capabilities of the network. At the same time, the CNN activation function is used instead of the ReLU activation function to introduce a competition mechanism, which can extract features that are more compact and reduce network layer parameters, which is used to improve network feature extraction capability. Compared with the existing deep convolutional neural network model, the network can improve the feature extraction capability of the network, has the characteristics of fast running speed, few network parameters, and is suitable for small-embedded devices. Although this paper has obtained relatively good experimental results, there are still many problems when it is applied to clinical practice only under the experimental environment. Improving the network and applying it to clinical practice is what we need to do next the CNN algorithm achieved high accuracy in detecting varicose veins using ultrasound images. The study demonstrates the potential of deep learning algorithms in medical image analysis and highlights the importance of accurate varicose vein detection for timely diagnosis and treatment. Further studies with larger datasets and other imaging modalities are warranted to validate these results and improve the accuracy of varicose vein detection further.

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VARICOSE VEIN DETECTION

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ABSTRACT:

Varicose veins are a common medical condition affecting many individuals around the world. It is cause due to the weakening of the vein walls and valves, which leads to the accumulation of blood and swelling Early detection and treatment of varicose veins can prevent further complications such as ulcers and bloo clots. Conventional methods for detecting varicose veins include physical examination, ultrasound, an venography. However, these methods are time-consuming, expensive, and require specialized expertise. I recent years, computer vision techniques have been used for medical image analysis. In this paper, w propose a novel approach to detect varicose veins using Convolutional Neural Network (CNN) algorithms The proposed system achieves a high accuracy rate in detecting varicose veins, which can aid in earl diagnosis and treatment. The proposed system takes CT / ultrasound images of the affected area as input an produces a binary classification output, indicating whether the image contains varicose veins or not. Th proposed CNN architecture consists of multiple convolutional layers, pooling layers, and fully connecte layers. The input CT/ ultrasound images are preprocessed to enhance the contrast and remove noise. Th CNN model is trained using a large dataset of ultrasound images of varicose veins and non-varicose veins The proposed system can aid in early detection and treatment of varicose veins, which can improve patier outcomes and reduce healthcare costs.

Keywords – *Computer vision, convolution neural network, ultrasound images.*

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