



Survey on Machine Learning Techniques in Agriculture

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ABSTRACT: In today's era the growing technology is getting used in many fields for its improvement. There are various machine learning algorithms used for automation crop disease detection, proper fertility analysis and drones with ml algorithm for various aspects are in Machine learning that is artificial neural network[ANN],Convolutional neural network[CNN],Supervised machine learning algorithm[SVM] is employed to enhance the productivity and quality of the crops within the agriculture sector. The seedretailers use this agriculture technology to churn the information to make better crops. The AI technologies are accustomed determine which corn and which conditions will produce the most effective yield. the main technologies that are most ordinarily being utilized by farms include: harvest automation, autonomous tractors, seeding and weeding, and rones. Farm automation technology addresses major issues sort of a rising global population, farm labor shortages, and changing consumer preferences. Hence this paper mainly focuses on the survey on various ways during which machine learning and computing is being utilized within the present modern agriculture.

KEYWORDS: machine-learning-algorithms: Artificial neural network,convolutional neural network,support vector machine

I.INTRODUCTION

Agriculture plays a really pivotal role within the global economy of the country. Because of the rise in population, there's constant pressure on the agricultural system to enhance the productivity of the crops and to grow more crops. Indian agriculture is one of the highest economical for the india. Its important for all of us to keep a care on the indian agricultural and safe guard its originality and thus help the farmers by any from and make them feel secured. The agricultural lands ,the crops and also the farms has to to be monitored each and every time it is grown and thus which helps us and the farms for abetter productivity and this could be possible by various technologies which are booming in todays world and this can actually visualize for a better future abd help the future generation with a better life and safe and healthy food.

Machine learning [ML]could be a trending technology nowadays and it are often utilized in modern agriculture industry. The uses of ML in agriculture helps to make more healthy seeds and lots of more benefits. The principle that was used earlier in machine learning experiments are utilized in today's modern agriculture. Artificial machine learning in agriculture is one among the fastest growing areas. The techniques that are being employed within the agricultural sector to extend the accuracy and to search out solutions to the issues more precisely. There are various applications of machine learning in agriculture like the digital farming, yield prediction and quality assessment, species identification of crop disease and weeds detection, It also incorporates a wide role in livestock management and selective breeding etc. Here that they had used around 630 questions describing diseased plants. and every plant had 49 attributes where each mapped to 49 vector of integers .

There were everywhere 17 diseases which it could categorize. there have been around 290 training instances which were selected from the corpus of 630.And finally eventually the pc could excellently bet the human derived rules with its new rules which had an accuracy of 97.6% Oof the time,compared to 71.8% for the expert derived rules. Hence within these ways machine learning plays crucial role in the field of agriculture.Thus this paper concentrates on applications of machine learning at various a part of agriculture.

II LITERATURE SURVEY

2.1 MACHINE LEARNING

Marvin Minsky and Dean Edmonds build the first neural network machine. As shown in figure 1 ML is a study of algorithms where we build a mathematical model based on the sample data, which enhances itself through experience. Here there is no program which is explicitly sent. Hence there are different types of machine learning techniques like the supervised learning, unsupervised learning, semisupervised learning or called the popular reinforcement learning.

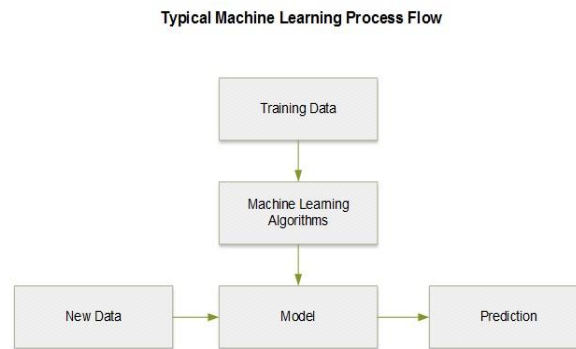


Figure-1 Typical Machine Learning Process Flow

2.2 SUPERVISED LEARNING

This is a sort of ML learning technique where there are labeled input and output i.e we actually know what's the input and what should be the required output. The training data is represented with array or vector which is termed the feature vector. Thus we've active learning ,classification and regression under this. Through iterative optimization of an objective function, supervised learning algorithms learn a function that may be wont to predict the output related to new inputs. As shown in figure 2 the supervised learning is that the SVM which divides the information into regions separated by linear-boundary.

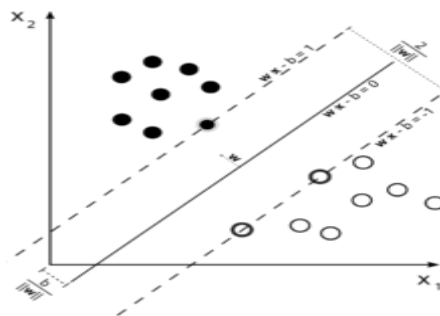


Figure-2 Graph representing supervised learning

2.3 UNSUPERVISED LEARNING

In this technique of unsupervised learning the data set is not labeled and the output is unknown hence there are several categories in this unsupervised learning like the clustering of data and grouping of data, dimensionality reduction.

2.4 REINFORCEMENT LEARNING

This is technique which is majorly used for predictive analysis and has applications all over with gaming ,robotics, navigation etc. Hence the machine learning is subset of artificial intelligence and then deep learning forms the subset of both artificial intelligence and machine learning.

2.4.1.ARTIFICIAL NEURAL NETWORK

Artificial neural networks are those which come under deep learning and is formed by getting inspired on the biological neural network. Here it consists several hidden layers and each one is connecting to every other from the input layer to the output as shown in figure 3 this is known as edge and so the nodes are those representing neurons. This neurons have weights which gets adjusted through the learning process

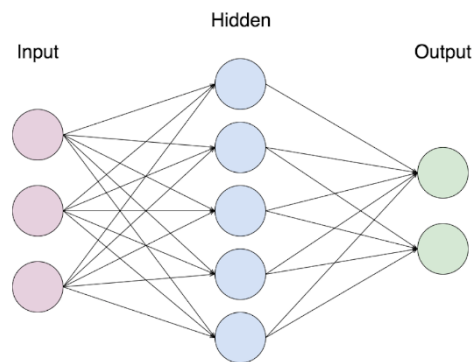


Figure-3 Typical Neural Network

2.4.2 DECISION TREES

This is an algorithm which is used mainly for predictive modelling in statistics, data mining and machine learning. These take sequential values in trees. In decision analysis, a choice tree is accustomed visually and explicitly represent decisions and deciding. In processing, a choice tree describes data, but the resulting classification tree is an input for deciding

2.4.3 SUPPORT VECTOR MACHINE

This is an algorithm which comes under supervised machine learning techniques and are used mainly for classification and regression. In SVM model the training is done in such a way that if the test data is given as input then the model will be capable of telling if it falls under any two if the categories. This is linear and binary classifier and is non-probabilistic.

2.4.4 REGRESSION ALGORITHM

In regression analysis there are various statistical ways to determine the relation between input and its features. As shown in figure 4 the most common form is the linear regression where there is single line drawn to best fit the given data. Later it is drop out performed to mitigate the overfitting ,if its non-linear then models have polynomial regression there is also an other tyor of regression called the logistic regression which introduces non-linearity .

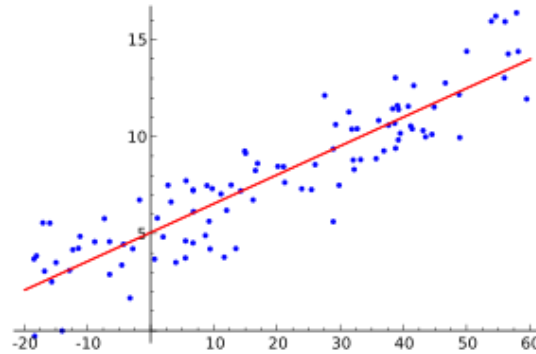


Figure-4 Regression Analysis

2.4.5 K-Nearest Neighbour algorithm

K-NN is additionally called lazy learning, where the function is solely approximated locally and every one computation is deferred until function evaluation. The training phase of the algorithm consists only of storing the feature vectors and sophistication labels of the training samples. This algorithm uses hamming code, Euclidean distance for its model.

2.4.6 k-Means algorithm

This is machine learning algorithm which is used to group or cluster similar objects as shown in figure 5 which is mainly used for classification.

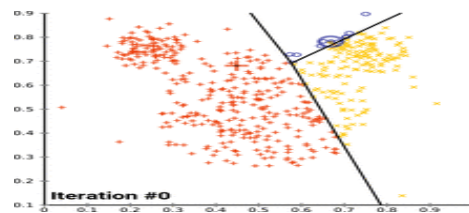


Figure-5 Clustering similar objects

2.4.7 RANDOM-FOREST ALGORITHM

This is another effective ML algorithm which is consisting of several decision trees with them and they have their predicting model having the highest tree i.e the one which gets the majority votes.

2.4.8 CONVOLUTIONAL-NEURAL NETWORKS

This is a deep neural network which most commonly applied for visual imagery which will useful in many field like the computer-vision,agriculture,healthcare etc. As shown in figure 6, in case of machine learning feature extraction is important but in deep learning is also done by the model itself.

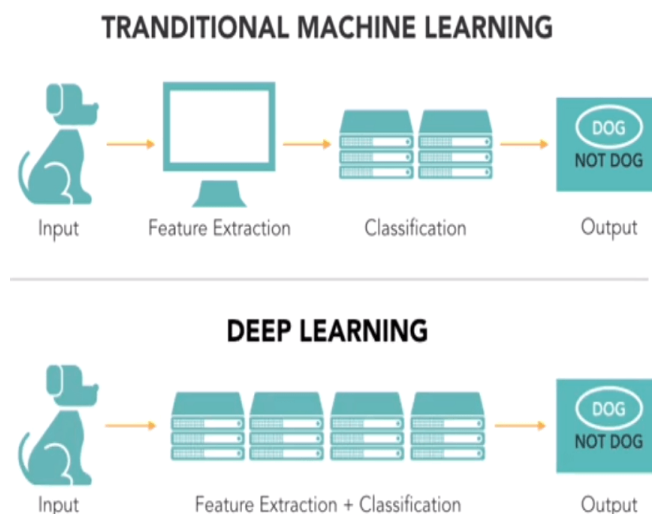


Figure-6 Process Flow of DL in variation with ML

III VARIOUS TECHNIQUES OF ML

3.1 AUTOMATIC RECOGNITION AND CLASSIFICATION OF VARIOUS BIOTIC AND ABIOTIC PADDY CROP STRESSES USING THE FIELD IMAGES

Here they have created a framework which automatically recognizes and classifies paddy crop using deep neural network. They have adopted pretrained VGG-16 CNN model for capturing of images and classification during the booting growth stage. This model has 3*3 convolution and 2*2 pooling which is implemented using python libraries with keras and also tensorflow in the backend for finding paddy crop images. There are totally five convolutional layers which are used. The ReLu function is used in all the hidden layers and also the softmax function is used at the end of the final layer for getting the probability value to be the output as 0 or 1. In the end this model has got an accuracy of 98.7% it could recognize and classify better. To improve the efficiency using more images as input gave better results[1].

3.2 MAPPING AGRICULTURAL LANDSCAPES USING SATELLITE IMAGERY

In this they have actually combined ZiYuan stereo satellite imagery and the SVM, feature extraction, artificial neural network and machine learning algorithms and proposed for surface mined and agricultural landscapes. ANN may be trapped by overfitting and local convergence as a result of high dimension datasets with irrelevant features or redundant information[2]. The satellite data has to be processed with the data features employed. There is also a survey which has to be taken for the fields and the two level land cover schemes were developed and then the training set was obtained based on polygons using stratified random sampling. Later there are different classification models using the SVM, RF, ANN was developed. After the classification model deployment the parameter has to be optimized. For subset based model the accuracy was obtained around 77.6% in RF, 72% in SVM and 64% in ANN. And for the full based model the RF obtained the highest accuracy in 74%, SVM in 68%, ANN in 61% [3].

3.3 MODELLING GROUNDWATER LEVEL CHANGES IN AGRICULTURAL REGIONS

The data is collected from the place which has to be monitored and then using the multilayer perceptron network (which was successfully used in hydrologic modelling) to simulate seasonal groundwater level change. A non-linear regression model was developed for groundwater level change using the perceptron. A logistic sigmoid transfer function was used at [0,1] range. Finally the model had the capability to cover 1124 wells across two large agricultural regions. The output was one neuron that represented seasonal groundwater level change. We constructed the MLP network by connecting layers through a series of two transformation types[4].

3.4 ML ALGORITHMS FOR CLASSIFYING LANDSCAPES USING SPOT 5 HRG IMAGERY

Pixel-based and object-based image analysis approaches were used for classifying broad land cover classes over agricultural landscapes and that are compared using three supervised machine learning algorithms which has a vital role in : decision tree , random forest, and the support vector machine. The results were not significant ,when the same machine learning algorithms were applied. Finally they got an accuracy of 85.4% in pixel based analysis and 83.3% in object based analysis[5].

3.5 AGRICULTURAL MACHINE VISION SYSTEMS

Machine vision is one of the useful technology in the present era it is used in various agricultural fields by automating ,drones and many more.Various techniques were used based machine learning ,deep neural networks, ANN, k-nearest-neighbor, naïve bayes. Advancement of ML with machine vision will make agricultural technologies accurate, robust and low cost. A machine vision could come up with image acquisition and processing that might need a discriminator to classify desire target with high dimensional data. Convincing ML techniques combine a suitable feature extraction and selection procedures with appropriate prediction algorithms[6].

3.6 CROP MANAGEMENT AND DISEASE DETECTION

Here they have calculated the coffee fruits in three categories: harvestable, not harvestable, and fruits with disregarded maturation stage. After which the method estimated the weight and the maturation percentage of the coffee fruits. The aim of this work was to provide information to coffee growers to exactly tell the economic benefits and plan their agricultural work[7] , a new system for the detection of nitrogen stressed, and yellow rust infected and healthy winter wheat canopies based on hierarchical self-organizing classifier and reflectance imaging data which actually aimed to accurately detect for usage of fungicides and fertilizers according to the plant's needs[8].

The main aim of the system was to reduce labor requirements in manual harvesting and handling operations[9].

3.7 LIVESTOCK MANAGEMENT

There are literally two commonly known sub categories of animal welfare and live -stock production. Animal welfare deals with the health and wellbeing of animals, with the most application of ML in monitoring animal behaviour for the first detection of diseases. However, livestock production deals with issues within the production system, where the most scope of ML applications is accurately estimation of economic balances for the producers supported assembly line monitoring.

3.8 SOIL MANAGEMENT

Machine learning will play a major role in soil management which has been used for temperature,moisture,soil drying etc. there are various machine learning algorithms where the computational analysis helps in the evaluation of the soil drying which helps inturn in the agricultural field by automatically increasing the crop yield[10]. Here they have created an AI based agricultural distance education model for crop price prediction and the yield level[13].

3.9 WEED DETECTION USING ML ALGORITHMS AND IOT

Weed detection forms a main threat to the farmers because detection of weeds forms a vital problem for farmers. However ,weed if detected will lead for sustainable crop growth and thus here comes the role of machine learning algorithms along with the sensors integrated will detect and discriminate weeds.

Here eradicate the weed silybum marianum which could cause a great loss hence they have used unmanned aircraft (UAS)for image collection and counter propagation artificial neural network along with multispectral images from the UAS[11]. There is also SVN algorithm which is used for the weed detection[12].

IV. CONCLUSION

Hence we can see that there are various machine learning algorithms which are available and which can make the life of agriculture easier by these technologies.

In future we may get more algorithms and that would again be used by all the fields for its convenience. Than machine learning its subset deep learning and the neural network like the ANN and CNN has a huge scope for minimizing the problems in the agricultural field.

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