LEAF DISEASE DETECTION AND REMEDY SUGGESTION USING CNN

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ABSTRACT—
When pests attack plants and crops, it impacts the country's agricultural output. Farmers usually detect and identify illness by looking at the plants with their eyes. This is how it's been done for ages. However, this procedure can be time-consuming, unaffordable, and imprecise. The findings of automatic detection by using image processing techniques are quick and accurate. This project presents a novel strategy to develop a leaf disease detection model based on leaf image classification and deep convolutional networks. Advances in computer vision provide the potential to expand and improve the practice of special plant protection while also expanding the market for computer vision applications in agriculture. The methodology and the novel training technique allow for a quick and effortless system set up in practice. All of the necessary steps for implementing this disease recognition model are detailed throughout the report, beginning with the collection of images to a database and using a deep learning CNN model for training. This presents a method for identifying plant diseases using a convolutional neural network/CNN that has been trained and fine-tuned to fit accurately to a database of a plant's leaves gathered independently for a variety of plant diseases

INTRODUCTION

Agriculture is one of the maximum vital professions at the planet. Food is a fundamental want for all residing matters in this earth, for this reason it performs an enormous role. As a result, it has come to be essential to enhance the first-rate of agricultural products. It is important to address those plants successfully from the start. A plant's lifespan has some of stages. Soil preparation, sowing, including manure and fertilizers, irrigation methods, ailment diagnosis, pesticide use, and crop harvesting are all included. Pests consisting of insects, weeds, nematodes, animals, and illnesses are notion to purpose crop output losses of 20-40% in general. Crop infections, in step with a few estimates, purpose common yield losses of forty-two percentage for the maximum vital meal's plants. Leaf Spot Diseases weaken bushes and shrubs with the aid of using interfering with photosynthesis, the technique via which plant life produce energy. Crop illnesses can occasionally wipe out a whole crop's production. Food is important for our bodies to characteristic properly, but immoderate fertilizer use has harmed now no longer best plant life. Plant disease diagnosis and surveillance are critical for long-term agriculture. It's difficult to keep track of plant diseases by hand. It demands a significant amount of labor, plant disease knowledge, and an excessive amount of processing time. As a result, image processing is employed in the detection of plant diseases. The major purpose of this paper is to treat agricultural fields in a targeted manner and to provide plant-based therapy, in which individual plants are separated and treated according to their needs.

LITERATURE REVIEW

The global burden of pathogens and pests on major food crops

AUTHORS: Savary, Serge, et al.

Crop pathogens and pests reduce the yield and quality of agricultural production. They cause substantial economic losses and reduce food security at household, national and global levels. Quantitative, standardized information on crop losses is difficult to compile and compare across crops, agroecosystems and regions. Here, we report on an expert-based assessment of crop health, and provide numerical estimates of yield losses on an individual pathogen and pest basis for five major crops globally and in food security hotspots. Our results document losses associated with 137 pathogens and pests associated with wheat, rice, maize, potato and soybean worldwide. Our yield loss (range) estimates at a global level and per hotspot for wheat (21.5% (10.1–28.1%)), rice (30.0% (24.6–40.9%)), maize (22.5% (19.5–41.1%)), potato (17.2% (8.1–21.0%)) and soybean (21.4% (11.0–32.4%)) suggest that the highest losses are associated with food-deficit regions with fast-growing populations, and frequently with emerging or re-emerging pests and diseases. Our assessment highlights differences in impacts among crop pathogens and pests and among food security hotspots. This analysis contributes critical information to prioritize crop health management to improve the sustainability of agroecosystems in delivering services to societies.

Using deep learning for image-based plant disease detection

AUTHORS: Mohanty, Sharada P., David P. Hughes, and Marcel Salathé

Crop diseases are a major threat to food security, but their rapid identification remains difficult in many parts of the world due to the lack of the necessary infrastructure. The combination of increasing global smartphone penetration and recent advances in computer vision made possible by deep learning has paved the way for smartphone-assisted disease diagnosis. Using a public dataset of 54,306 images of diseased and healthy plant leaves collected under controlled conditions, we train a deep convolutional neural network to identify 14 crop species and 26 diseases (or absence thereof). The trained model achieves an accuracy of 99.35% on a held-out test set, demonstrating the feasibility of this approach. Overall, the approach of training deep learning models on increasingly large and publicly available image datasets presents a clear path toward smartphone-assisted crop disease diagnosis on a massive global scale.

A practical plant diagnosis system for field leaf images and feature visualization

AUTHORS: Fujita, E., et al.

An accurate, fast and low-cost automated plant diagnosis system has been called for. While several studies utilizing machine learning techniques have been conducted, significant issues remain in most cases where the dataset is not composed of field images and often includes a substantial number of inappropriate labels. In this paper, we propose a practical automated plant diagnosis system. We first build a highly reliable dataset by cultivating plants in a strictly controlled setting. We then develop a robust classifier capable of analyzing a wide variety of field images. We use a total of 9,000 original cucumber field leaf images to identify seven typical viral diseases, Downy mildew and healthy plants including initial symptoms. We also visualize the key regions of diagnostic evidence. Our system attains 93.6% average accuracy, and we confirm that our system captures important features for the diagnosis of Downy mildew.

Textural features for image classification

AUTHORS: Haralick, Robert M., Karthikeyan Shanmugam, and Its' Hak Dinstein

Texture is one of the important characteristics used in identifying objects or regions of interest in an image, whether the image be a photomicrograph, an aerial photograph, or a satellite image. This paper describes some easily computable textural features based on gray-tone spatial dependancies, and illustrates their application in category-identification tasks of three different kinds of image data: photomicrographs of five kinds of sandstones, 1:20 000 panchromatic aerial photographs of eight land-use categories, and Earth Resources Technology Satellite (ERTS) multispecial imagery containing seven land-use categories. We use two kinds of decision rules: one for which the decision regions are convex polyhedra (a piecewise linear decision rule), and one for which the decision regions are rectangular parallelpipeds (a min-max decision rule). In each experiment the data set was divided into two parts, a training set and a test set. Test set identification accuracy is 89 percent for the photomicrographs, 82 percent for the aerial photographic imagery, and 83 percent for the satellite imagery. These results indicate that the easily computable textural features probably have a general applicability for a wide variety of image-classification applications.

Support-vector networks

AUTHORS: Cortes, Corinna, and Vladimir Vapnik

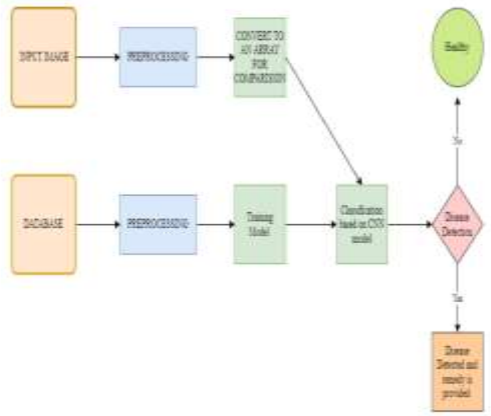
The support-vector network is a new learning machine for two-group classification problems. The machine conceptually implements the following idea: input vectors are non-linearly mapped to a very high-dimension feature space. In this feature space a linear decision surface is constructed. Special properties of the decision surface ensures high generalization ability of the learning machine. The idea behind the support-vector network was previously implemented for the restricted case where the training data can be separated without errors. We here extend this result to non-separable training data.High generalization ability of support-vector networks utilizing polynomial input transformations is demonstrated. We also compare the performance of the support-vector network to various classical learning algorithms that all took part in a benchmark study of Optical Character Recognition.

0 Most of the previous techniques Detection and classification technique of diseases in plant leaves using k-means clustering. Color Co-Occurrence method, Naïve Bayesian classifier. In many cases the existing system even follows SVM Classifier using K-means Clustering. Some of the projects even used a genetic algorithm, Arduino, Masking the green pixel and color co-occurrence method. Some papers even referred to FUZZY Classification, Support Vector Machine (SVM), for all these algorithms the accuracy is less and efficiency is not so good. Another existing System is A Deep-Learning-Based Real

PROPOSED SYSTEM In the proposed system, the user needs to capture the picture of the leaf that has to be diagnosed and will have to upload the captured image to the system. The image is analysed and is tested against the numerous image which were used to train the model. Once the image is analysed as the result is displayed on the screen which consists of the name of the disease with which the leaf is suffering from and the remedy to cure it. The Plant Village Dataset is used. In total, there are 54,300 images of 14 different plant species, distributed in 38 distinct classes given as species/disease pair. Classical methods depend on image pre-processing and the extraction of features which are then fed into one of the Ml algorithms.

SYSTEM ARCHITECTURE AND IMPLEMENTATION

SYSTEM ARCHITECTURE



It assists farmers in identifying illness and increasing crop output. The type of food that people consume has an impact on their health. If food is unhealthy, it will almost likely lead to poor nutrition and the development of a variety of health issues. As a result, healthy plants are required for the CNN-based Leaf Disease Detection and Remedy Recommendation System is a system that uses AI to identify and provide treatments for leaf diseases in the early stages which can prevent crop loss. Because prevention is better than cure, the goal of this initiative is to assist farmers in protecting their farms from insect and disease attacks and eradicating them without disrupting the soil's decorum or undisturbed plant sections. This application is efficient, speedy, and minimizes data loss. It makes it simple to determine what ailment the leaf is afflicted with and how to treat it. There can be two types of predictions: healthy leaves and Infected leaves along with the remedy

IMPLEMENTATION

1) The dataset we use here is acquired from Kaggle and it goes by "Plant Village Dataset". It has 54,300 images of 14 different plant species.

2) Data pre-processing is the most basic and important step in any machine learning project. Data processing consists of certain steps like Data cleaning, Data imputation, Dealing with outliers, Data transformation and Data visualization.

3) The next step is to train the model and later the classification is caried out using various algorithms.

4) Validation gives us with the information if a customer is going to leave or no.

5) It involved giving values which can give either of the two results that are if the disease is detected or not.

6) If the output is Yes then name of the disease along with the remedy is displayed.

7) If the output is No then the leaf is healthy

8) We intend to make a web app where attributes can be given and it then it gives us the output which can be helpful for the farmers to determine whether the leaf is healthy or ill and if unhealthy what will be the remedy to cure the illness.

CONCLUSION AND FUTURE ENHANCEMENT 4

CONCLUSION Convolutional neural network is used to detect and classify plant leaf diseases. Which consists of various layers that are used to make predictions. The complete method was outlined, from the set of images used for training and testing to the preprocessing and enhancement of the image and then the training method for the deep CNN and optimization. The Network was trained using photos obtained in the natural environment and achieved an accuracy of 96.81 percent. This demonstrates CNN's capacity to extract key features from the natural environment that are essential for plant disease categorization. This project is developed for the purpose of helping our farmers. By using the application, the users can get a quick and an accurate diagnosis. **FUTURE ENHANCEMENT** In future we can try to improve the method of analyzing the data from a dataset to a web-based application which also uses the camera to capture a live image and analyze the image at an instant. Better result of detection can be obtained with the larger database and advanced feature extraction of color. Similar application can be developed for various other problems such as skin infection detection. Cancer cell Image processing and many more. It can even be deployed as a mobile application which will make much easier for the users

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