Deforestation Classification using Deep Learning

A project report Submitted for the partial fulfillment of the requirement for the award of degree

Bachelor of Technology Degree

In

Computer Science and Engineering

By

Vaibhav Kumar
(D/18/CSE/118)
Sanjana Kumari
(D/19/CSE/123)

Under the Supervision of

Dr. Ajit Kumar Singh Yadav

Assistant Professor
(Department of Computer Science and Engineering)

अष्टदाँ प्रान्तभूमिः प्रज्ञा

North Eastern Regional Institute of Science and Technology
Deemed To Be University (MHRD), Govt. of India
Nirjuli-791109, Arunachal Pradesh, India.

May 2023

DECLARATION

We hereby declare that the project "Deforestation classification using deep learning" submitted to the North Eastern Regional Institute of Science and Technology, Nirjuli, is a record of an actual work done by under the supervision of Dr. Ajit Kumar Singh Yadav, Assistant professor Department of Computer Science and Engineering, NERIST. The project report is being submitted in order to complete the prerequisites for the degree of "Bachelor of Technology" in Computer Science and Engineering. This report's findings have not been submitted to any other university or institute for the purpose of conferring a degree or diploma. The greatest care has been made to guarantee that any content used in the development of the project, such as codes, libraries, references, and so on, does not infringe on any rights and is not plagiarized to the greatest extent possible. In addition, correct attribution has been given in the form of citations whenever and wherever possible.

Sanjana Kumari (D/19/CS/123)

Vaibhav Kumar (D/18/CS/118)

CERTIFICATE OF APPROVAL

Certified that the project report entitled "**Deforestation Classification Using Deep Learning"** is a bonafide work carried out jointly by **SANJANA KUMARI (D/19/CS/123)** AND **VAIBHAV KUMAR(D/19/CS/129).** The project report embodies the original work done by them towards partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in Computer Science and Engineering at North Eastern Regional Institute of Science and Technology, Arunachal Pradesh. It is understood by this approval that the undersigned do not endorse or approve any statement made, opinion expressed or conclusion drawn therein, but approve the project only for the purpose for which it has been submitted.

Dr. Ajit Kumar Singh Yadav
(Project Supervisor)
Asst Professor
Department of Computer Science & Engineering

Dr. Amar Taggu
(Project Coordinator)
Asst. Professor
Department of Computer Science & Engineering

Dr. Satya Jyoti Borah

(Head of the Department)

Department of Computer Science & Engineering

Acknowledgment

This project report on **“Deforestation Classification Using Deep Learning”** brings us great delight and a sense of accomplishment. We would want to use this occasion to extend our heartfelt gratitude to everyone who has assisted us in completing this project successfully. We would like to use this occasion to express our heartfelt gratitude to our internal guide, Dr. Ajit Kumar Singh Yadav, for his helpful advice and for sharing his extensive expertise and experience in project preparation with us. We would want to express our gratitude for his time and for correcting our errors in order to improve the accuracy of our project. We would also want to express our gratitude to the entire faculty of Computer Science and Engineering, particularly for their constant guidance. We are delighted to extend our heartfelt gratitude to every one of our Department of Computer Science and Engineering faculty members. Finally, we’d want to express our gratitude to all of our classmates and professors from the Department of Computer Science and Engineering for sharing their expertise on the subject and assisting us in making this a better project.

Abstract

Human-induced deforestation has a major impact on forest ecosystems and therefore its detection and analysis methods should be improved. Where, this type of detection or classification helps us to degrade the deforestations in future. In this project we are mainly focusing on the problem of deforestation, performing the classification of deforestation and the healthy forests with the help of deep learning model. CNN is the algorithm that which are been using here for the classification process. We are preparing a dataset which is trained using the algorithm and classification will be performed in testing.
Keywords: Deforestation, Deep learning, CNN

List of figures

Figure No	Figure Name	Page no
3.1	Block diagram of proposed method	15
3.4	Architecture	16
3.6.1	CNN layers	18
3.6.2	Convolutional neural network scan images	19
3.6.3	CNN Architecture	20
3.19.1	Block diagram of use case	22
3.9.2	Class diagram	22
3.9.3	Sequence diagram	23
3.9.4	Collaboration diagram	24
3.9.5	Deployment Diagram	24
3.9.6	Activity diagram	25
3.9.7	Component diagram	26
3.9.8	ER diagram	26
3.9.9	DFD diagram	27
4.1	Home page	28
4.2	About	29
4.3	Login Page	29
4.4	Image Uploading	30
4.5	Classified image as Forest	30
4.6	Classified as Deforestation	31

Contents

Sr.no	Topic	Page.no
i	**Declaration**	i
ii	**Certificate of approval**	ii
iii	**Acknowledgment**	iii
iv	**Abstract**	iv
v	**List of figures**	v
1	**Introduction** 1.1 Background 1.2 Causes 1.3 Environmental effect 1.3.1 Atmospheric 1.3.2 Hydrological 1.4Organization of the report	7-11
2	**Literature Survey** 2.1 Banskota, Kayastha, Falkowski, Wulder, Froese and White 2.2 Liu, Zhan. Q, Gao. S, Yang 2.3 Wang. C, Myint S.W, Hutchins. M 2.4 Dalponte. M, Bruzzone. L, Gianelle. D 2.5 Frohn. R, McGwire. K, Dale. V, Estes. J	12-13
3	**Methodology** 3.1 Existing method 3.2 Proposed method 3.3 Application 3.4 Architecture 3.5 Modules 3.5.1 system 3.5.2 User 3.6 Algorithm 3.7 Steps for executing the project 3.8 System Design 3.9 Diagrams 3.9.1 use case diagram 3.9.2 class Diagram 3.9.3 Sequence Diagram 3.9.4 Collaboration diagram 3.9.5 Deployment diagram 3.9.6 Activity Diagram 3.9.7 Component Diagram 3.9.8 ER Diagram 3.9.9 Data Flow Diagram	14-27
4	**Results**	28-31
5	**Conclusion and Future Work** 5.1 Conclusion 5.2 Future work	32
6	**Reference**	33-34

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

Deforestation refers to the intentional clearing of a forest or a group of trees in a particular area, carried out with the intention of repurposing the land for non-forest purposes. Such activities involve converting wooded areas into agricultural fields, livestock ranches, or urbanized zones. The majority of deforestation occurs within tropical rainforests, which comprise roughly 31% of the Earth's land mass. Each year, an estimated 15 to 18 million hectares of forest are lost, which is equivalent to the size of Belgium. Shockingly, this translates to an average of 2,400 trees being felled every minute.

Without regard to the underlying cause, whether it be human-related or not, the Food and Agriculture Organisation of the United Nations (FAO) defines deforestation as the conversion of wooded lands into alternative land uses. It is crucial to distinguish between the terms "deforestation" and "forest area net change." The latter refers to the overall changes in forest cover within a given period, taking into account both the combined losses (deforestation) and gains (forest expansion). Depending on whether the gains outweigh the losses or vice versa, the net change may be positive or negative.

The failure to implement sufficient reforestation measures when removing trees has led to significant consequences such as habitat destruction, biodiversity loss, and increased aridity, either caused by inadequate reforestation efforts or vice versa. Deforestation has led to the extinction of species, alterations in climate patterns, desertification triggers, and the displacement of populations, as substantiated by present-day observations and fossil records. Furthermore, deforestation has a detrimental impact on the capacity to sequester atmospheric carbon dioxide, thereby exacerbating negative feedback loops that contribute to global warming. These consequences of global warming, in turn, exert additional pressure on communities, leading them to clear forests for agricultural purposes, which further diminishes arable land. Deforested areas also suffer from significant environmental consequences, such as detrimental soil erosion and degradation, ultimately transforming once-lush lands into desolate wastelands.

The flexibility and sustainability of human food systems greatly depend on biodiversity, which includes diverse components like shrubs and trees that thrive in arid regions, playing a crucial role in combating desertification. Additionally, insects, bats, and birds found in forests contribute to crop pollination, while trees in mountain ecosystems with extensive root systems help prevent soil erosion. Furthermore, mangrove species offer essential coastal flood protection. The value of forests in both mitigating climate change and absorbing and storing carbon for the agriculture sector is growing as climate change continues to pose difficulties for food systems.

1.2 CAUSES

The United Nations Framework Convention on Climate Change (UNFCCC) secretariat claims that agricultural practises are the main cause of deforestation. According to the research, commercial agriculture only accounts for 32.5% of deforestation, while subsistence farming is responsible for 48.5% of it. 14% of deforestation is caused by logging, and 5% is caused by fuel wood removal.

Experts hold divergent views on the role of industrial logging in global deforestation, leading to disagreements. Certain experts assert that the underprivileged, driven by limited alternatives, are more inclined to clear forests, whereas others argue that financial constraints prevent the poor from bearing the expenses associated with forest clearance. Surprisingly, a mere 8% of tropical deforestation cases were found to be primarily linked to population growth resulting from high fertility rates.

Today's deforestation is a result of a number of reasons, such as governmental corruption, unequal wealth and power distribution, population expansion, overpopulation, and urbanisation. Although deforestation is frequently attributed to globalisation as the main cause, it is crucial to note that in some instances, localised forest regeneration has been aided by the arrival of new labour, capital, commodities, and ideas.

Deforestation is also influenced by climate change, as evidenced by the fact that 23% of tree cover losses can be attributed to wildfires that are exacerbated by the changing climate. Increasing temperatures contribute to the escalation of substantial wildfires, particularly in Boreal forests, which have the potential to bring about significant changes in their overall composition.

The FAO (Food and Agriculture Organisation of the United Nations) emphasised that the relationship between population dynamics and deforestation might have differing degrees of impact in various local settings in 2000. Population pressure and the presence of unfavourable economic, social, and technological conditions are just two of the many variables that can lead to deforestation.

Economic factors that lead people to believe that converting forests rather than conserving them will increase profits can be blamed for the demise of forest ecosystems.. Many essential roles performed by forests do not have established economic markets, leading to a diminished recognition of their worth among forest owners and communities who rely on forest resources. Developing nations claim that wealthier industrialised nations disproportionately benefit from the advantages of forests, such as their function as carbon sinks or biodiversity reserves, and that these essential services are not adequately compensated. In the eyes of developing countries, it is viewed as hypocritical to deny them similar opportunities, particularly considering that some developed nations, like the United States, historically gained economic advantages from deforestation. They assert that the burden of preservation should not fall on the impoverished when it was the affluent who initially caused the problem.

In the past three decades, there have been changes to the causes of deforestation. Subsistence practises and government-backed programmes, like colonisation in Latin America, India, and Java, as well as transmigration in Indonesia, contributed significantly to deforestation in the late 1800s and early 1900s. However, during the 1990s, industrial factors, such as the extractive industries, substantial agriculture, and large-scale cattle ranching, have become the main causes. Deforestation caused by demand for commodities has risen in prominence recently and now accounts for about 25% of all disturbances to forests since 2001. This phenomena has caused substantial losses in places like Southeast Asia and South America.

1.3 ENVIRONMENTAL EFFECT

1.3.1 Atmospheric

One of the main causes of global warming and a frequent role in the greenhouse effect's intensification is deforestation, which is widely acknowledged as a major factor. About 20% of the world's emissions of greenhouse gases are caused alone by deforestation in the tropics. Deforestation, particularly in tropical areas, might be responsible for up to one-third of human-caused carbon dioxide emissions, according to the Intergovernmental Panel on Climate Change. Nevertheless, according to current analyses, emissions from deforestation and forest degradation, excluding peatland emissions, account for around 12% of all human-generated carbon dioxide emissions, with a range of 6% to 17%. By releasing carbon dioxide into the atmosphere during the deforestation process, a layer that traps solar energy is formed. As a result of this trapped radiation being turned into heat, the greenhouse effect, or global warming, occurs.

Through photosynthesis, plants take up carbon dioxide, but they also release some of it through respiration. Trees and forests have the ability to actively remove carbon from the atmosphere and store it in plant tissues during periods of growth. However, when wood decays or is burned, a significant amount of stored carbon is released back into the air. However, some forests have an underground network of symbiotic fungi that can store a significant quantity of carbon. Even if the tree that supplied it dies, decays, or is cut down and burned, the carbon that has been stored in it is unaffected. Another approach to carbon sequestration in forests involves harvesting wood and using it to create long-lasting products, with new trees replacing the ones that were harvested. Deforestation, on the other hand, can result in the release of carbon stored in the soil. The role of forests as carbon sinks or sources depends on various environmental factors. Mature forests go through cycles where they function as net sinks or net sources of carbon dioxide at different stages.

1.3.2 Hydrological

By interfering with the vital transpiration mechanism, deforestation significantly affects the water cycle. Trees release groundwater into the atmosphere during transpiration by drawing it up through their roots. A substantial rise in aridity, however, results from the disruption of this process when forests are destroyed. Deforestation reduces air moisture in addition to lowering soil and groundwater water levels. Lack of trees increases the likelihood of erosion, flooding, and landslides and decreases the capacity to absorb water.

A landscape's ability to collect, store, and discharge precipitation is negatively impacted by a decrease in forest cover. When woods are still standing, they serve as underground water storage areas, allowing water to seep into the earth. Rapid surface water runoff, which moves more quickly than subsurface flows, is increased in deforested areas, though. Through transpiration, forests are essential for redistributing a sizable part of precipitation to the atmosphere. The majority of precipitation unfortunately evaporates as runoff in areas with less vegetation. Unlike in places where the forest cover is intact, this rapid surface water movement can cause flash floods and localised flooding. Deforestation decreases evapotranspiration as well, which lowers atmospheric moisture. Since water is not recycled to forests downwind but instead is lost through runoff and eventually ends up in the oceans, this can have an adverse effect on precipitation levels. The average annual precipitation in deforested areas of north and northwest China decreased by one-third between the 1950s and 1980s, according to a research.

The water cycle is significantly influenced by trees and plants in general through a variety of mechanisms:

Rainfall that is partially intercepted by canopies and subsequently evaporates back into the atmosphere is referred to as canopy interception.

Surface runoff is slowed down by the presence of tree stems, debris, and trunks.

Improved water penetration is facilitated by the creation of huge channels in the soil known as macropores by tree

Through transpiration, trees reduce soil moisture and aid in terrestrial evaporation.

The properties of soil are altered by organic matter, which reduces the soil's capacity to retain water.

Tree leaves regulate ambient humidity through transpiration. Most of the water that the roots take in is transferred to the leaves, where it is discharged.

Because of this, the presence or absence of trees can have a substantial impact on how water is distributed in the atmosphere, in soil, and in groundwater. These modifications then have an effect on water availability for ecosystem services as well as human demands, as well as erosion rates. In lowland plains, deforestation changes cloud formation and causes rainfall to be concentrated at higher altitudes.

1.4 Organization of the report

The successful completion of the project and its implementation at any area will have the following advantages.

- Fights Global warming and climate Change.
- Regulates the water Cycle.
- Reduce the greenhouse gas effect by acting as carbon sinks.
- Development of New Ecosystem.

CHAPTER 2
LITERATURE SURVEY

[2.1] Banskota, Kayastha, Falkowski, Wulder, Froese and White: The Landsat program has been collecting and storing Earth observation data for 41 years, ensuring a continuous supply of measurements that are relevant for management and scientific purposesLandsat-8's successful launch ensures that data will be accessible at the right scales for the foreseeable future. Forest monitoring has greatly benefited from the Landsat Time Series (LTS) approach, which allows for the assessment of baseline conditions, detection of gradual and sudden changes, and the ability to attribute these changes to different factors. The LTS approach is facilitated by factors such as data accessibility, readily usable image products, improved computing and storage capabilities, and advanced image processing techniques. This review provides an overview of the current state of forest remote sensing and the monitoring of forest dynamics using the LTS approach, covering topics such as sensor technology, variables used in LTS analysis, data availability, data preprocessing, analysis methodologies, and validation factors.

[2.2] Liu, Zhan. Q, Gao. S, Yang: This study addresses the issues surrounding the effects of local warming brought on by urbanisation and how it relates to the thermal environment of cities and landscape elements. The combined effects of geographical non-stationarity and seasonal variability, which are inherent features of the environmental system, have, however, been neglected in earlier studies. The study uses a recently developed technique called multi-scale geographically weighted regression (MGWR) to fill this knowledge gap by looking at associations between land surface temperature (LST) and urban landscape indicators at various scales while taking seasonal variations and spatial non-stationarity into account. LST data from Landsat-8 pictures are gathered for the summer, winter, and transitional seasons for the city of Wuhan in this case study. As potential factors affecting LST, the study looks at a variety of landscape composition indicators, including fractional vegetation cover (FVC), albedo, and water percentage (WP), as well as urban morphology indicators, including building density (BD), building height (BH), and building volume density (BVD).

[2.3] Wang. C, Myint S.W, Hutchins. M: Forest resources are plentiful in Myanmar. Recently, the world has paid close attention to the deforestation and forest degradation in Myanmar. Using satellite data from the Moderate Resolution Imaging Spectroradiometer (MODIS), this chapter examines spatiotemporal patterns of deforestation and forest degradation and evaluates the release of forest carbon in Myanmar between 2000 and 2010. According to the findings, 82,426 km2 of forest were lost over the study period, with a deforestation rate of 2.07% per year. With an annual degradation rate of 0.002%, the total area of the degraded forest was 85.5 km2. Mixed forests had the largest degradation area while evergreen needle leaf forests had the highest rate of deterioration. 18.5 million tonnes of forest carbon were released in total at a rate of 0.45% each year. Evergreen needle leaf woods had the highest carbon release rate, while mixed forests emitted the most carbon. In this study, there was no evidence of any forest type storing carbon.

[2.4] Dalponte. M, Bruzzone. L, Gianelle. D: The combined effects of hyperspectral and light detection and ranging (LIDAR) data on categorising complicated forest regions are investigated in this study's analysis. The elements of our investigation are as follows: 1) a sophisticated method that successfully combines LIDAR and hyperspectral data for challenging classification tasks, 2) an assessment of support vector machines (SVMs) and Gaussian maximum likelihood with leave-one-out-covariance algorithm classifiers that show promise in deciphering complex forest scenarios with multiple species in a multisource framework, and 3) an inquiry into enhancing the classification accuracy of hyperspectral images by incorporating different types of data.

[2.5] Frohn.R, McGwire. K,Dale. V, Estes. J: In this work, a thorough simulation model is assessed to gauge deforestation in Brazil's Ronodonia region. In order to compare the model to the analysis of Landsat data using landscape pattern metrics, socioeconomic and ecological factors are taken into account. Percent Cleared, Contagion, and Fractal Dimension metrics from picture classifications are contrasted with the results of the simulation model. The results show that the deforestation rates and spatial patterns produced by the model and the Landsat study are comparable. However, differences in clearing patterns are seen as a result of things like geography, particular farming difficulties in a certain area, and the heterogeneous makeup of clearings. The study also looks at how the measures are affected by various spatial resolutions.

CHAPTER 3

METHODOLOGY

3.1 EXISTING METHOD

This model focuses on a pre-existing technique developed through the utilization of deep learning's Artificial Neural Network (ANN) algorithm. Given the significant consequences of deforestation on forest ecosystems, it is crucial to enhance methods for detecting and analysing deforestation. The classification of deforested areas and healthy forest regions holds considerable importance, and the implementation of ANN enables the accurate identification and classification of these areas.

Disadvantages:

- Limited feature compatibility
- Restricted input and output size
- Diminished accuracy

3.2 PROPOSED METHOD

We suggest employing a Convolutional Neural Network (CNN), which is a deep learning method, for the classification of deforestation. Human-driven deforestation poses significant threats to forest ecosystems, underscoring the need for improved detection and analysis methods. The objective of this study is to enhance future deforestation monitoring by developing a classification system that accurately distinguishes between deforested areas and healthy forests. The primary focus of this project revolves around addressing the deforestation issue, employing a deep learning model to classify deforested regions and healthy forests. The CNN algorithm is utilized for the classification process, with a dataset being prepared for training and subsequent testing of the classification. The diagram below depicts the block structure of the proposed system.

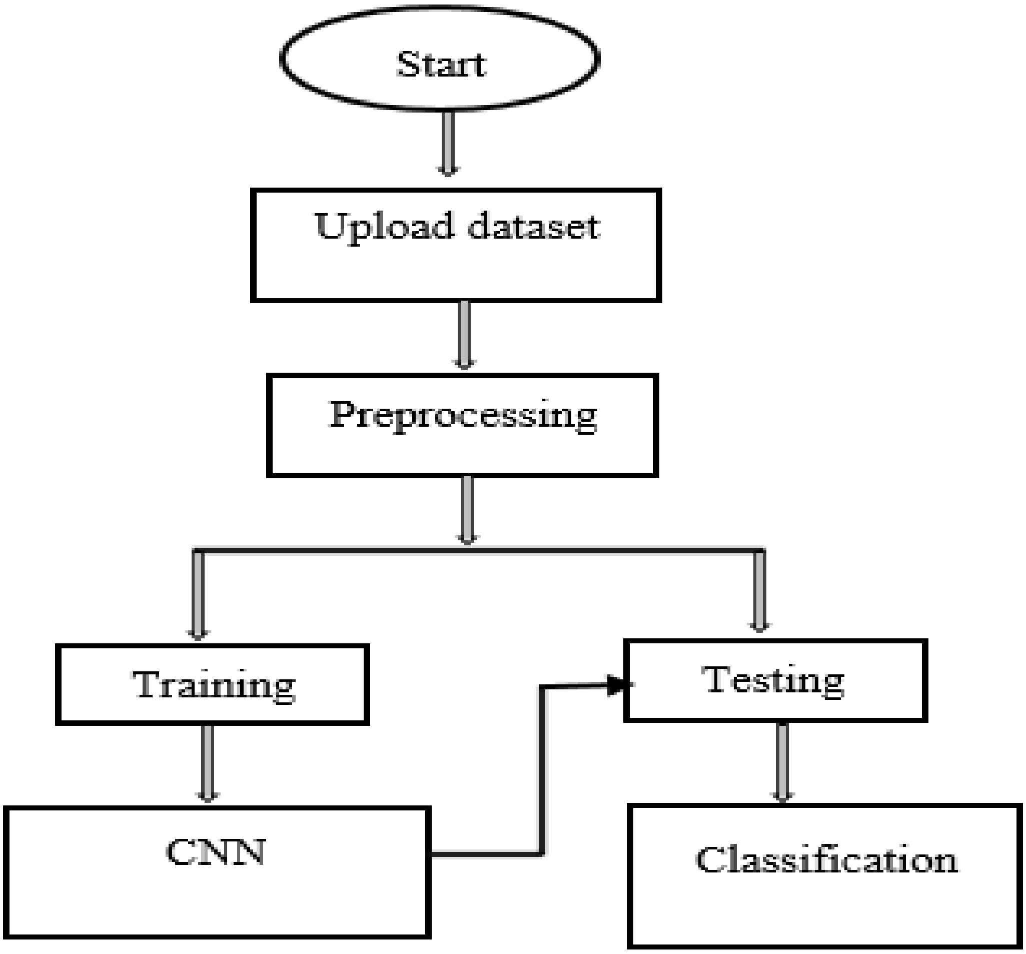


Fig3.1. Block diagram of proposed method

Advantages:

- Precise categorization
- Reduced intricacy
- Excellent performance

3.3 APPLICATION

- Image processing
- Picture retrieval
- Classifications

3.4 ARCHITECTURE

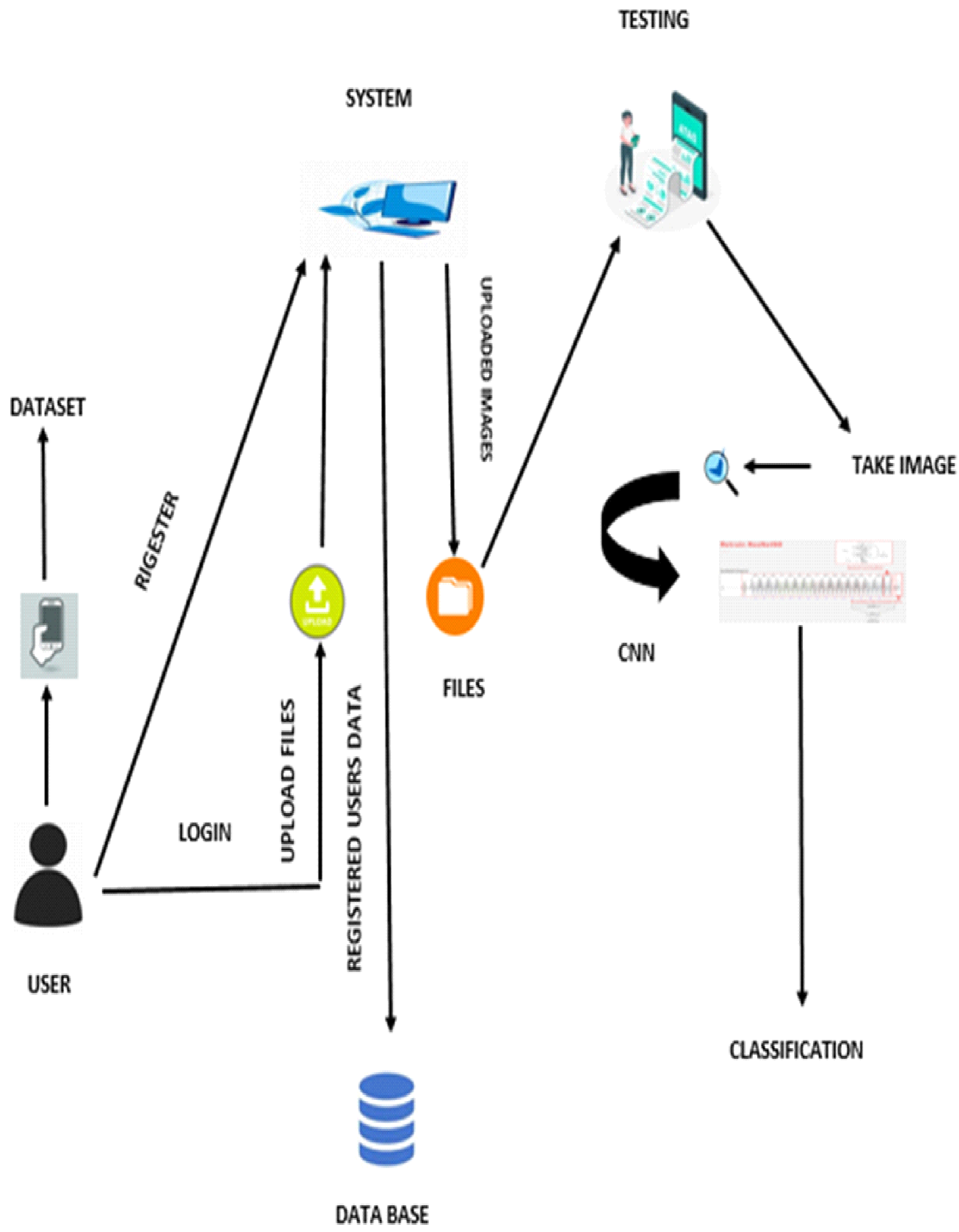


Fig3.4. Architecture

3.5 MODULES

3.5.1. System:

- **Create Dataset:**
  The training and testing datasets, each with a test size of 30–20%, are created from the dataset of images that need to be categorised.
- **Pre-processing:**
  We resize and reshape the images to the required format for training our model.
- **Training:**
  The CNN technique is used to train our model using the pre-processed training dataset.

3.5.2. User:

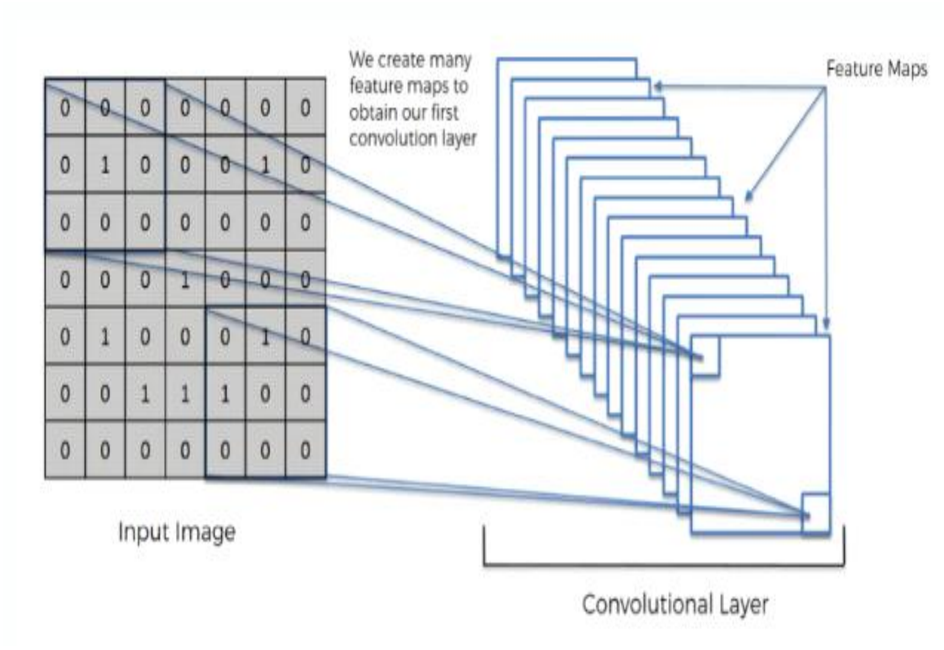
- **Register**
  To access the system, users are required to register, and their data is stored in a MySQL database.
- **Login**
  An authorized user can log in to the website using valid credentials to access and utilize the application.
- **About-Project**
  In this application, we have successfully created an application which takes to classify the given images.
- **Upload Image**
  The user is required to upload an image for classification.
- **Prediction**
  The output of our model is presented as the classification of either a healthy forest or deforestation.
- **Logout**
  After the classification process is complete, the user can log out from the application.

3.6 ALGORITHM

3.6.1. Convolutional Neural Network (CNN)

Step 1: Convolution Operations

The first step in our approach involves performing the convolution operation. In this stage, we employ feature detectors as filters within the neural network. Furthermore, we investigate feature maps, the parameter learning process for these maps, pattern detection, the layers responsible for detection, and the mapping of the identified features.



The Convolution Operation

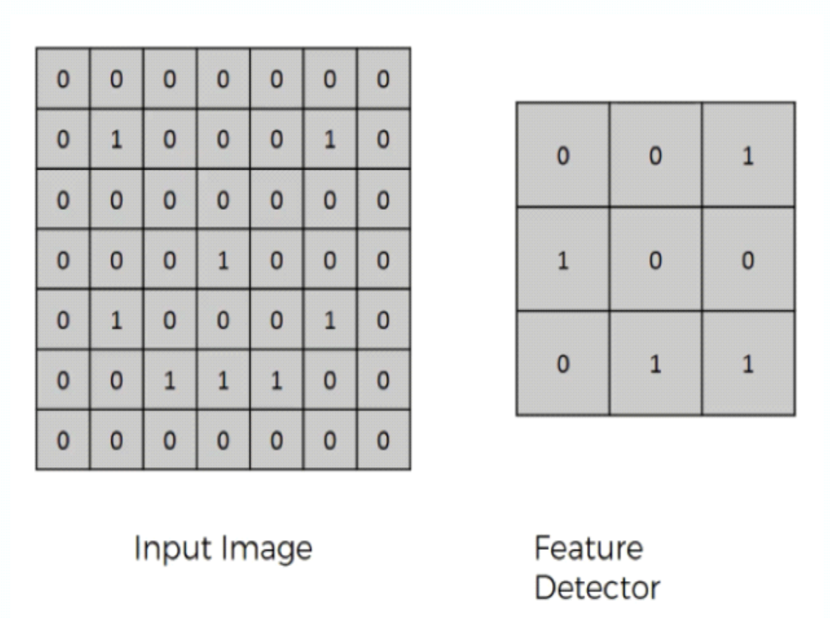


Fig3.6.1 CNN layers

Step1: ReLU Layer

The subsequent phase of this step entails the utilization of the Rectified Linear Unit (ReLU). We explore ReLU layers and analyze the significance of linearity in Convolutional Neural Networks (CNNs).

Convolutional Neural Networks Scan Images

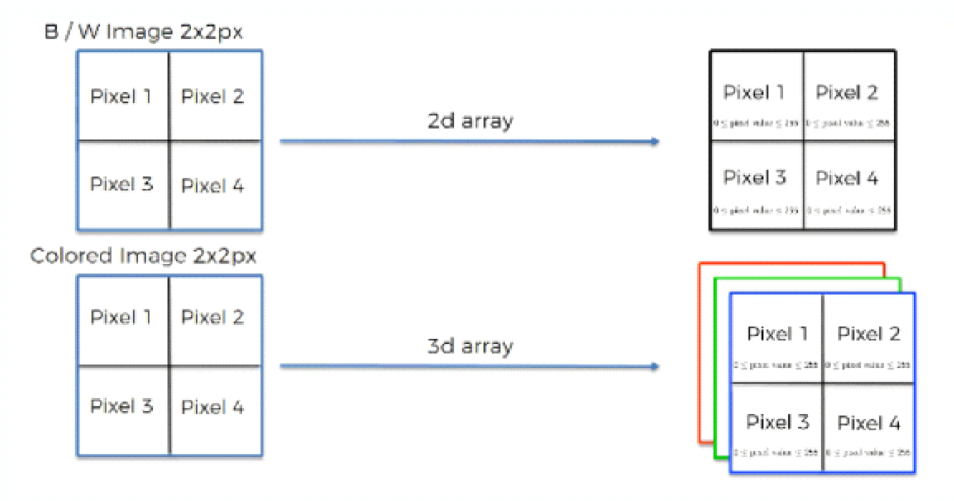


Fig3.6.2. Convolutional neural network scan images

Step 2: Pooling Layer

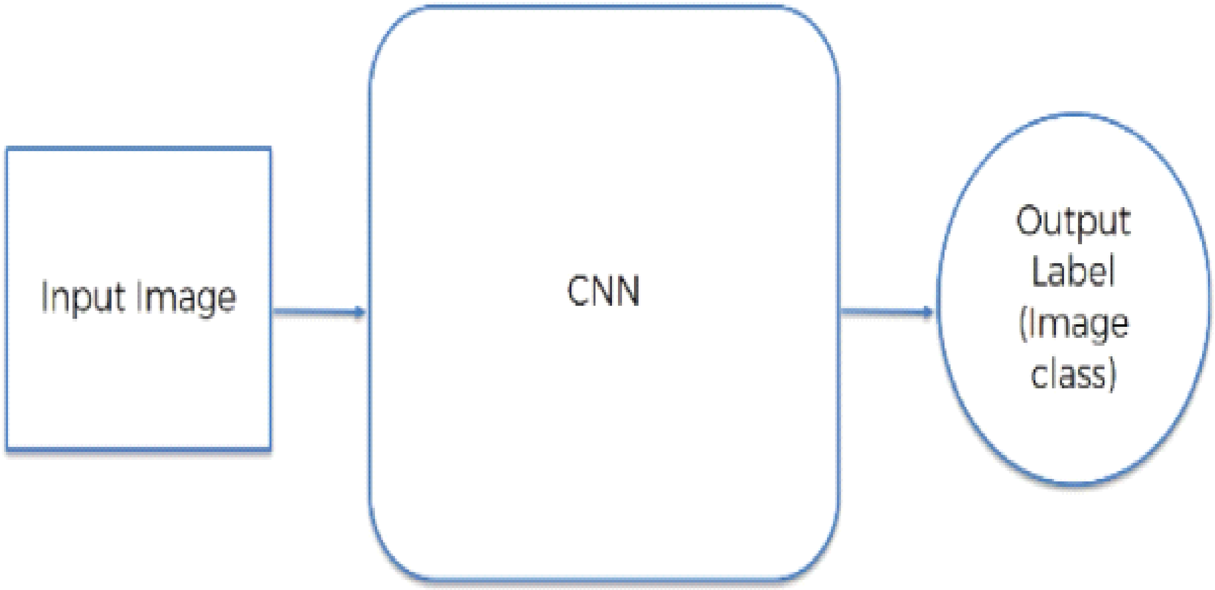
In this section, we have discussed pooling and gained a comprehensive understanding of its functioning. However, our focus here has been on a particular type of pooling known as max pooling. We have also explored alternative pooling techniques such as mean (or sum) pooling. To provide a clearer understanding of the concept, we have included a demonstration using a visual interactive tool.

Step 3: Flattening

In this stage, we'll give a brief overview of the flattening process and how convolutional neural networks (CNNs) go from having pooling layers to having flattened layers.

Step 4: Full Connection

In this section, by incorporating all the concepts discussed in this section, we aim to provide you with a comprehensive understanding of the functioning of Convolutional Neural Networks and how the "neurons" within these networks learn to classify images. This comprehensive approach will enhance your visualization of the entire process.



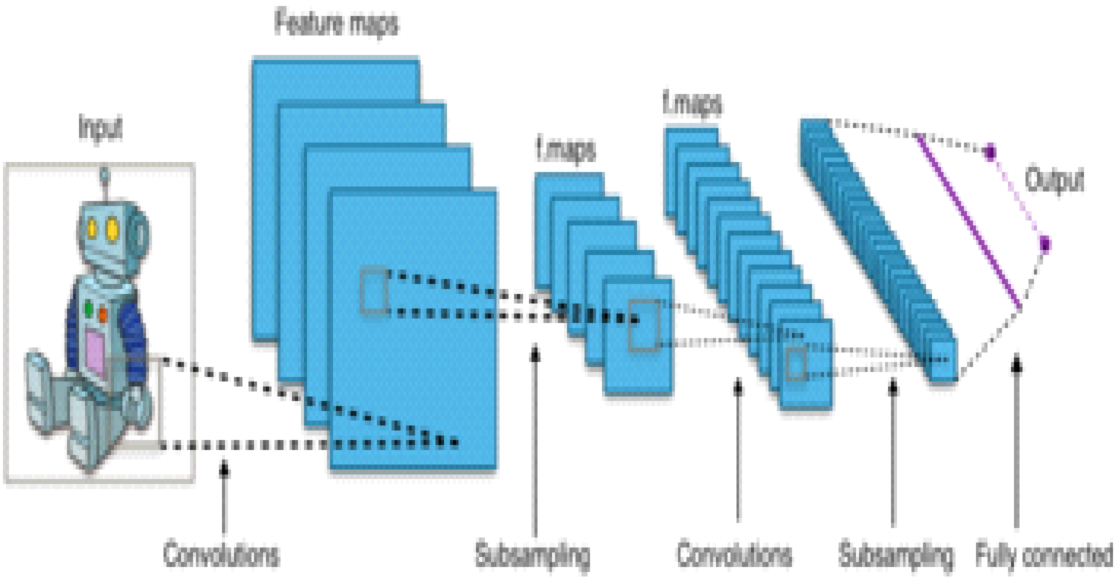


Fig 3.6.3. CNN Architecture

3.7 STEPS FOR EXECUTING THE PROJECTS

- Package Installation
- Custom Model Definition
- Dataset Loading
- Dataset Pre-processing
- Custom Model Training
- Training the Pretrained Model with Our Dataset using CNN
- Classification Execution
- Development of a Flask-Based User Interface

3.8 SYSTEM DESIGN

3.8.1 UML Diagrams: Unified Modelling Language (UML), also known as standardised modelling language, is widely used in the area of object-oriented software engineering. The Object Management Group (OMG) is responsible for its creation and management. The primary aim of UML is to establish a shared language for modeling object-oriented computer software. It comprises two key elements: a Meta-model, which defines UML's concepts and rules, and a notation, which offers graphical symbols and diagrams to represent software models. In the future, UML might also incorporate a method or process to enhance its capabilities. UML serves as a robust tool for specifying, visualizing, constructing, and documenting software artifacts, as well as modeling non-software systems within business contexts. It encompasses a set of well-established engineering practices that prove effective in handling large and intricate systems. The successful creation of object-oriented software depends on the integration of UML into the software development process since it makes use of graphical notations to depict the design of software projects..

3.8.2 Goals: The UML design encompasses various primary goals:

The aim is to provide users with an accessible and expressive visual modeling language that allows for the creation and sharing of significant models.

- To enable the extension and specialization of core concepts by providing mechanisms for flexibility and customization.
- To ensure flexibility and compatibility by not being reliant on specific programming languages or development processes.
- To enhance the clarity and precision of the modeling language by establishing a formal foundation for better understanding.
- To encourage the innovation and availability of supporting resources, fostering the expansion of the market for object-oriented tools.
- To enable the integration of more complex software architectures and promote the use of advanced development concepts like collaborations, frameworks, patterns, and components.

- To incorporate established approaches and methodologies from the industry into the UML framework, integrating best practices.

3.9 DIAGRAMS

3.9.1 Use Case Diagram:

In the Unified Modelling Language (UML), a use case diagram is a graphic depiction of a system's functionality that results from a use-case study. By outlining the actors, their objectives (expressed as use cases), and the connections between these use cases, it seeks to give a thorough picture of the system's capabilities. A use case diagram allows for the representation of the roles played by actors inside the system while also serving as a means of illustrating the system functions connected to each nodes.

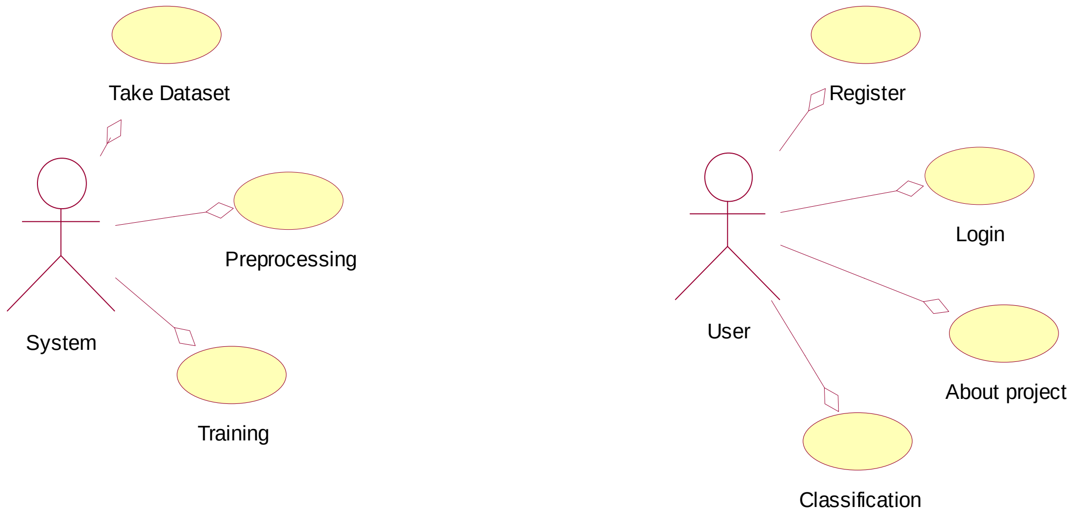


Fig3.9.1 Block diagram of use case

3.9.2 Class diagram

A class diagram in the Unified Modelling Language (UML) is a graphical representation that demonstrates the static structure of a system in the field of software engineering. It offers a high-level overview of the system's structure by showing the classes, their properties, operations, and connections among them. A class diagram's main use is to visually represent how data is organised and how classes are related to one another.

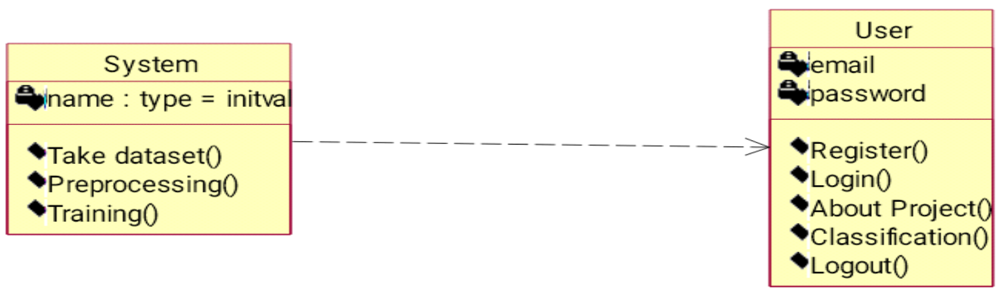


Fig3.9.2 Class diagram

3.9.3 Sequence diagram

A sequence diagram is an interaction diagram that shows the sequential flow and ordering of actions within a system in the context of the Unified Modelling Language (UML). Sequence diagrams offer a graphical depiction of the communication flow among various entities. They are alternatively referred to as event diagrams, event scenarios, or time diagrams, as they capture the chronological order of events and the exchange of messages between components.

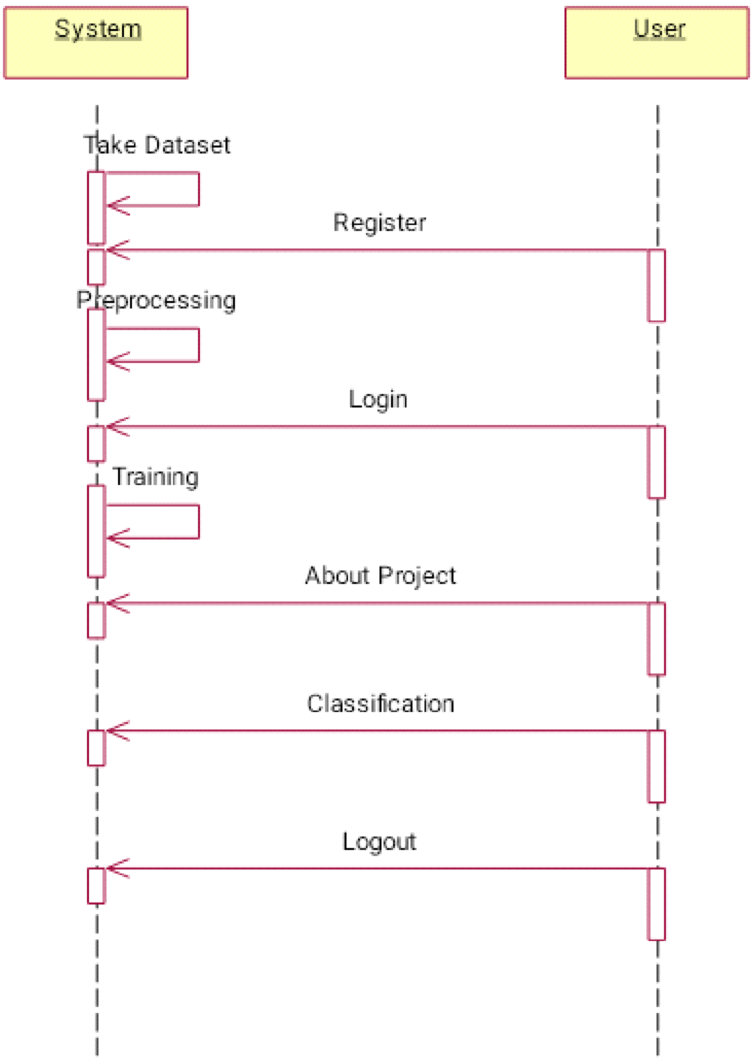


Fig3.9.3 Sequence diagram

3.9.4 Collaboration diagram

A cooperation diagram uses a numbering mechanism to depict the order of method invocations and the sequence of method calls. In this particular case, an order management system is employed as an example to demonstrate the collaboration diagram. The method calls in a collaboration diagram resemble those in a sequence diagram, with the distinction lying in the focus of the collaboration diagram on presenting the organization and connections between objects, while the sequence diagram primarily emphasizes the sequence of message exchanges among objects.

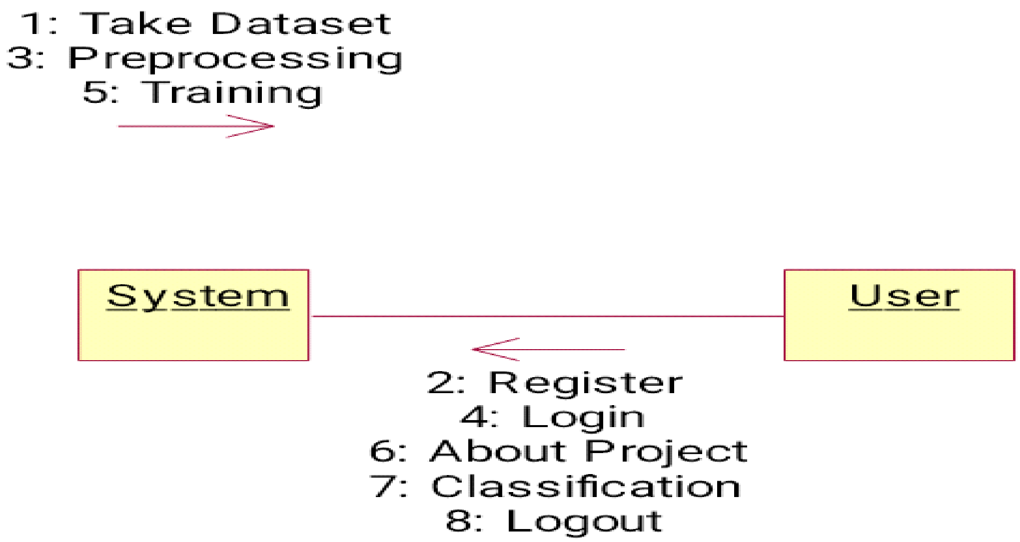


Fig3.9.4 Collaboration diagram

3.9.5 Deployment diagram

The component diagram and the deployment diagram are closely related since they both indicate how components are deployed. The deployment diagram offers a visual depiction of the system's deployment view. Nodes in this figure reflect the actual hardware used to deploy the application. These nodes can be regarded as the tangible entities or machines that host the system's components.

Fig3.9.5 Deployment Diagram

3.9.6 Activity Diagram

Activity diagrams in the Unified Modelling Language (UML) are visual representations of workflows that illustrate a series of sequential activities and actions. They encompass various elements such as decision-making, repetition, and parallelism, and are commonly used to depict the operational and business workflows of system components.. Their primary objective is to provide a comprehensive understanding of the control flow within the system.

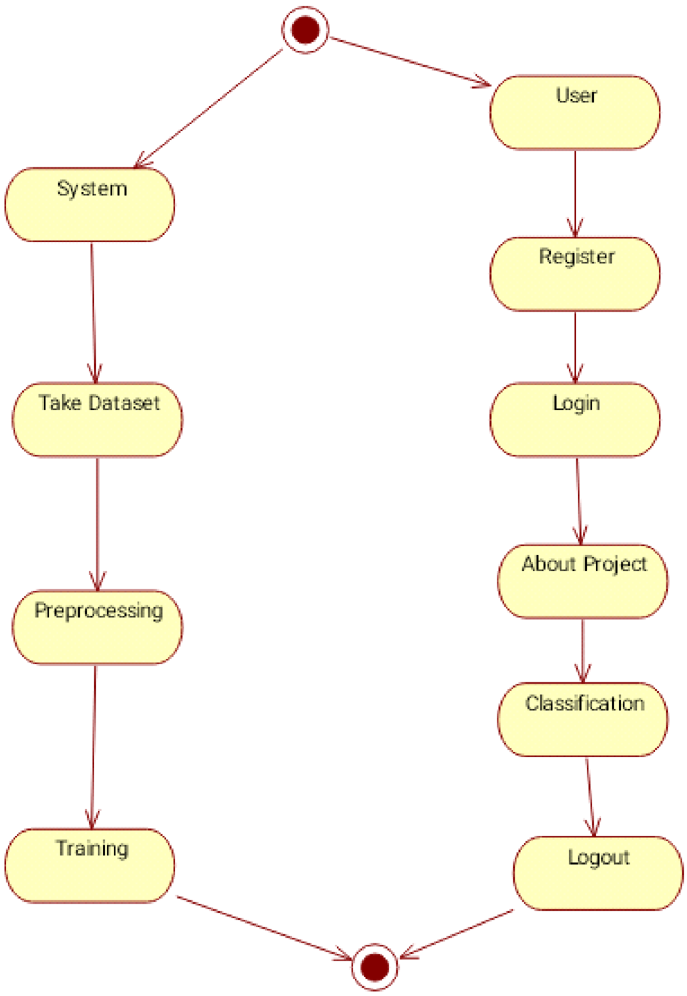


Fig3.9.6 Activity diagram

3.9.7 Component diagram

A UML component diagram is a visual representation in the Unified Modeling Language (UML) that depicts the arrangement and interconnections of physical components in a system.These diagrams are frequently used to portray implementation specifics and ensure the inclusion of all essential system functionalities in the planned development phase. They visually depict the structure and associations among the physical components of the system.

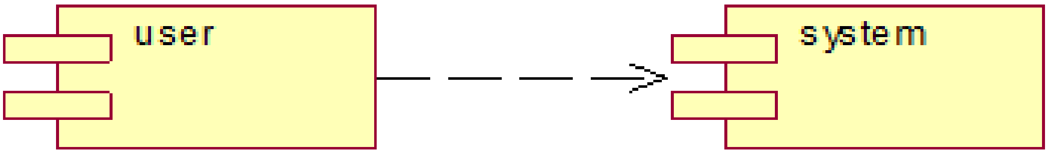


Fig3.9.7 Component diagram

3.9.8 ER Diagram

An Entity Relationship Diagram (ER Diagram) is used by an ER model, sometimes referred to as an Entity-Relationship model, to show how a database is structured. It serves as a layout or design guide for a database that can be put into use at a later time. Entity sets and relationship sets are an ER model's core components.

An ER diagram visually represents the associations between entity sets. An entity set refers to a group of similar entities, each of which may possess attributes. In the context of a database management system (DBMS), an entity corresponds to a table or a table attribute within the database. Therefore, by depicting the relationships between tables and their attributes, an ER diagram offers a comprehensive depiction of the logical structure of the database.

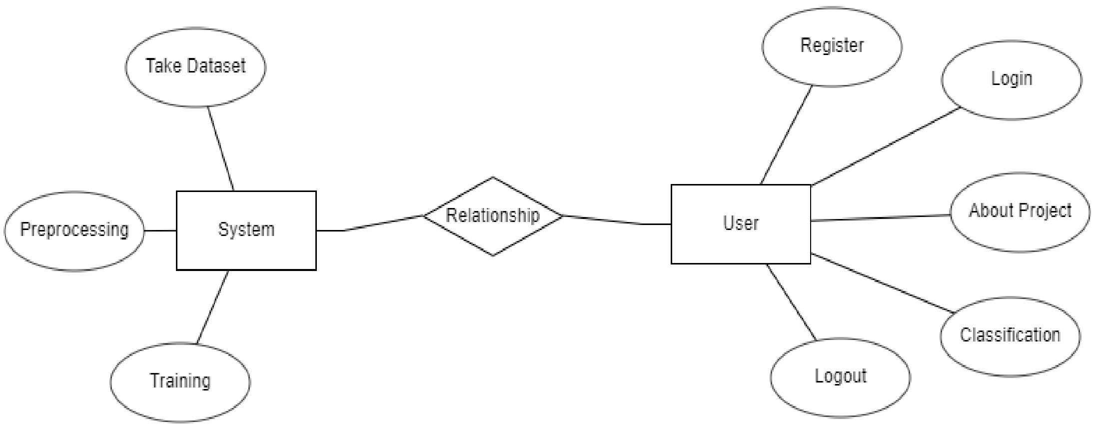


Fig3.9.8 ER diagram

3.9.9 Data Flow Diagram (DFD)

The typical method for visualising the information flow within a system is a data flow diagram. A well-organized and concise DFD can effectively represent a significant portion of the system's requirements in a graphical format. The creation of a DFD can be done manually, automated, or by combining both approaches. It illustrates how information enters and exits the system, identifies processes that modify the information, and indicates where the information is stored. The main objective of a DFD is to demonstrate the overall extent and boundaries of a system. It serves as a communication tool between a systems analyst and stakeholders involved in the system, and it acts as a starting point for system redesign efforts.

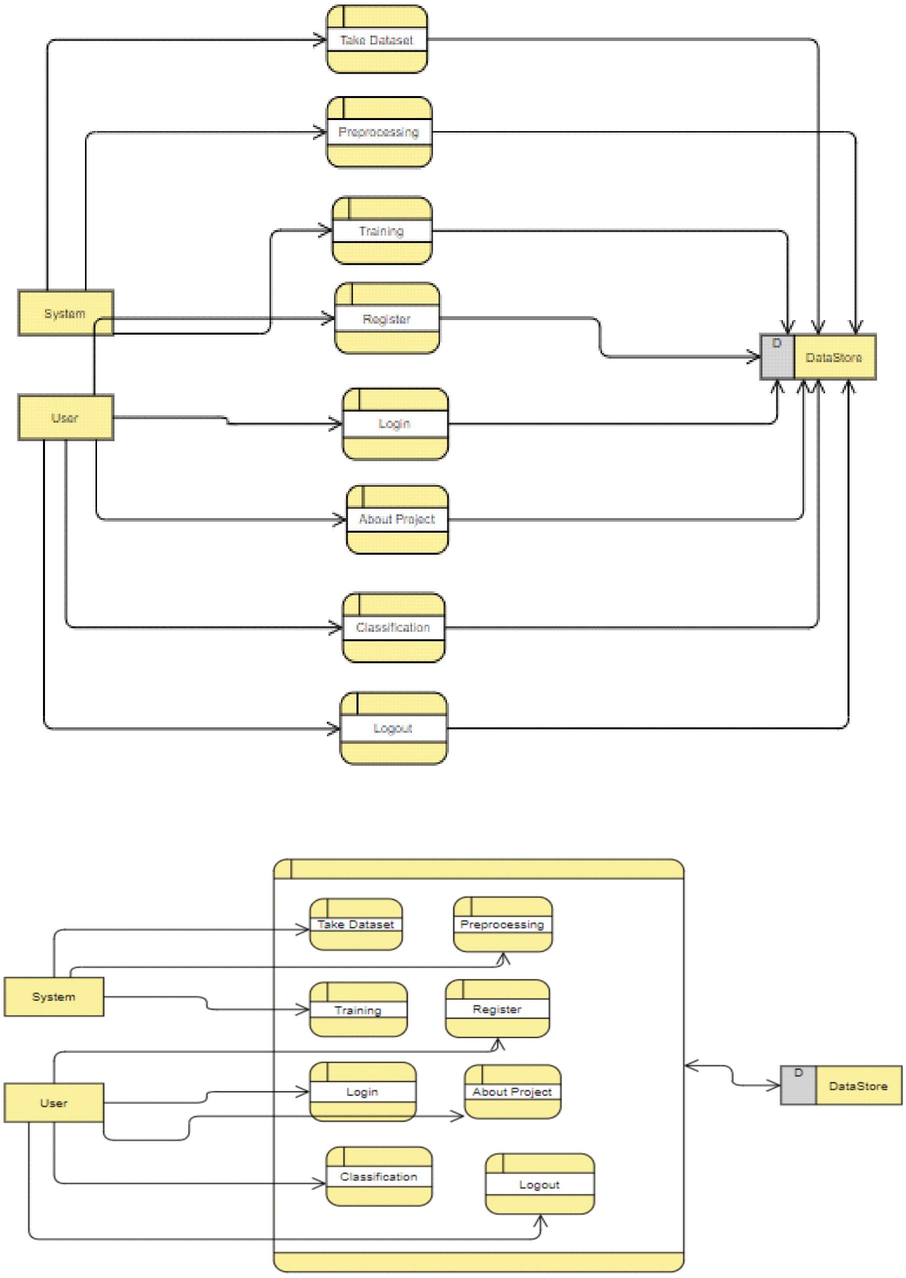


Fig3.9.9 DFD diagram

CHAPTER 4
RESULTS

4.1 Home page

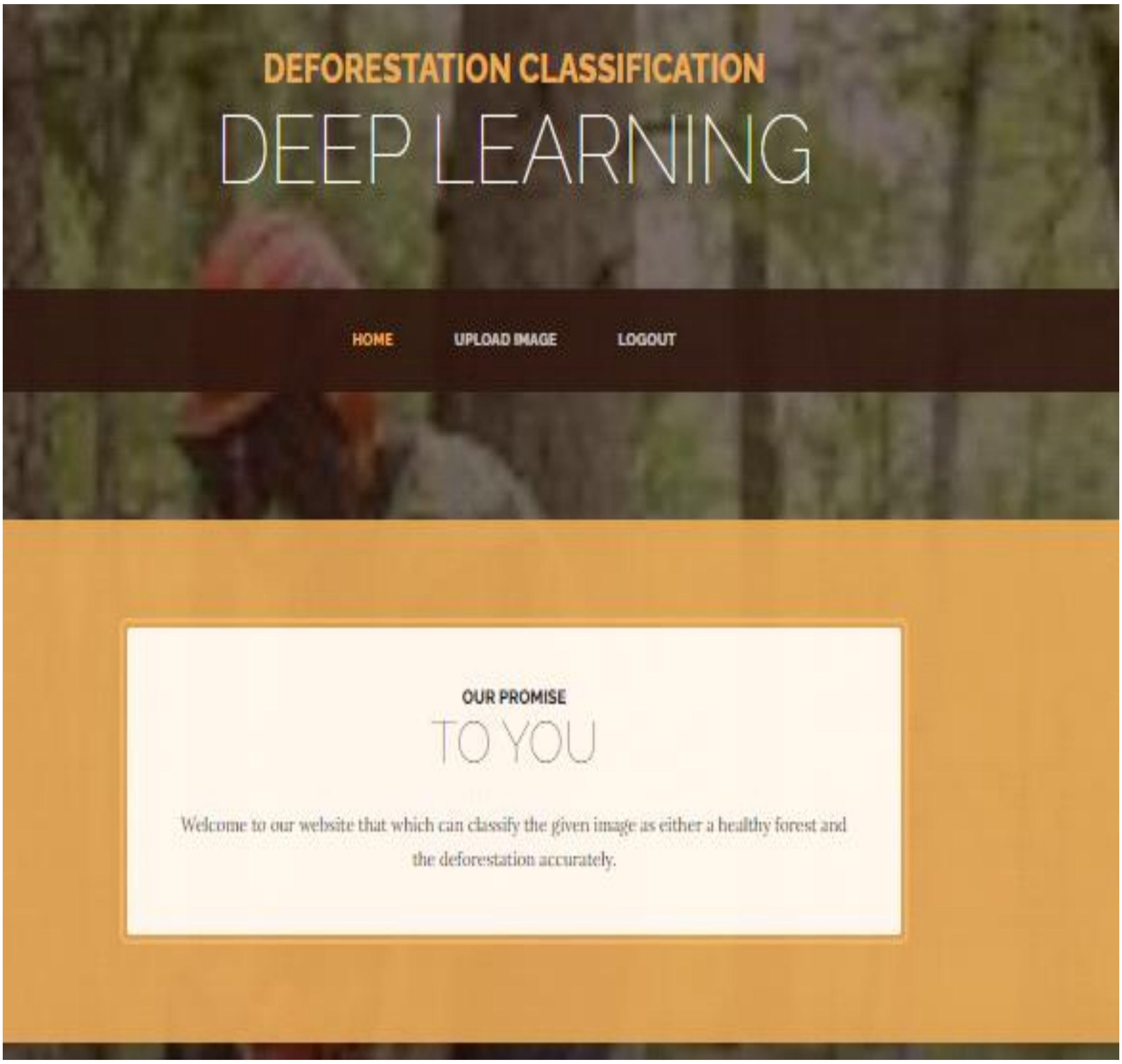


Fig4.1 Home page

4.2 About project

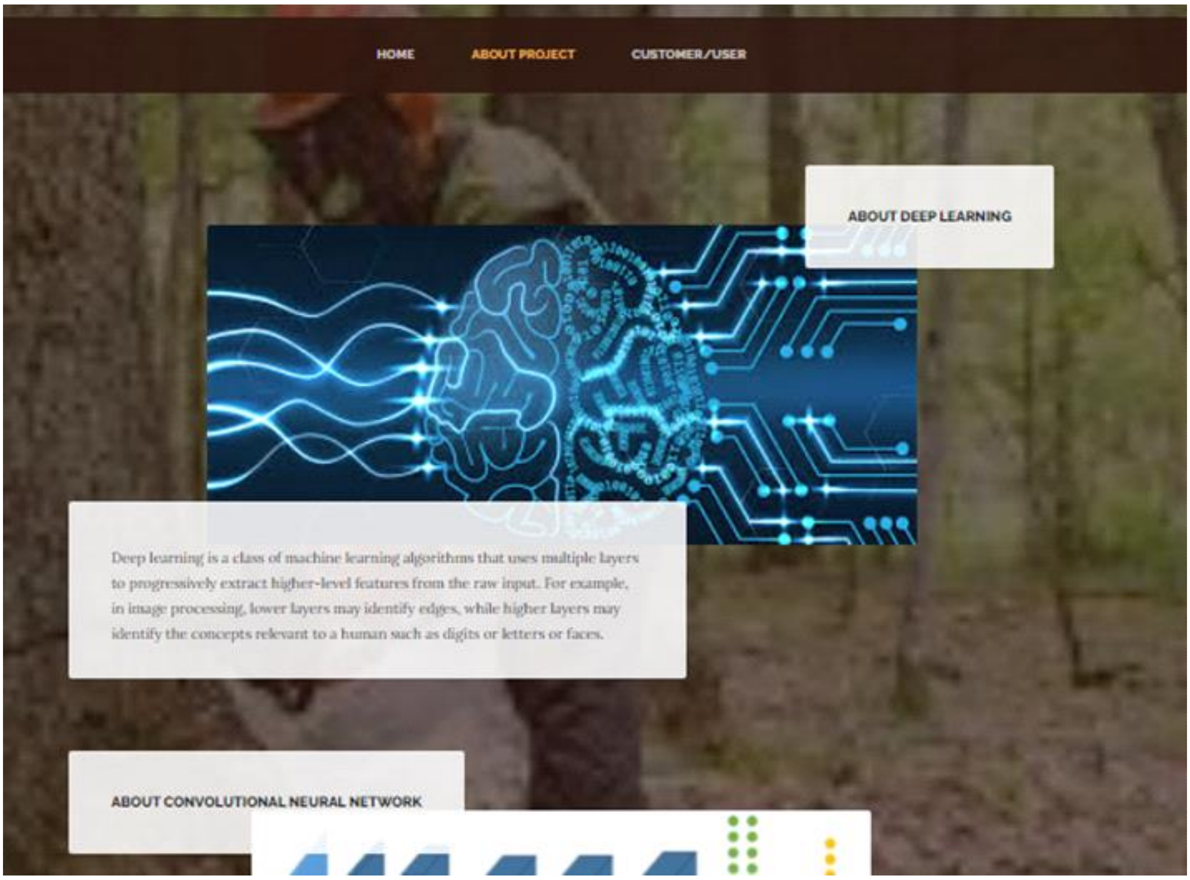


Fig4.1 About

4.3 Login page

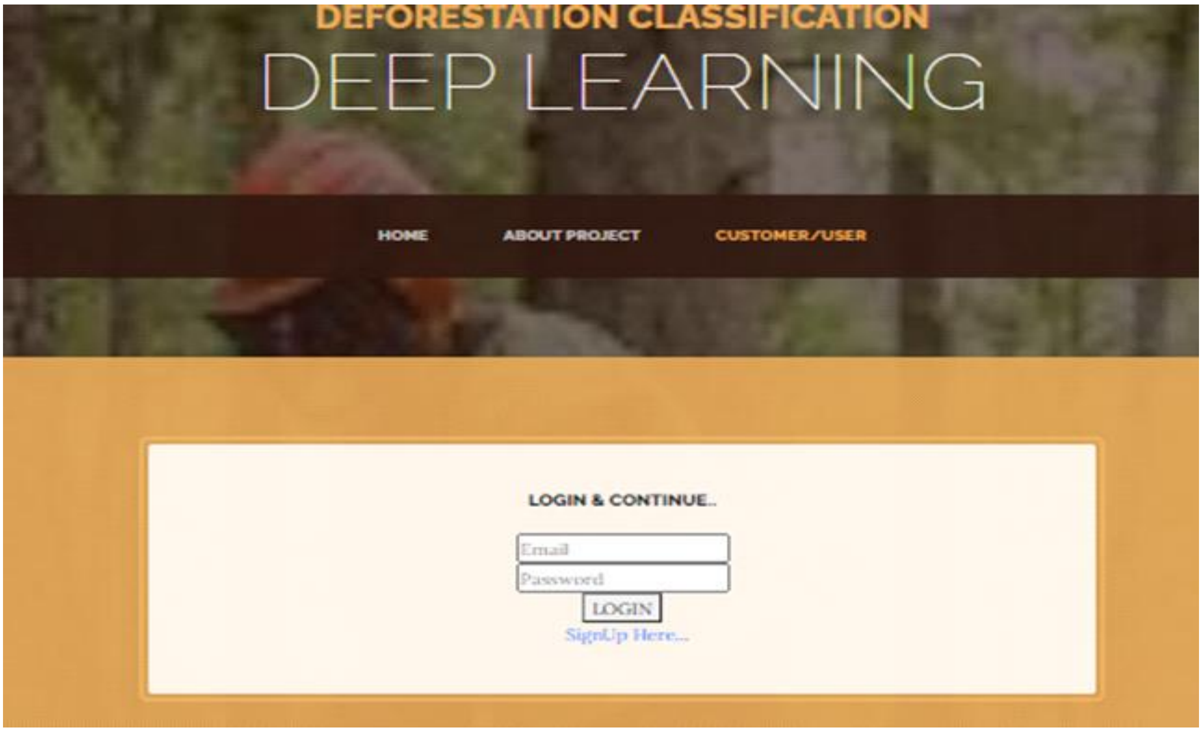


Fig4.3 Login Page

4.4 Image Uploading

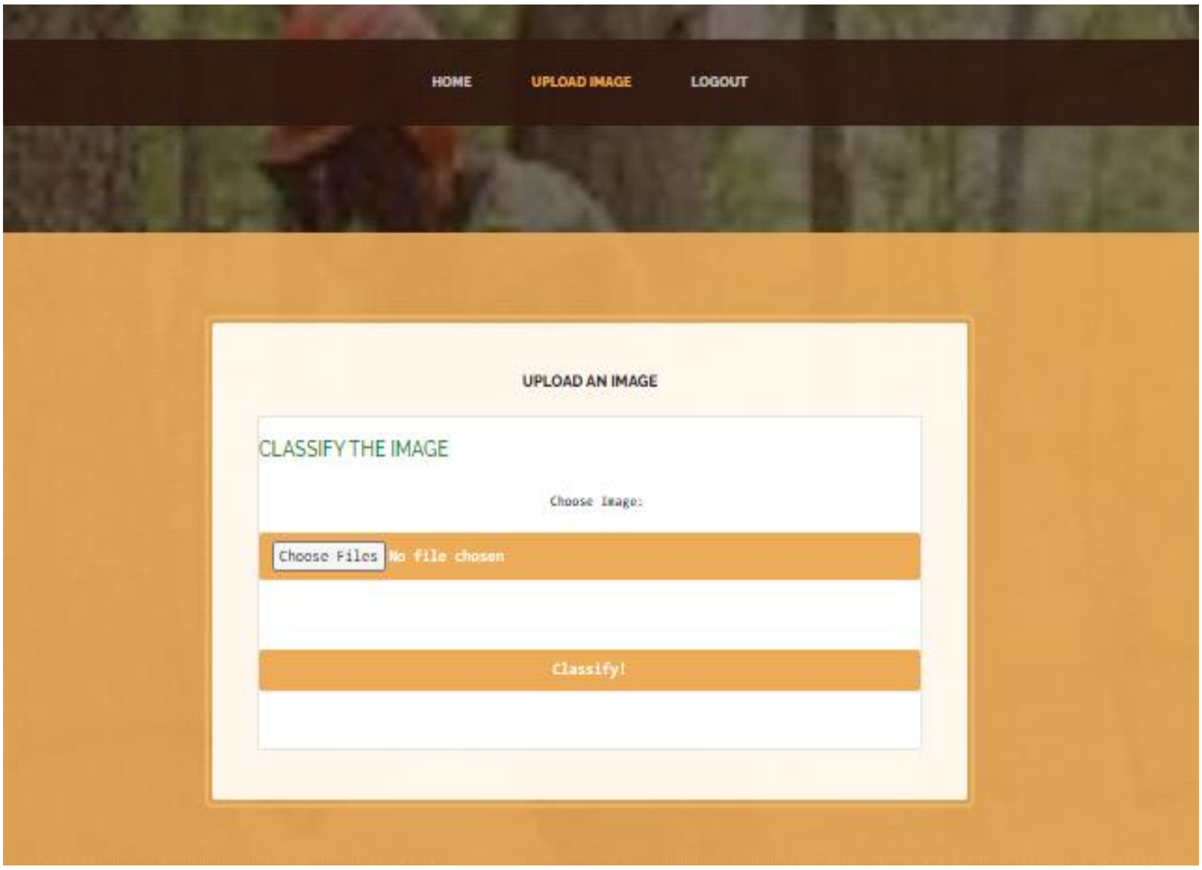


Fig4.4 Image Uploading

4.5 Classified image as Forest

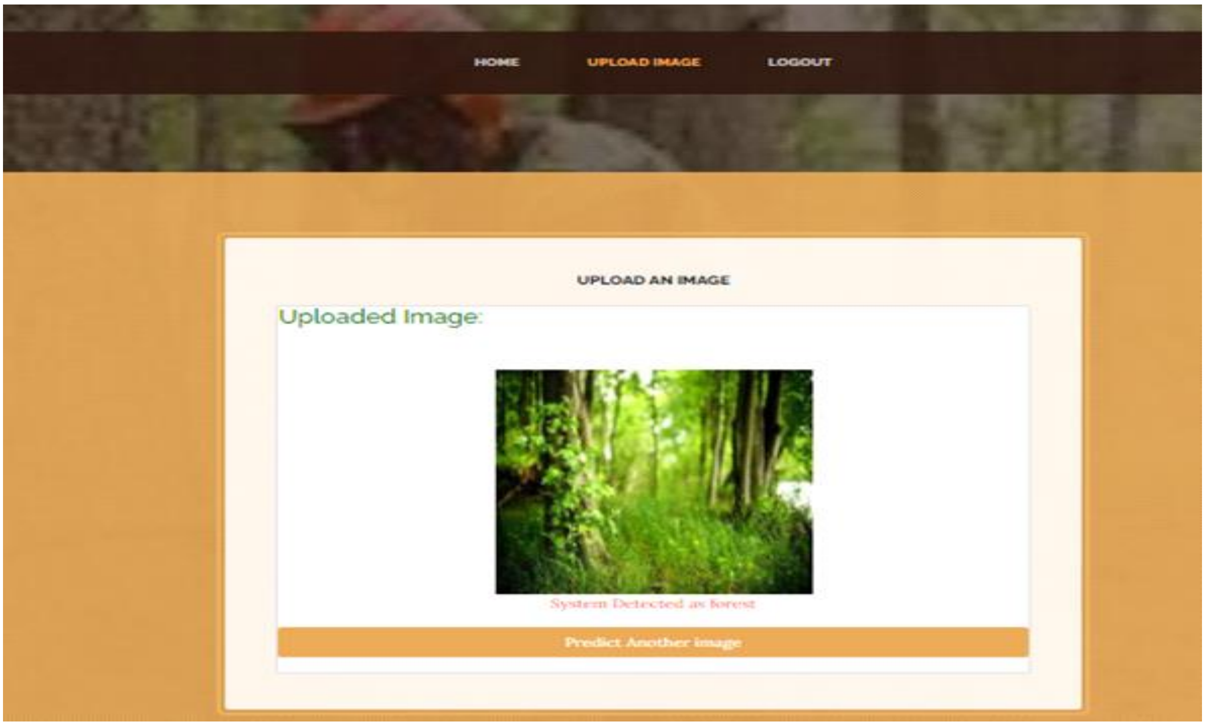


Fig4.5 Classified image as Forest

4.6 Classified image as Deforestation

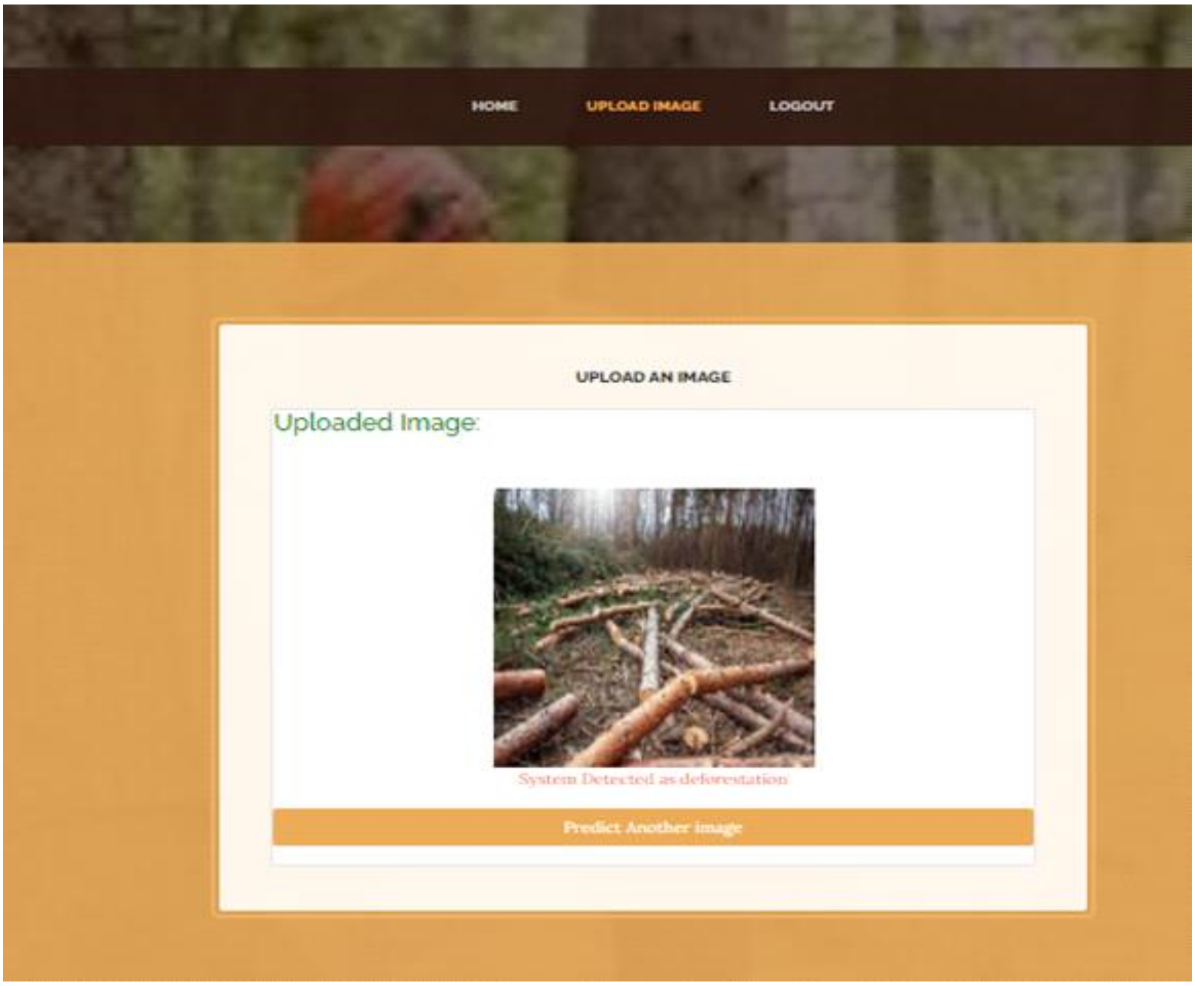


Fig4.6 classified as Deforestation

CHAPTER 5

CONCLUSION AND FUTURE WORK

5.1 CONCLUSION

In our undertaking, we have achieved successful classification of images into two categories: healthy forest and deforested areas, using convolutional neural network (CNN) in deep learning. The dataset consisted of images belonging to these two classes, where one class represented non-deforested areas and the other represented deforested areas. We trained the CNN model using this dataset. Following the training phase, we conducted tests by uploading images and classifying them accordingly.

5.2 FUTURE WORK

Going forward, this approach can be applied to various types of image classification and retrieval tasks, enabling accurate and reliable results. The method we have developed can be utilized for a wide range of applications where precise classification is required.

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