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Study on artificial intelligence applications uses in agriculture

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***Abstract*---**The automation is popular in agriculture sector is key concern besides emergent issue across the globe. The population remains growing enormously besides through this rise claim of food besides employment remains also growing. The traditional approaches which was cast-off by farmers, remained not adequate sufficient towards fulfill these necessities. Therefore, innovative automated approaches remained presented. These innovative approaches fulfilled the food necessities besides also providing service prospects on the way to billions of people in Present of Artificial Intelligence(AI).This paper presents a assessment of the software of AI in management of soil , management of crop ,weed disease . A superior attention remains arranged to observe the glitches, developed the suitable explanations for that in addition to create optimal results designed for it, artificial intelligence act by way a great help to report the diseases of harvests. Thus, the review paper discuss an quick summary of application of an artificial intelligence in agronomy, so the existing methods for agronomy besides spotlight of the numerous approaches existing intended for the discovery of diseases in harvests. The classification techniques Convolutional Neural Network delivers improved precision associated towards traditional methods.

***Keywords*---**artificial intelligence, deep learning, classification mechanisms, crop disease detection.

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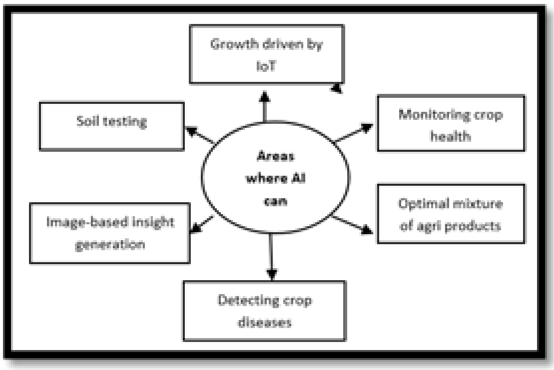
Introduction

By 2050, the world's population is expected to reach approximately 10 billion, expanding agricultural order in a condition of modest financial development by roughly 50% compared to 2013. Crop production currently accounts for around 37.7% of total land surface. Agriculture is significant in terms of job creation and contribution to national income. It makes a substantial contribution to the economic prosperity of industrialised countries and also plays an important role in the economies of emerging countries. A large increase in the per-capita income of the rural community has resulted from the expansion of agriculture. As a result, emphasising the agriculture sector will be sensible and appropriate. Agriculture contributes for 18% of GDP in India and Employs 50% of the workers. Rural development will be boosted by agricultural growth, which will eventually lead to rural transformation and structural transformation By 2030, India's population is predicted to exceed 1.6 billion people. With such a large increase in population, significant demand for agricultural products is also expected. The progress of the service industry has resulted in a large shift of workers from the primary to tertiary sectors. Furthermore, a lack of awareness about emerging diseases in crops is lowering crop yields. Food being the most basic requirement of human life, future research should focus on revitalising the agricultural sector. Because of the wide variety of agronomy species, a comprehensive database for various aspects of agriculture is required. Farming may be made more efficient for farmers by employing appropriate artificial intelligence techniques and datasets. These techniques can be deemed substantial implementations in the event of a future crisis. Agriculture has been elevated to a new level thanks to AI-based equipment and tools. Crop production has improved as a result of this technology, as has real-time monitoring, harvesting, processing, and marketing. In the agro-based sector, the latest technologies of automated systems using agricultural robots and drones have made a significant contribution. Several high-tech computer-based systems have been developed to identify various critical factors such as weed detection, yield detection, crop quality, and a variety of other ways.Medical science, education, economics, agriculture, industry, security, and a variety of other fields have all been impacted by AI. AI implementation necessitates a machine learning process. This leads us to the "Machine Learning" sub-domain of the AI field. Machine learning's main objective is to give the machine data from previous experiences and statistical data so that it can complete its assigned duty of solving a specific problem. Today's uses include data analysis based on prior data and experience, speech and facial recognition, weather prediction, and medical diagnostics. The domains of big data and data science have evolved to such a significant extent as a result of machine learning.
Machine learning is a method for creating intelligent machines that is based on mathematics.

Figure1:Represent The Important Area In Agriculture Where Ai Can Be Used.



1) Growth driven by IoT: IoT generates massive amounts of data in both organised and unstructured formats every day (internet of things). These include information such as historical weather patterns, soil reports, fresh studies, rainfall, pest infestation, and photographs captured by drones and cameras, among other things. All of this data may be sensed by cognitive IoT solutions, which can then deliver actionable insights to increase yield.
2) Soil testing: Proximity Sensing and Remote Sensing are advanced technologies that represent for smart data fusion. Soil testing is one applications of this high-resolution data. Although remote sensing necessitates the integration of sensors into aerial or satellite systems, proximity sensing necessitates sensors that are in direct contact with the ground like at a relatively near range. This aids in the classification of soils depending on the soil underneath the surface at a particular spot.
3) Image-based insight generation: Drone-based imaging can contribute with in-depth field analysis, crop monitoring, field scanning, and other tasks. They can be used in association with computer vision technologies and the Internet of Things to permit farmers to initiate quick actions. These services provide the farmers with daily weather alerts.
4) Detecting crop diseases: Under white/UV-A light, Computer Vision Technology is used to acquire images of diverse crops. Farmers can then sort the produce into distinct stacks before delivering it to the market. The leaf images are split into sections for further diagnosis thanks to image pre-processing. Such a technique would identify pests more distinctly.
5) Optimal mixture of agri products: Cognitive computing gives advice to farmers on the simplest choice of crops and seeds based on several parameters like soil condition, weather outlook, seed kind, as well as infestation around a certain zone. The advice is further adapted depending on the requirement of the farm, local conditions, including previous achievements. Artificial intelligence can however take into account external factors including such market trends, prices, as well as consumer expectations.
6) Monitoring crop health:Remote sensing techniques, and also hyper spectral imagery as well as 3D laser scanning, were required to develop crop metrics over thousands of acres. It has the potential to usher inside a fundamental shift in how producers monitor crops in terms of time and energy. This device will track crops throughout their whole life cycle and produce data to identify any irregularities.

Literature Survey

Farming comes with a lot of possibilities as well as uncertainties. The weather fluctuates from season to season, as do the prices of farming materials, soil degradation, crop failure, weed suffocation, pest damage, plus climate variability. Farmers should manage with these uncertainties. Although planting is vast, soil, crop, disease, as well as weeds are all major contributors towards agricultural production under this study. Reviewing the AI system to agriculture in terms of soil, crop, disease, as well as pest management is critical.

Soil is now a vital component of successful agriculture because it offers the original source of nutrients for crop growth. Soil is just the foundation of all agricultural, forestry, as well as fishing production systems. Water, minerals, and proteins are stored in the soil until they are needed for crop growth and development. Crop cultivation is extremely important to Long-term economic growth. It also does, however, provide food, raw materials, and jobs. Marketing, processing, distribution, and after-sales support are now considered part of agricultural production in modern times. Crop cultivation as well as other primary industries are now being prioritised in locations in which real income per capita seems to be low. Increased crop factory output as well as productivity are seen to contribute significantly to a country's overall economic development. They can be used in association with computer vision technologies and the Internet of Things to permit farmers to initiate quick actions. Plant diseases diminish agricultural production quantity and quality as agriculture tries to meet the demands of a fast rising population. Post- harvest infection loss in agriculture can be devastating. Weeds are a significant danger to all agricultural activity. Weeds diminish farm as well as forest productivity, overrun crops, suffocate pastures, and even in some circumstances kill livestock. They constantly struggle for water, nutrients, as well as sunlight with the crops, resulting in reduced agricultural output with reduced agricultural quality.

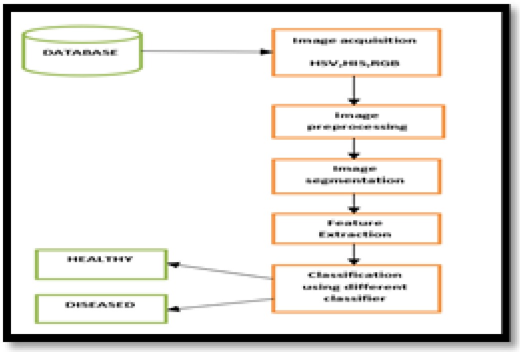
Table I. Represent the study of usages of ai in agriculture

Research paper	Advantage	Disadvantage
Smart Farming towards Agriculture - 2020 [1]	Current status of advanced farm management systems with the end goal that producers can make streamlined choices to save money while securing nature.	A few studies report that horticultural robots incorporating types of AI can carry out specific responsibilities quicker than people. In spite of there are different examinations that negate this announcement, mechanical autonomy is a developing economy and robots are unusual.
Technical devices used for differential fertilizer application - 2020 [2]	Represented new specialized gadgets for differential utilization of manures considering heterogeneity of the thickness of the humus horizon.	It costs a lot of money and huge computation power to make or buy robots and to train models for AI.
Future of Precision Agriculture in India using Machine learning and Artificial Intelligence - 2019[3]	Conversation on the eventual fate of exactness agribusiness which has been demonstrated to work in different nations utilizing AI and computerized reasoning. The extent of usage is centered around medium and enormous scope ranchers with a plan to bring up the points of interest and detriments of the methods.	To cultivate and advance accuracy agriculture through guides, reliefs, charge occasions and different motivators to ranchers will enormously pull in speculation. This move will subsequently help conscious endeavors to ensure the development and supportability of people in the future yet to come.

AI techniques used for detection of diseases in agriculture

Crop leaf Images are a great source of information about plant disease and structural behaviour, thus they must be thoroughly retrieved and studied. In the identification and study of leaf diseases, image processing is critical [28]. The approach used here crop leaf disease identification is depicted in the diagram below.

Figure 2:Represent the Various Method Crop Diseases Detection



(a) Image Acquisition: The diseased leaves are photographed. The images in this collection are in JPEG format which include a wide range of plant diseases. After then, the images is read.

(b) Image Pre-processing:
Different image pre-processing techniques are used to remove noise from the image or to exclude other objects. Because the pixel size of the original image is large and the overall operation takes longer, image scaling is used to convert the original image into thumbnails. After converting the image into thumbnails, the pixel size will drop and the entire procedure will take less time.

(c) Image segmentation: In a targeted application, image segmentation is one of the most often utilised strategies for distinguishing pixels of an image well. It divides a picture into several discrete states, resulting in high similarity between pixels in every area and high dissimilarity among areas.

(d) Feature Extraction:
Disease detection highly depends on feature extraction techniques. It is crucial in determining the identity of an object. Feature extraction is used in a variety of image processing applications. Color, texture edge, as well as shape are some of the features used in disease identification.

(e) Detection and classification of plant diseases: Classifiers: Based on the data acquired, classifiers are used to identify and categorise the many diseases that affect plant leaves. K-nearest neighbours (K- NN), Support Vector Machines (SVM), Convolutional Neural Network (CNN), and Artificial Neural Network (ANN) are some of the classifiers that have been used to detect diseases in plants in the past.

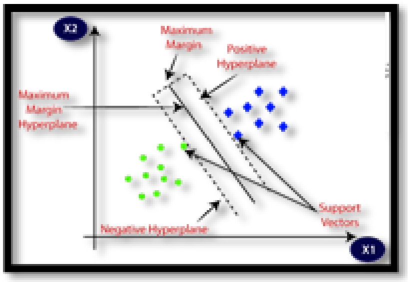
Comparative Study Of Differeent Classification Technique For

A. Convolutional neural networks: Convolutional neural networks are distinguished from other neural networks by their superior performance with image, speech, or audio signal inputs. The purpose of CNN is to reduce images into an easier-to-process form, without compromising the features that are essential for getting a good prediction. There are different available architectures for CNN such as AlexNet, GoogLeNet, VGGNet etc.

B. Support Vector Machine (SVM):

The Support Vector Machine, or SVM, is a popular Supervised Learning technique that may be used to solve both classification and regression issues. However, it is mostly utilised in Machine Learning for Classification difficulties. The SVM algorithm's purpose is to find the optimum line or decision boundary for classifying n-dimensional space into classes so that additional data points can be readily placed in the correct category in the future. A hyperplane is the optimal choice boundary. SVM selects the hyperplane's extreme points/vectors. Support vectors are the extreme instances, and the algorithm is called a Support Vector Machine. Consider the diagram below, which shows how a decision boundary or hyperplane is used to classify two different groups.

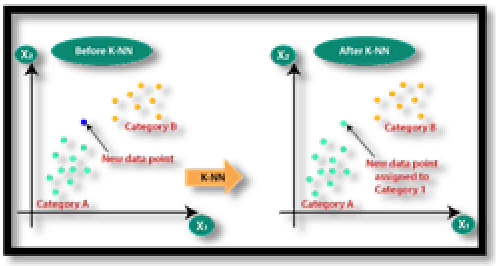
Figure 3:Represent The Classfier Support Vector Machine



C. K-Nearest Neighbor

The K-Nearest Neighbour algorithm based on the Supervised Learning technique and is one of the most basic Machine Learning algorithms. The -NN algorithm assumes that the new case/data but also existing cases are comparable as well as places the new case in the category that is most similar to the existing category. The KNN algorithm maintains every available data as well as classifying new data points into groups that really are similar to previous data. This means that when fresh data comes, the K-NN algorithm could quickly classify it into a suitable category. The KNN algorithm are used for both regression as well as classification, but it is more commonly used for classification tasks. The K-NN algorithm is really a non-parametric algorithm, that means it makes no assumptions regarding data. It's also known as a lazy learner technique because it doesn't learn from thetraining set right away; alternatively, it saves the dataset as well as performs an action on it when it comes time to classify it. During the training phase, the KNN algorithm simply stores the dataset, and then when it receives dataset, it classifies it into a category that is quite similar to the new data.

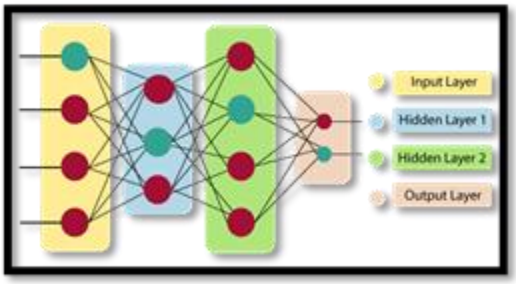
Figure 4:Represent The Classfier K-Nearest Neighbor



D. Artificial Neural Network

Biological neural networks establish the functioning of the human brain, and also the phrase "Artificial Neural Network" is taken from them. Artificial neural networks, like the human brain,contain neurons which are coupled to one another in different layers of a networks. Nodes are the name for these neurons.

Figure 5:Represent The Classfier Artificial Neural Network



First layer is Input Layer: It takes data in various of ways specified by the programmer. Second layer is Hidden Layer: A hidden layer exists between both the input and output layers. It performs all of the calculations necessary to reveal hidden appropriate features.Third layer is Output Layer: The hidden layer modifies the input, results in output that is conveyed using this layer.

Existing Research	Techniques	Plants Used (Dicots or Monocots)	Images	Result
Via Deep Learning aimed at Image-Based Plant Disease Detection [4]	CNN	Apple, Blueberry, Cherry, Corn, Grapes, Orange, Peach, Potato, Strawberry, Tomato (Dicots)	54,306	range of 85.53% to 99.34%.
Identification of rice	Deep-CNN	Rice (Monocot)	500	Maximu m

diseases with deep convolutional neural networks [5]				accuracy was 95.48% and 93.29% respectively.
Identification of plant leaf diseases with a nine-layer deep convolutional neural network [6]	Deep-CNN	Apple, grape, tomato, potato, soybean, cherry, peach, and blueberry (Dicots)	54,448 images	accuracy of 96.46%
Attention embedded residual CNN used for disease detection popular tomato leaves [7]	CNN	Tomato (Dicot)	95,999 images	accuracy of 98%.
Plant leaf disease identification by means of exponential spider monkey optimization [8]	SVM	Potato and Apple (Dicot)	1000 images	92.12%
Detection also Classification of Diseases of Banana Plant With Local Binary Pattern besides Support Vector Machine [9]	SVM	Banana (Monocot)	123 images	89.1% and 90.9%.
Support vector machine classifier based detection of fungal rust disease in Pea Plant (Pisam sativam) [10]	SVM	Pea (Dicot)	500 images	89.60% accuracy .
Disease Detection and Severity Estimation in Cotton Plant from Unconstrained Images [11]	KNN	Cotton (Dicot)	130	82.5%
A Color and Texture Based Approach for the Detection and Classification of Plant Leaf Disease Using KNN Classifier [12]	KNN	Various Plant leaves	237 leaf images	96.76% accuracy
Automated plant identification using artificial neural	SVM and ANN	Ficus (Dicot)	60 images	83.3%.

network and support vector machine [13]				
Leaf Disease Detection: Feature Extraction with K-means clustering and Classification with ANN [14]	ANN	Cotton and Tomato (Dicots)	20 images	92.5 %

Table II. Represent different classification techniques uses for plant disease detection in agriculture sector

are numerous outstanding issues in the publishedliterature that must be addressed as well as overcome in terms of developing robust as well as viable crop disease detection systems that really can operate accurately under such a range of field circumstances.

A. Data is insufficient : The inadequacy of datasets in regards of both diversity as well as size is a serious issue in the use of deep learning models for plant disease diagnosis. These algorithms necessitate a huge amount of data. In the most common of circumstances, plant disease diagnosis has been carried out under optimalas well as controlled conditions. Because of these considerations, creating a trustworthy, efficient, and complete dataset is incredibly difficult.
B. Data is Imbalanced: To fully concentrate on training algorithms and avoid being distracted by other difficulties, the most widely used datasets for crop disease detection are cleaned or their unbalanced character is ignored.
C. Problem of Overfitting and Underfitting: Due to the enormous number of factors involved, which are connected in complicated ways, learning models have an extremely high risk of overfitting and underfitting the data during the training stage.
D. Problem with Disease Classification: In many of the cases listed below, the classifier used to identify plant diseases may not be able to distinguish between them;
   - Differences in illness symptoms: Depending on the stage of disease development, a specific disease can have quite different symptoms in terms of shape, colour, and size, posing major identification issues.
   - Several illnesses, such as dietary deficiencies, pests, and infections, can exist at the same time: Most methodologies assume that there is only one disease per image whereas, in reality, multiple different diseases, as well as other types of problems including nutritional inadequacies and pests, can be present at the same time.

Challenges With Agricultural Disease Detection Area Which Have Not Been Resolved

The preceding section summarizes of promising recent research in the field of agricultural disease recognition as well as detection through a variety of methodologies. There

Conclusion

The AI can benefit the agriculturalists towards rise the volume of production besides decrease the price of production and labour. Not at all essential to say that dispersal of AI popular altogether application areas determination to take an perfect change in the method we prepare study besides expansion in agronomy today. AI changes near additional robotics through additional precision to achieve happening real period management, which remains serving in usual instable of old-style agriculture towards precision agriculture through low price. The AI resolution essential remain feasible besides available to the agricultural public. Current review study précis the diverse applications of AI in Agriculture area. Serious illnesses in crops mains to the annual sufferers of the farming harvest. Hence, recognition the diseases on an initial phase in crop remain very critical aimed by the anticipation of such extreme sufferers in the forthcoming. This paper, reviewed Monocotyledonous besides Dicotyledonous plant relations sideways through the connected method about of the image processing stages. Different techniques that remain utmost generally used aimed at identification besides recognition of diseases been reviewed. The utmost current work been analysed besides it is depicted in tables. Different techniques that take been used in current work done, maximum precision been accomplished through deep learning ideas that is over CNN approach. some challengeswith agricultural disease detection area which have not been resolved are also discussed.

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