IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.53

Volume 4, Issue 6, May 2024

Plant Leaf Disease Detection and Suggesting Medication using Image Processing and Convolutional Neural Network Techniques

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Abstract: *In day-to-day life many factors that affect plants. Many problems are occurring at a rapid pace and new diseases are rapidly being identified. In today's world of pollution and soil quality, disease detection is essential and its supplement is required to protect the plants. The main motivation of doing this project is to present a disease prediction model for the prediction of occurrence of plant crop disease. Further, this research work is aimed towards identifying the best classification algorithm for identifying the possibility of disease in plants.*

The identification of the possibility of disease in plants is complicated task for practitioners because it requires years of experience and intense tests to be conducted. The main objective of this significant research work is to identify the best classification algorithms suitable for providing maximum accuracy when classification of normal and abnormal plants is carried out.

Convolutional neural network (CNN) architecture is used to map the relationship between the indoor PM and weather data to the found values. The proposed method is compared with the state-of-the-art deep neural network (DNN) based techniques in terms of the root mean square and mean absolute error accuracy measures. The applied CNN classification helps to predict the heart disease with more accuracy in the new data set. The coding language used is Python 3.10..

Keywords: Diseases, Machine Learning, Image Processing, Convolutional neural network, Deep Learning, Medication.

I. INTRODUCTION

Plant disease, an impairment of the normal state of a plant that interrupts or modifies its vital functions. All species of plants, wild and cultivated alike, are subject to disease. Although each species is susceptible to characteristic diseases, these are, in each case, relatively few in number. The occurrence and prevalence of plant diseases vary from season to season, depending on the presence of the pathogen, environmental conditions, and the crops and varieties grown. Some plant varieties are particularly subject to outbreaks of diseases while others are more resistant to them.

1.1 RESEARCH OBJECTIVE

- Identification of safe or risk category of disease in plants.
- Feature reduction of data set for convolutional neural network.
- To consider CNN Classification so that prediction in the given new test data is possible.
- To classification the thirty-nine types of plants using CNN

Pathogenesis is the stage of disease in which the pathogen is in intimate association with living host tissue. Three fairly distinct stages are involved:

Inoculation: transfer of the pathogen to the infection court, or area in which invasion of the plant occurs (the infection court may be the unbroken plant surface, a variety of wounds, or natural openings—e.g., stomata [microscopic pores in leaf surfaces], hydathodes [stomata-like openings that secrete water], or lenticels [small openings in tree bark])

Incubation: the period of time between the arrival of the pathogen in the infection court and the appearance of symptoms. Infection: the appearance of disease symptoms accompanied by the establishment and spread of the pathogen.

II. LITERATURE REVIEW

Obtaining Disease resistant plants

https://www.britannica.com/science/plant-disease/Obtaining-disease-resistant-plants

The techniques of genetic engineering can be used to manipulate the genetic material of a cell in order to produce a new characteristic in an organism. Genes from plants, microbes, and animals can be recombined (recombinant DNA) and introduced into the living cells of any of these organisms.

Classification of plant diseases by causal agent

Plant diseases are often classified by their physiological effects or symptoms. Many diseases, however, produce practically identical symptoms and signs but are caused by very different microorganisms or agents, thus requiring completely different control methods. Classification according to symptoms is also inadequate because a causal agent may induce several different symptoms, even on the same plant organ, which often intergrade. Classification may be according to the species of plant affected. Host indexes (lists of diseases known to occur on certain hosts in regions, countries, or continents) are valuable in diagnosis. When an apparently new disease is found on a known host, a check into the index for the specific host often leads to identification of the causal agent. It is also possible to classify diseases according to the essential process or function that is adversely affected. The best and most widely used classification of plant diseases is based on the causal agent, such as a noninfectious agent or an infectious agent (i.e., a virus, viroid, mycoplasma, bacterium, fungus, nematode, or parasitic flowering plant).

Diseases caused by viruses and viroids :

https://www.britannica.com/science/plant-disease/Obtaining-disease-resistant-plants

General characteristics

Viruses and viroids are the smallest of the infectious agents. The structurally mature infectious particle is called a virion. Virions range in size from approximately 20 nanometers (0.0000008 inch) to 250–400 nanometers and are of various shapes. Viroids differ from viruses in that they have no structural proteins, such as those that form the protein coat (capsid) of the virus.

Both viruses and viroids are obligate parasites—i.e., they are able to multiply or replicate only within a living cell of a particular host. A single plant species may be susceptible to infection by several different viruses or viroids. Major disease of important food crops such as potato, tomato, wheat, oats, rice, corn, peach, orange, sugar beet, sugarcane, and palm result from viral infection. Diseases are generally most serious in plants that are propagated vegetatively, or asexually—i.e., grown from cuttings, cut divisions, sprouts, and other plant material—rather than grown from seeds (sexually propagated).

Control measures

Control measures for nematodes often include rotation with nonhost plants, growing of resistant varieties and species, use of certified, nematode-free nursery stock, and use of soil fumigants (nematicides) as preplanting or postplanting treatments. Steam or dry heat is applied to soil in confined areas, such as greenhouse benches and ground beds. Exposure to moist heat, such as steam or hot water at 50 °C (120 °F) for 30 minutes, is sufficient to kill most nematodes and nematode eggs. Shorter periods are needed at higher temperatures. State and federal quarantines prohibiting movement of infested soil, plants or plant parts, machinery, and other likely carriers also exist. Cultural practices to promote vigorous plant growth (i.e., watering during droughts, proper application of fertilizers, clean cultivation, fall and summer fallowing, use of heavy organic mulches or cover crops, and plowing out roots of susceptible plants after harvest) are useful for specific nematodes. Asparagus, marigolds (Tagetes species), and Crotalaria species are toxic to many plant-infecting nematodes.

Parasitic seed plants

A number of flowering plants are parasites of other plants. Among the more important ones are mistletoe, dodder, and witchweed

Mistletoe

Mistletoes are semiparasitic seed plants that feed on trees and obtain water and mineral salts by sending rootlike structures (haustoria) into vascular tissue of the inner bark. There are three important types: American (Phorodendron species), European (Viscum album), and dwarf (Arceuthobium species). All produce sticky seeds spread by birds. American mistletoe, restricted to the Americas, is best known for its ornamental and sentimental uses at Christmastime. The leafy, bushy evergreen masses, up to one metre or more in diameter, appear on tree branches. They are most conspicuous after deciduous leaves have fallen. The European mistletoe is similar in habit and appearance to its American relative. Tree branches infected by mistletoes may become stunted or even die

III. SYSTEM SPECIFICATION

HARDWARE REQUIREMENTS

This section gives the details and specification of the hardware on which the system is expected to work.

Processor	:	Intel Dual Core Processor
RAM	:	8 GB SD RAM
Monitor	:	17” Color
Hard disk	:	1 TB
Keyboard	:	Standard102 keys
Mouse	:	Optical mouse

SOFTWARE REQUIREMENTS

This section gives the details of the software that are used for the development.

Operating System	:	Windows 10 Pro
Environment	:	IDLE
Web Technology	:	Flask
Language	:	Python 3.10

Packages

Google Colab is the most widely used Python distribution for data science and comes pre-loaded with all the most popular libraries and tools. Some of the biggest Python libraries included in Anaconda include

- Pandas - It is a fast, powerful, flexible and easy to use open-source data analysis and manipulation tool.
- NumPy - It is the core library for scientific` computing, which contains a powerful N-dimensional array object.
- Matplotlib - Matplotlib is a plotting library for the Python programming language.
- Scikit-learn - Machine learning library for the Python. It has classification, regression and clustering algorithms

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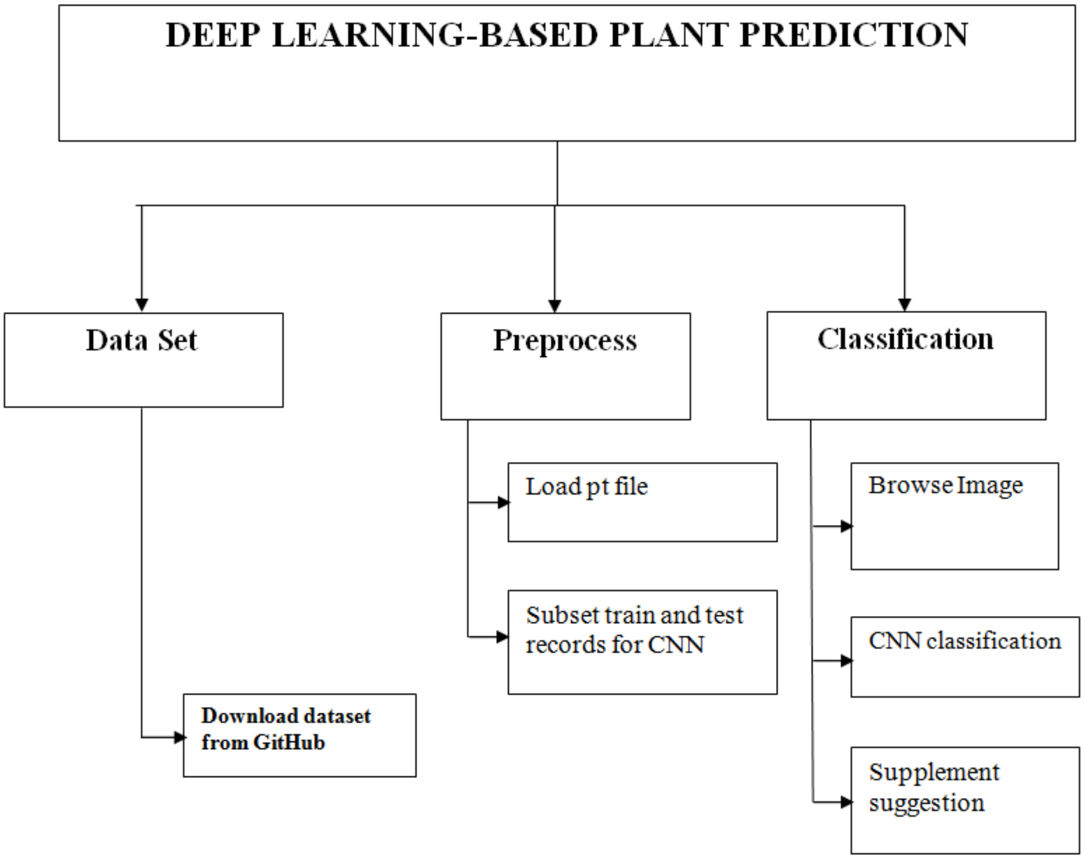
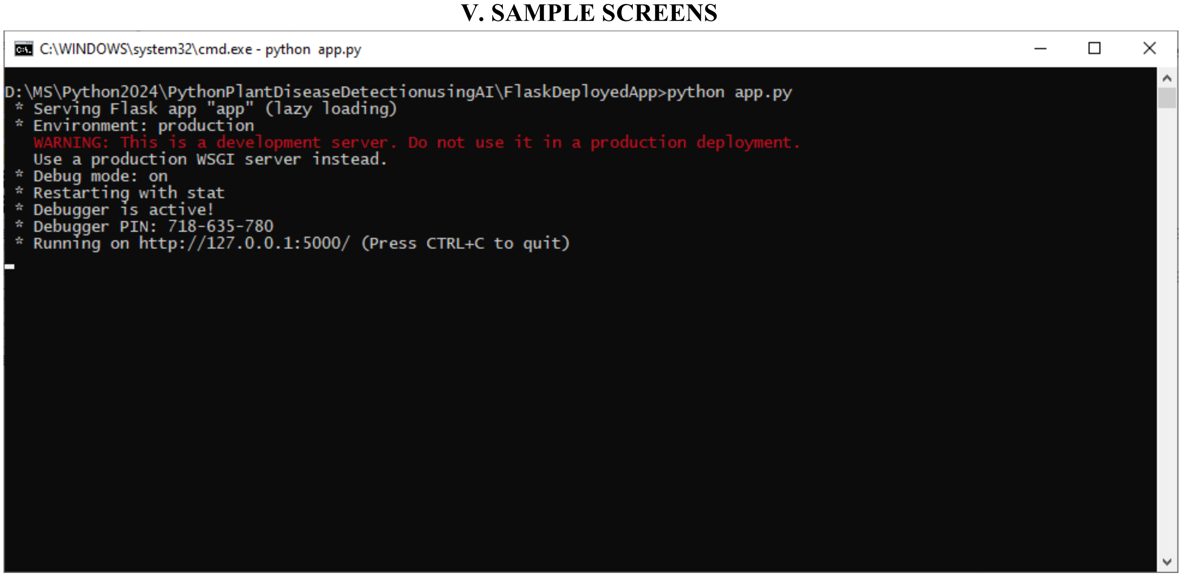
IV. SYSTEM FLOW DIAGRAM



SYSTEM FLOW DIAGRAM

V. SAMPLE SCREENS



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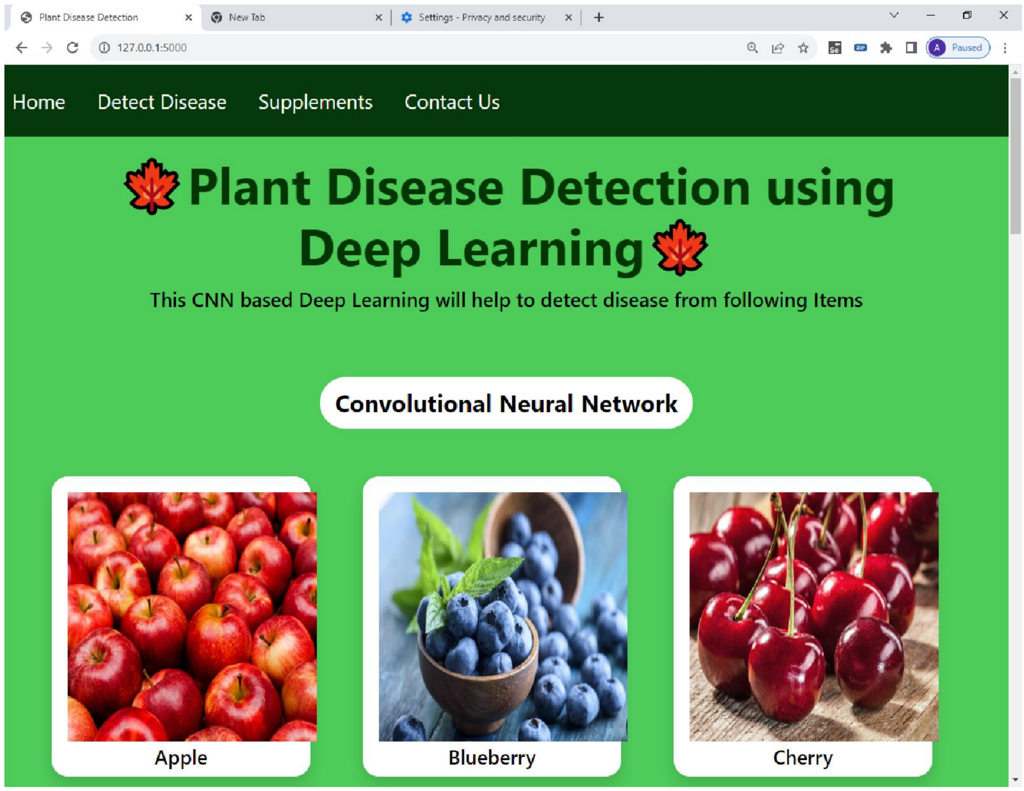
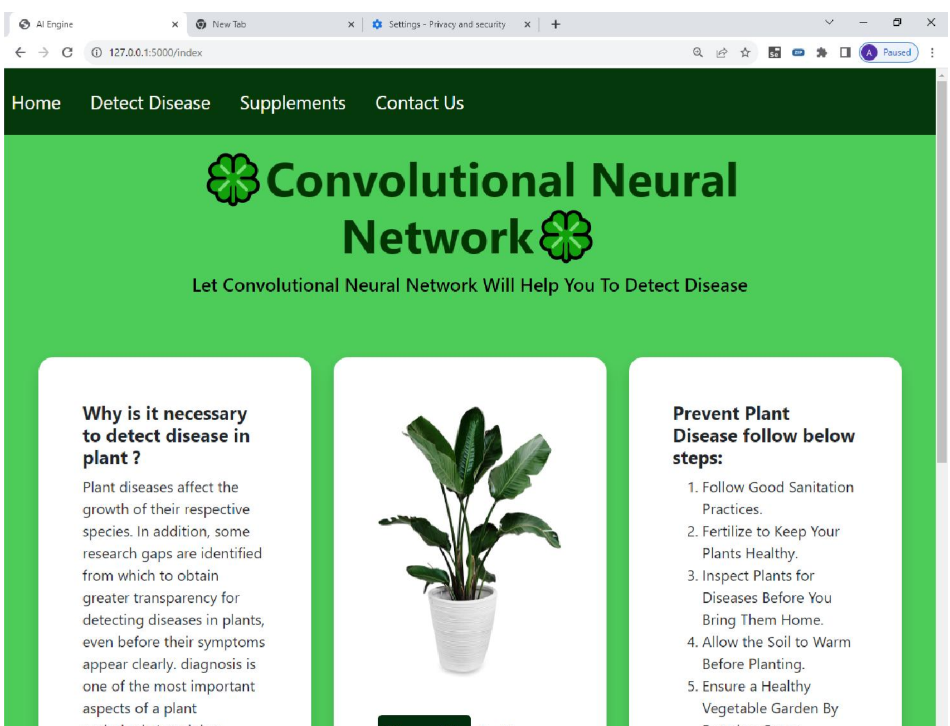
SCREENSHOTS





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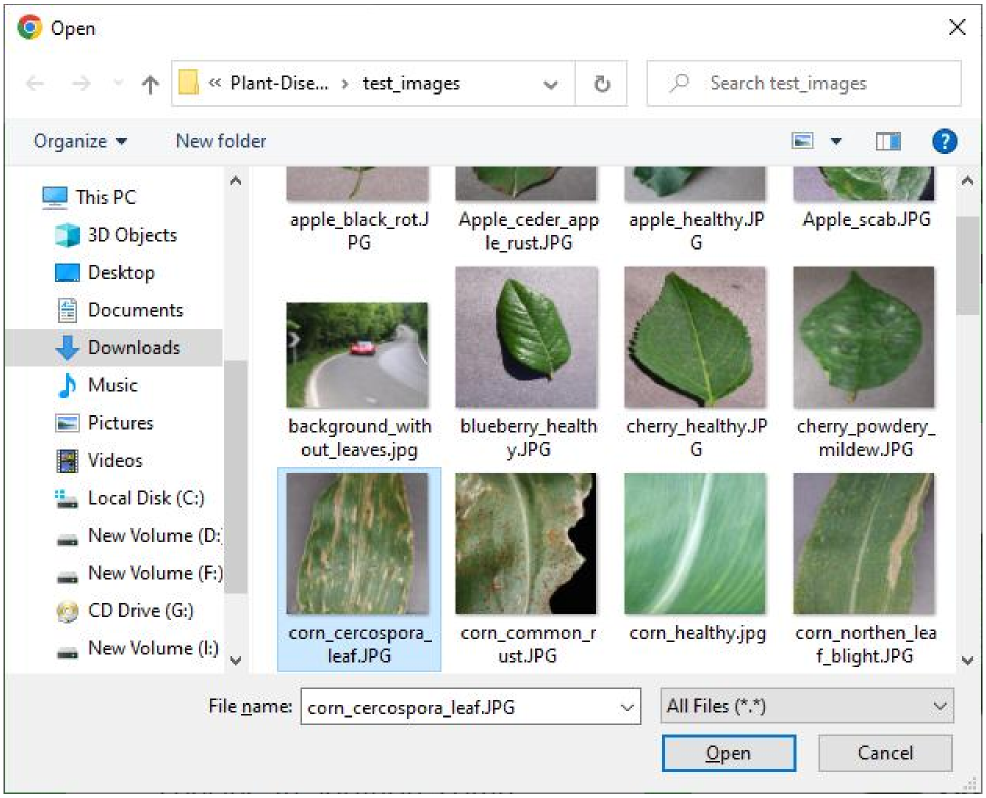

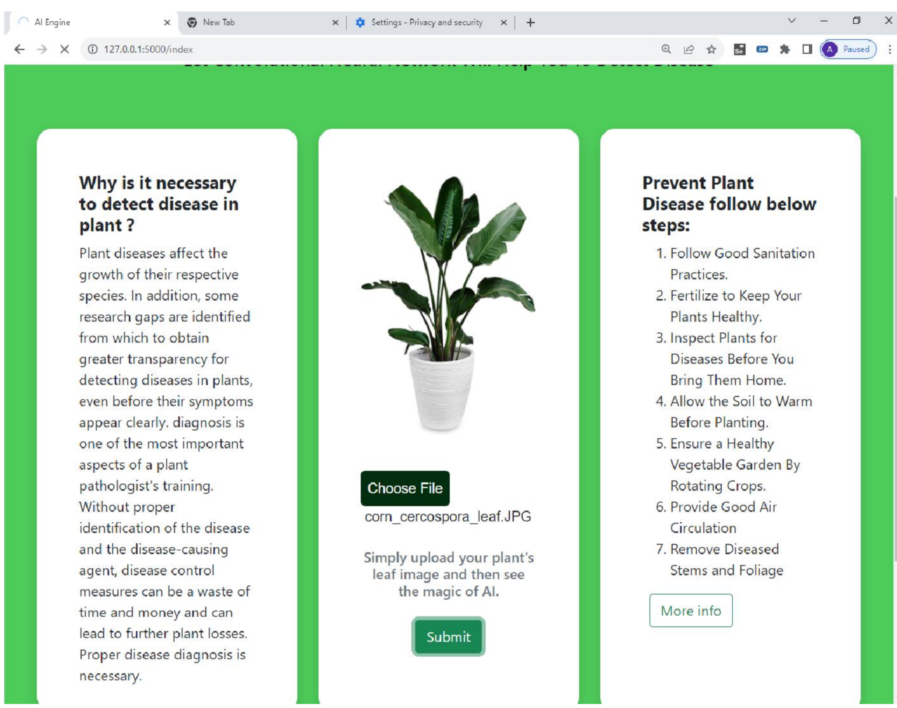

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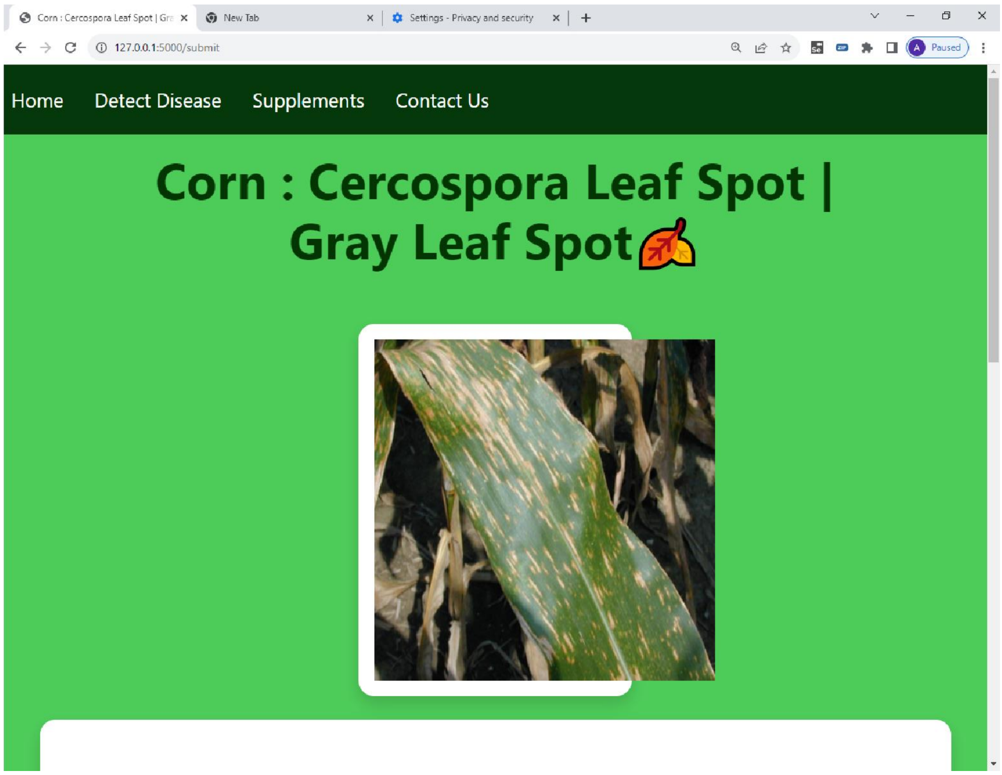

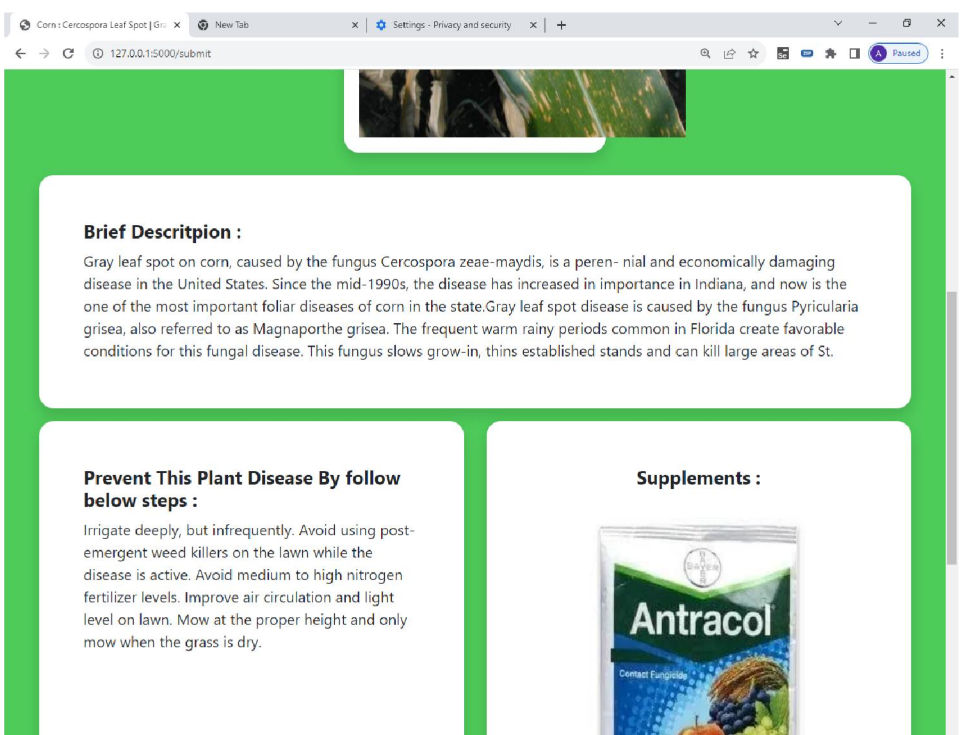

DOI: 10.48175/IJARSCT-18517

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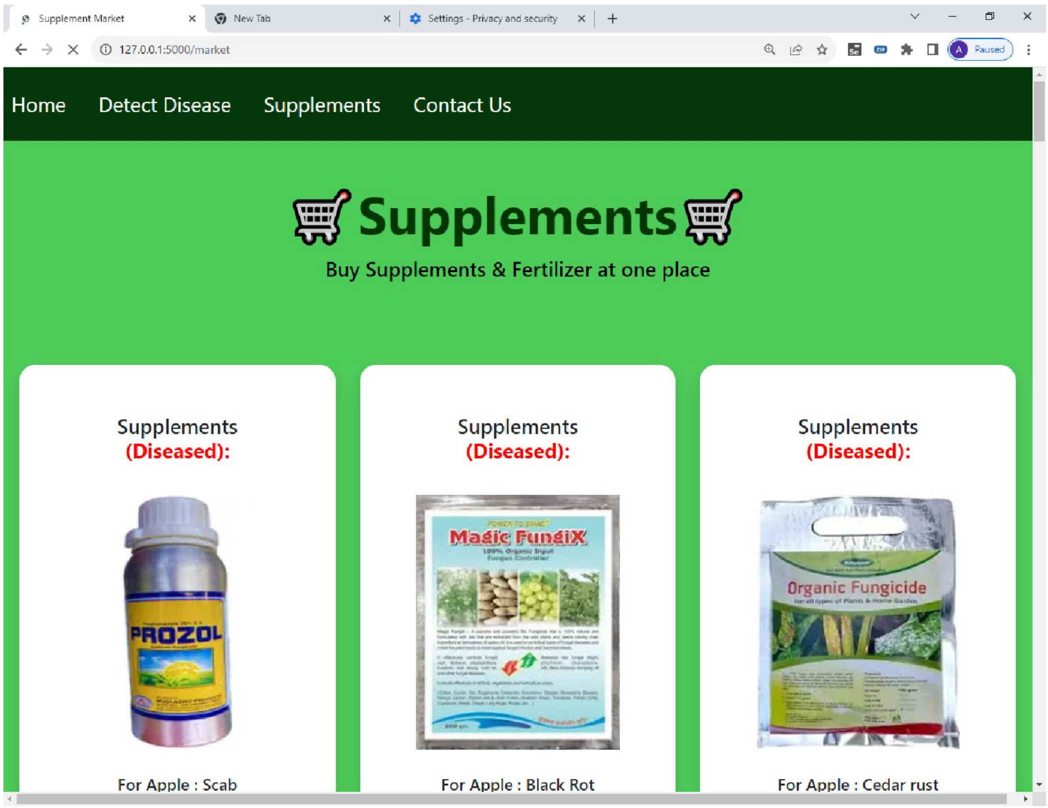

VI. CONCLUSION

The project focuses on CNN classification algorithms to effectively detect disease types. The dataset is taken from github repository. Preprocessed like image resizing is carried out here. Important features are extracted out for better classification. Confusion matrix is prepared with accuracy score calculation. In addition, neural network effectively detect risk types. The dataset is taken and checked against the loaded .pt file for better classification.

Confusion matrix is prepared with accuracy score calculation. Accuracy prediction is also carried out. Convolutional Neural Network based prediction model is worked out to find algorithm efficiency. 80% training records and 20% test records are taken out for convolutional neural network training. There are several directions for future research. The current investigation of classification is still preliminary.

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