

DEEP LEARNING APPROACHES FOR FRUIT DISEASE DETECTION AND DIAGNOSIS: A REVIEW

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Abstract: In India, agricultural industry has a prohibited demand, so it is important to improve productivity and quality of farming. Farmer uses traditional approach like manual monitoring to get solution for the problems. But manual monitoring will not give satisfactory result all the times and they always need proper advice from experts. During literature survey for smart farming we come up with various techniques and methodologies that have been used. With the help of computational methods human efforts are decreased and better yield and quality of farming is possible to achieve. Image processing, machine learning, support vector machine (svm), artificial neural network (ANN), deep learning are different techniques used to implement smart farming. We introduce a technique which will detect and diagnose fruit diseases. Traditional system has lots of limitations and cannot give accurate results. With computational technique for fruit disease detection effective growth and improved yield of fruits is achieved. For this system we have come up with deep learning technique for fruit disease detection and diagnosis.

Deep Learning is the modern and recent technique for image processing and data analysis for various domains. Deep learning is a branch of machine learning and completely based on artificial neural networks. Deep learning train models and classify data. In deep learning it skips the manual steps of extracting features of images. Deep learning is capable working with big data. Deep learning gives promising results and has large potential. Deep learning provides high accuracy as compared to other existing systems. Various literature papers have been studied to get idea about the deep learning technique and other existing systems along with their working in smart farming. This paper is all about survey of different research papers about deep learning.

Index Terms - Smart farming, Deep learning, artificial neural network, image processing, agriculture, survey

I. INTRODUCTION

EXISTING SYSTEM: IMAGE PROCESSING:

The reason for proposed framework is to manage the maladies on products of the soil substitute answer for solid yield and great profitability. Naming of outskirts pixel can be accomplished by picture division this should be possible by K-Means bunching method. Prepared database of tainted picture has been produced utilizing Neural Network. Highlight vectors, for example, picture shading, Morphology, surface and structure of opening are connected for removing highlights of each picture and for conclusion of ailment morphology gives exact outcome. SURF calculation utilized as locator and descriptor for extricating the highlights. Utilizing extricated highlights Scope of Interest can be determined what's more, extraction can be pursued as its initial step after which refinement and examination is finished. Group of Artificial Neural Network is motivated by organic Neural Networks which is utilized to assess or 972 2015 International Conference on Green Computing and Internet of Things (ICGCIoT) examination works that relies on gigantic number of data sources also, they are commonly obscure. They are frameworks of associated "neurons" and utilities from contributions for figuring and are having a capability of AI alongside example acknowledgment in versatile nature. This is helpful strategy which lessens human exertion and gives 90% exact outcome. For beginning this procedure, at first non-uniform loads are fixed and after that preparation starts. Administered and unsupervised are two approaches utilized for preparing. Administered preparing system furnishes the system with the particular yield either by physically "evaluating" the system's execution or by giving the ideal yields achieved by the data sources while individual preparing can be accomplished by system that takes contributions without outer help. Administered preparing approach is utilized by majority of systems though unsupervised preparing is connected to execute some underlying qualities on inputs. Fundamentally database server is utilized for correlation of separated picture with prepared database which in turns analyze furthermore, arrange ailment of natural products.

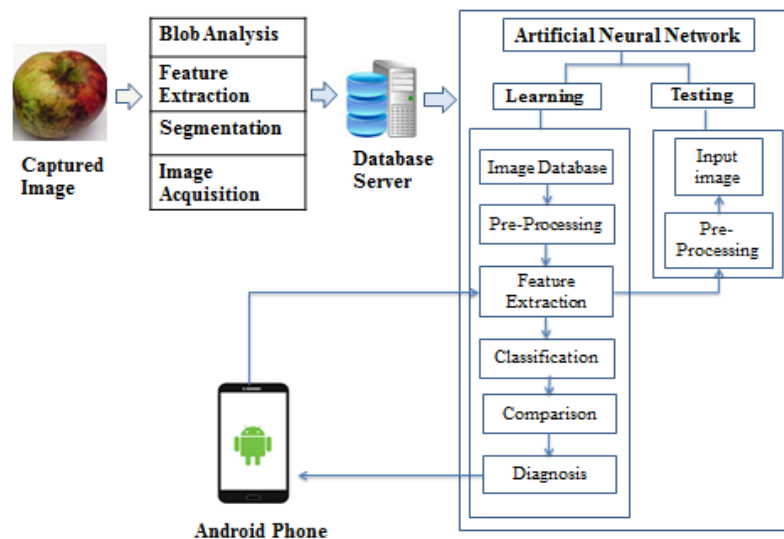


Fig. 1 Existing System

A. Introduction to Deep Learning

Deep learning is a subfield of machine learning which attempts to learn high-level abstractions in data by utilizing hierarchical architectures. It is an emerging approach and has been widely applied in traditional artificial intelligence domains, such as semantic parsing, transfer learning, natural language processing, computer vision and many more [5]. There are mainly three important reasons for the booming of deep learning today: the dramatically increased chip processing abilities (e.g. GPU units), the significantly lowered cost of computing hardware, and the considerable advances in the machine learning algorithms. Various deep learning approaches have been extensively reviewed and discussed in recent years [6].

Alongside Big Data and Analytics, Cloud/Edge Registering based Big Computing and the Internet of Things (IoT)/Cyber-Physical Systems (CPS), the subject of Deep Learning has come to overwhelm industry and research circles for the improvement of an assortment of shrewd world frameworks, and in light of current circumstances like shrewd cultivating. Profound learning has indicated noteworthy potential in approximating and diminishing vast, complex datasets into exceptionally exact prescient and transformational yield, incredibly encouraging human-focused savvy frameworks. Interestingly to complex hard-coded programs produced for a sole firm errand, profound learning models can be connected to all kinds of information, be they visual, sound, numerical, content, or a few blend. What's more, best in class profound learning stages are winding up always modern, regularly open source and accessible for across the board utilize[3].

In spite of the fact that relapse investigation and auto-encoding are not new points in the field of machine adapting, profound learning usage can give higher precision and better prescient execution, and are more adaptable and configurable. As one of the biggest regions of profound learning applications, administered learning assignments for order have far surpassed even human capacities in regions like penmanship and picture acknowledgment. What's more, unsupervised realizing on datasets with no specific names has demonstrated the potential for the extraction of unexpected investigative and business esteem through grouping and measurable examination. Conceivably the most fascinating yet, fortification learning gives the potential for profound learning without human supervision, through criticism from an associated domain. This kind of profound learning has been vigorously connected to the field of mechanical autonomy and PC vision [15].

With the persistent development of IoT and keen world frameworks driven by the development of CPS, in which all gadgets are arrange associated and ready to impart detected information and screen physical items, bigger and bigger datasets are getting to be accessible for the utilization of profound learning, ready to really affect our day by day lives. For instance, shrewd transportation frameworks will interconnect self-driving vehicles and foundation systems to alter every day mass travel, for all intents and purposes disposing of crashes what's more, empowering optional electrical matrix stockpiling [8]. Shrewd urban areas will empower the improvement of asset administration through order and control in about all spaces, from power, correspondences, and different utilities, to development, transportation, and crisis reaction. Brilliant wearable's and tele-wellbeing gadgets gathering demonstrative information may uncover patterns that could draw out human life through illness and example revelation, making an exploration populace of incomprehensible scale. Cell phones have managed the huge making of rich printed, sound, and visual information from different web based life applications and inserted sensors, and in like manner huge area and populace development information through inserted GPS modules. Plainly these applications, alone or in mix, create uncommon Big Data [2]. As an answer to the handling, dimensionality decrease, pressure, and extraction of such Big Data, profound learning gives the most instantly applicable and proper apparatuses, empowering the quick investigation of complex information that traverses an assortment of modalities[5][9].

B. Machine Learning and Deep Learning

Machine learning: For the most part, to execute Artificial Intelligence, we utilize Machine Learning. We have a few calculations that are utilized for Machine Learning. For instance:

1. Find-S
2. Decision trees
3. Random forests
4. Artificial Neural Networks

Generally, there are 3 types of learning algorithms:

1. Supervised Machine Learning Algorithms make predictions. Further, this algorithm searches for patterns within the value labels that were assigned to data points.
2. Unsupervised Machine Learning Algorithms: No labels are associated with data points. Also, these ML algorithms organize the data into a group of clusters. Moreover, it needs to describe its structure and make complex data look simple and organized for analysis.
3. Reinforcement Machine Learning Algorithms: We use these algorithms to choose an action. Also, we can see that it is based on each data point. After some time, the algorithm changes its strategy to learn better.

Deep Learning: Machine Learning centers just on tackling genuine issues. It likewise takes a couple of thoughts from Artificial Intelligence. Machine Learning experiences the Neural Networks that are intended to imitate human basic leadership abilities. ML apparatuses and methods are the two key thin subsets that just concentrate more on Deep Learning. We have to apply it to take care of any issue that requires thought — human or counterfeit. Any Deep Neural Network will comprise of three sorts of layers:

1. The input layer
2. The hidden layer
3. The output layer

We can say Deep Learning is the newest term in the field of Machine Learning. It's a way to implement Machine Learning.

C. Deep Learning vs. Machine Learning:

We utilize a machine learning to parse information, gain from that information, and settle on educated choices dependent on what it has realized. Essentially, Deep Learning is utilized in layers to make an Artificial "Neural Network" that can learn and settle on smart choices all alone. We can state Deep Learning is a sub-field of Machine Learning [9].

Comparison of Machine Learning and Deep Learning:

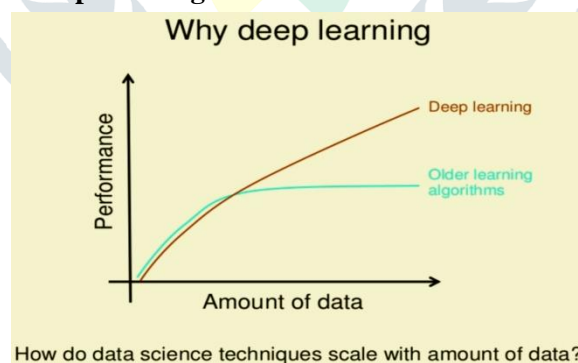


Fig. 2. Why Deep Learning

1. Data dependencies:

Performance is the fundamental key distinction between the two calculations. Despite the fact that, when the information is little, Deep Learning calculations don't perform well. This is the main reason DL calculations require a lot of information to comprehend it impeccably. But, we can see the use of algorithms with their handcrafted rules prevail in this scenario. The above image summarizes this fact.

2. Hardware Dependencies:

For the most part, Deep Learning relies upon top of the line machines while customary learning relies upon low-end machines. Accordingly, Deep Learning necessity incorporates GPUs. That is a basic piece of its working. They likewise complete a lot of network augmentation tasks.

3. Feature Engineering:

It's a general procedure. In this, area information is put into the production of highlight extractors to lessen the multifaceted nature of the information and make designs more unmistakable to take in the calculation working. In spite of the fact that, it's exceptionally hard to process. Consequently, it's tedious and skill.

4. Problem Solving Approach:

Generally, we use the traditional algorithm to solve problems. However, it needs to break a problem into different parts to solve them individually. To get a result, combine them all.

5. Execution Time:

Generally, Deep Learning sets aside greater opportunity to prepare when contrasted with Machine Learning. The primary reason is that there are such a significant number of parameters in a Deep Learning calculation. While Machine Learning sets aside considerably less opportunity to prepare, running from a couple of moments to a couple of hours.

6. Interpretability:

We have interpretability as a factor for correlation of both learning systems. Albeit, Deep Learning is still idea multiple times previously its utilization in industry.

D. Deep Learning in Agriculture:

- **Areas of use:**

Sixteen zones have been distinguished altogether, with the famous ones being distinguishing proof of weeds, arrive cover grouping, plant recognition, fruit ailment discovery, leaf ailment location natural products tallying and edit type arrangement. It is striking that all papers, were distributed amid or after 2015, showing how later and current this strategy is, in the area of farming. The vast dominant part of the papers manage picture arrangement and recognizable proof of regions of enthusiasm, including discovery of obstructions at a plant sickness ID issue based on leaf pictures. A few papers center around foreseeing future parameters, for example, corn yield, soil dampness content at the field what's more, climate conditions [10]. From another point of view, most papers target crops, while few works consider issues, for example, weed recognition, arrive cover, inquire about on soil, domesticated animals horticulture, hindrance identification and climate expectation [1].

- **Data Source:**

Watching the wellsprings of information used to prepare the DL show at each paper, vast datasets of pictures are chiefly utilized, containing thousands of pictures at times, either genuine ones, or manufactured. Some datasets start from understood and freely accessible datasets, for example, Plant Village, LifeCLEF, MalayaKew, UC Merced what's more, Flavia, while others establish sets of genuine pictures gathered by the creators for their exploration needs. Papers managing land cover edit type grouping and yield estimation, and in addition a few papers identified with weed location utilize fewer pictures [1]. Also, a few papers utilize content information, gathered either from vaults or field sensors. As a rule, the more entangled the issue to be unraveled, the more information is required. For instance, issues including expansive number of classes to distinguish as well as little Variation among the classes, require extensive number of information pictures to train their models.

- **Data Variation:**

Variety between classes is essential for the DL models to be capable to separate highlights and attributes, and perform precise classifications. Hence, precision is emphatically connected with variety among classes. In addition, some specific perspectives of the plants (i.e. blossoms and leaf checks) offer distinctive arrangement precision than branches, stems what's more, photographs of the whole plant. A major issue in plant phenology acknowledgment is the way that appearances change step by step and it is testing to recognize pictures falling into the developing spans that are amidst two progressive stages. A comparative issue shows up while surveying the nature of vegetative improvement. Besides, in the testing issue of natural product checking, the models experience the ill effects of high impediment, profundity variety, and uncontrolled brightening, including high shading comparability between natural product/foilage. At last, distinguishing proof of weeds faces issues concerning lighting, goals, and soil type, and little variety among weeds and harvests fit as a fiddle, surface, shading and position, this low variety has influenced grouping exactness altogether, i.e. over 5% [1].

- **Data Pre-processing:**

The vast larger part of related work included a few picture pre-preparing ventures, before the picture or specific attributes/highlights/insights of the picture were bolstered as a contribution to the DL display. The most widely recognized pre-preparing strategy was picture resize, as a rule to a littler size, with the end goal to adjust to the necessities of the DL display [1]. Sizes of 256×256, 128×128, 96×96 what's more, 60×60 pixels were normal. Picture division was additionally a well known practice, either to expand the span of the dataset or then again to encourage the learning procedure by featuring areas of premium or to empower less demanding information explanation by specialists and volunteers. Foundation evacuation, frontal area pixel extraction or non-green pixels expulsion dependent on NDVI veils was additionally performed to decrease the dataset's general clamor. Different activities included the making of jumping boxes to encourage identification of weeds or tallying of organic products. Some datasets were changed over to grayscale or to the HSV shading model. Furthermore, some papers used features extracted from the images as input to their models, such as shape and statistical features, histograms, Principal Component Analysis (PCA) filter, Wavelet transformations.

- **Data Augmentation:**

It is worth-specifying that a portion of the related work under investigation utilized information expansion systems, to expand misleadingly their number of preparing pictures. This enhances the general learning methodology and execution, what's more, for speculation purposes, by methods for sustaining the model with differed information. In this case, information increase enabled their models to sum up and be capable to adjust to this present reality issues all the more effortlessly. Changes are mark saving, and included revolutions, dataset dividing/trimming, scaling, transposing, reflecting, interpretations and point of view change. Papers including reenacted information played out extra enlargement procedures, for example, differing the HSV channels and including arbitrary shadows or adding reenacted roots to soil pictures [11].

- **Technical Details:**

From a specialized side, half of the exploration works utilized prevalent CNN models, for example, Alex Net, VGG16 also, Inception-ResNet. A portion of the CNN approaches joined their demonstrate with a classifier at the yield layer, for example, strategic relapse, Scalable Vector Machines (SVM), Large Margin Classifier and perceptible cell automata. As to structures utilized, every one of the works that utilized a few understood CNN design had likewise utilized a DL system, with Caffe being the most famous, trailed by Tensor Flow. Learning rate is about how rapidly a system learns. Higher qualities help maintain a strategic distance from the solver being stuck in neighborhood minima, which can lessen execution altogether [10]. A general methodology utilized by numerous individuals of the assessed papers is to begin with a high learning rate furthermore, bring down it as the preparation goes on. We take note of that learning rate is extremely reliant on the system design [1].

- **Performance Metrics:**

As to use to assess execution, different measurements have been utilized by the creators, each being particular to the model utilized at each examination. In a few papers where the creators alluded to exactness without indicating its definition, we expected they alluded to arrangement exactness. Starting here onwards, we allude to "DL execution" as its score in some execution metric. CA was the most prominent metric utilized, trailed by F1. We take note of that at times, an exchange off can exist between measurements. For instance, in a weed location issue, it may be attractive to have a high R to dispose of most weeds, however not disposing of products is of a basic significance, thus a lower P may be worthy.

E. Advantages of Deep Learning:

With the exception of from upgrades in execution of the arrangement/ expectation issues in the studied works, the benefit of DL as far as decreased exertion in highlight building was exhibited in a significant number of the papers. Hand-designed segments require impressive time, an exertion that happens naturally in DL. Furthermore, here and there manual look for good component extractors isn't a simple and evident errand. For instance, on account of evaluating crop yield, removing physically includes that fundamentally influenced yield development was unrealistic. This was additionally the instance of evaluating the dirt dampness content. Another favorable position of DL is the likelihood to create recreated datasets to prepare the model, which could be appropriately structured all together to take care of true issues. For instance, in the issue of identifying weeds and maize in fields, the creators survived the plant foliage covering issue by mimicking top-down pictures of covering plants on soil foundation. The prepared system was then equipped for separate weeds from maize even in covering conditions [1] [11].

Conclusion:

In this paper, we have played out a review of profound learning-based look into endeavors connected in the agrarian area. We have recognized significant papers, inspecting the specific zone and issue they center on, specialized points of interest of the models utilized, wellsprings of information utilized, pre-preparing errands and information growth strategies received, what's more, generally execution as indicated by the execution measurements utilized by each paper. We have then contrasted profound learning and other existing systems, regarding execution. Our discoveries demonstrate that profound learning offers better execution and beats other well known picture preparing methods. For future work, we intend to apply the general ideas and best practices of profound learning, as depicted through this overview, to different regions of horticulture where this advanced method has not yet been sufficiently utilized. A portion of these territories have been recognized in the dialog area. Our point is that this

overview would persuade more specialists to try different things with profound getting the hang of, applying it for comprehending different horticultural issues including arrangement or expectation, identified with PC vision and picture examination, or all the more for the most part to information investigation. The general advantages of profound learning are empowering for its further utilize towards more astute, more feasible cultivating and more secure nourishment generation.

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