

High Precision Agriculture using Machine Learning

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Abstract - In this paper we propose the concept of high precision agriculture. To improve the efficiency of agriculture and reduce the cost we use the concept of Machine learning. Machine learning is a technology that used to train the computer for decision making. We demonstrate different machine learning techniques like Decision Tree Ensemble, Random Forest, Support Vector Machine used in agricultural fields. Satellite are used to keep eye on agricultural field and concept of Image Processing to recognize and label the agriculture fields. The key innovation is to use different machine learning techniques and algorithms to minimize the labour cost, improve quality of crops, increase quantity of crops and maximum profit.

Key Words: Decision Tree Ensemble, Random Forest, Support vector Machine, Image processing, Machine learning, Precision Agriculture, Artificial Intelligence

Motivation — To help the farmer to proper utilize the resource in order to increase the efficiency of agriculture and reduce labour cost. It will bring revolution that will change the upcoming future of farming

1. INTRODUCTION

Nowadays Artificial Intelligence has a very huge scope in different fields like agriculture, medical, research, production, aeronautical field. Here we use the concept of machine learning for the survival of farmers in this today's world [1].

Machine Learning is the field of Artificial Intelligence by use of which we train the computers without explicit programming. Another application of machine learning other than agriculture fields are Weather monitoring system, Medical field, Recommended systems etc.

In machine learning, the data is stored in the form of datasets and different machine learning algorithms are used to train and test the model based on datasets for decision making purpose.

Machine learning has two main types categorized as Supervised and Unsupervised learning.

1.1 Supervised Learning

Supervised learning is a type of algorithm where output of the model is known and we have to map the input features based on output.

Types of Supervised Learning: -

1. Linear Regression.
2. Logistic Regression.
3. Classification.
4. Naïve Bayes Classifier.
5. Support Vector Machine.

1.2 Unsupervised Learning

Unsupervised learning algorithm are trained the model by grouping the unlabelled data into clustering and categories. In this algorithm model works on its own. For example, fraudulent transactions on a credit card.

Types of Unsupervised Learning: -

1. K-means Clustering.
2. k-nearest Neighbours.
3. Hierarchical Clustering
4. Principal Component Analysis.

2. LITERATURE SURVEY

Year	Paper Title	Abstract	Advantages
IEEE/2018	Decision Tree Ensemble vs NN Deep Learning	study of the efficiency of machine learning algorithms applied on an image recognition task.	precision agriculture, which aim is to increase the productivity and maximize the yield of a crop
IEEE/2016	Satellite alerts track deforestation In real time	Satellites are used to monitor the forest and keep an eye on	Satellite are valuable tool For monitoring deforestation, Reducing

		deforestation	the Deforestation by 80%.	2017	Detection of rapped coffee plant	This paper presents a comparison of four features set to detect the red fruits in Coffee plants. An Unmanned Aerial Vehicle is used to obtain high-resolution RGB images of a coffee hall.	Easily classify the Coffee fruits using ANN model
MIT Technology review/2014	Agricultural Drones Relatively cheap drones with advanced sensors and imaging capabilities	Relatively cheap drones with advanced sensors and imaging capabilities are giving farmers new ways to increase yields and reduce crop damage.	Low cost and Easy to use, small GPS modules, incredibly powerful processors				
2016	Vineyard detection from unmanned Ariel system images	A new method automatically detect vine rows in Gray-scale aerial images is presented. It is constituted by three main steps based on dynamic segmentation	very limited error rate, it is robust against irregular illumination	2019	User Controlled Precision Irrigation System	This paper is an attempt to recognize and test the intelligent and smart irrigation system.	Time efficient, Low cost, Save lots of water, Saves Money.
2010	Assessing Object Based Classification: Advantages and Limitations	We classify the images based on Object based classification and pixel-based classification and compare them.	Reduces class pixel variation	2020	AI Down on the Farm	ML has been used to model aspects of agricultural production systems and provide information useful for farm-level management decisions.	Precise and efficient irrigation systems, Increase production

Chart -1: Literature Survey

3. ALGORITHM SURVEY

We use different Machine learning algorithms to increase precision of agriculture. These techniques and algorithms are use to increase the accuracy of predicted data by training and testing on different algorithms.

1. Image Processing is used to identify and label the images based on train/test datasets. In this, different operations are performed on images. Image processing includes Image Detection, Image Recognition, and Image Classification.

Image Detection is a technique in which images are processed and detection of object is done. For example, detection of vineyard and roads in images.

Image Classification is a method used to label the different objects bases on different classes. For example, classifying the different objects based on vineyard or roads.

Image recognition is process to identify the object based on detection and classification. For example, labelling the object as vineyard or road

In this scenario this technique is to identify and recognize the Ariel images recorded by the HR cameras attached to the Satellite or Unmanned Ariel Vehicles (UAV) [2]and then image processing is done on the image datasets and they are classified as vineyard or road based on percentage. They analyse the images and helps in detection of multiple zones.

2. Decision Tree Ensemble is combination of different decision trees to improve the accuracy of prediction rather than using single Decision tree. Each set in DTE went through Data Preparation process in which features

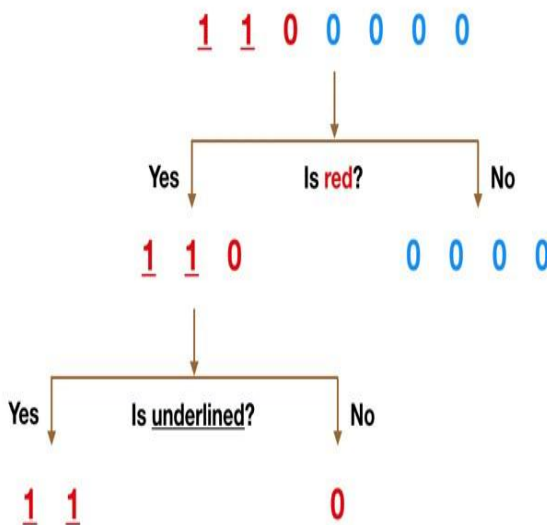


Fig-1: Example of DTE Tree

elimination is done in which minimal number of features are required for classification. In feature elimination features are selected that reduces the overall accuracy and increases the computational time. Then, Model Evaluation is done in which comparison is done between different techniques and best one is chosen that gives the best overall accuracy and less standard errors. Here DTE gives the best overall accuracy in detecting vineyards than other techniques. DTE provides accuracy up to 97% which is 3% more than other methods.

3. Support Vector Machine (SVM) [3] is a type of algorithm that can be implemented to classify between two different

groups. Hyperplane is used to divide the plane in to two parts. We use SVM to calculate the percentage of vineyard on the tiles and classify them as vineyard or road. After obtaining the input data and applying the pre-processing method, the classification or prediction system can be done based on train/test split method.

4. CONCLUSION

From the above survey, it can be concluded that the Machine learning algorithms and techniques can be very useful in increasing efficiency (quality, quantity etc.) of agriculture and reducing the cost. Machine Learning is most fastest growing technical field due to its variety of applications and different types of functions it performs. DTE method is most useful in detecting the farm from UAV vehicle and used to give us high efficiency than the past method. By using Decision Tree Ensemble (DTE) efficiency increases from 94% to 97%. DTE method is very efficient in detecting vineyard than other methods whereas less efficient in detecting roads than Other methods. Machine Learning is also useful in agricultural field by using different AI devices and techniques like automated irrigation System, Crop and weed detection system, drones for spraying pesticides and robots for reducing human labour.

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