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# A Review On Decision Making On Agriculture Data Mining Technique

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**Abstract: Extracting knowledge and patterns from large datasets is data mining. Data processing and data retrieval are essential for farmers in the agricultural area since they have to deal with a lot of information. As a result, the management and organization of this data requires the use of proper procedures and techniques. Classification is the process of generalizing existing structure to fit new information. A decision tree is used to represent the classification process. These are the most often used classification algorithm because of the ease with which they can be implemented, as well as the ease with which they can be understood in comparison to other classification algorithms. With regard to new areas of agricultural research, data mining can be used. Data mining can be used to develop and adapt efficient strategies for solving complicated agricultural challenges. This document introduces some of the most essential agricultural data mining approaches. Miners in agriculture are pioneers in a new field of groundwork. In the agricultural area, data mining techniques can be used effectively since they can predict issues before they occur. Data mining techniques are used in this study to try and get the required results. The purpose of the study was to examine the most effective techniques.**

**Keywords: Data Mining, Agriculture, Knowledge discover system, Issues in Agriculture, Applications of Agriculture data mining.**

## I. INTRODUCTION

The agricultural industry has benefited significantly from recent technological advancements. Its forethought has enabled us to plant crops in the middle of a desert, which would have been impossible otherwise. Technical progress has increased agricultural productivity and contributed to the development of the agricultural sector [1]. The selection and implementation of technologies in the past was done in order to increase the quantity of produce, the productivity of farmers, and the revenue of farmers. Crop yields are influenced by a range of factors, including physical, market, and environmental considerations, among other things. While conducting this research, we are primarily concerned with physical variables like water and fertiliser requirements for specific crops, as well as the environmental conditions in which these crops are grown (available nutrients in soil).Additional to this, fertiliser applications for crop production should be dependent on the physical and environmental characteristics of the growing environment.

Using knowledge-driven decisions as a starting point, data mining can forecast future trends and behaviours. It goes beyond the summarization of past occurrences, which is commonly offered by relevant instruments typical of decision support systems. Data mining is the process of collecting and analysing data [2]. The data mining techniques that are currently available are the result of years of research and experimentation. It must meet the conditions outlined below in order to be used by commercial enterprises.

- Data mining Algorithms
- Massive data collection
- Powerful multiprocessor computers

### *1.1 Agriculture Issues*

A significant portion of agriculture is negatively affected by weather-induced climate change. According to climate research, several agricultural specialists have anticipated a 30 percent drop in agricultural output by 2050 as a result of catastrophic climate change [3]. The quality of the crop is being degraded as a result of climate change's impact on the characteristics of agriculture that have already been identified and documented.

Plant diseases and a lack of suitable pesticide management systems have a substantial impact on agricultural yield, as has a lack of adequate pesticide management methods [4]. Sensors that are connected to the Internet of Things (IoT) may be able to collect photos of plants that are in risk of dying and then make an appropriate and timely decision to save the plant. Plant pathologists rely on image preprocessing and the Internet of Things to make accurate disease detection and diagnostic determinations.

The amount of fertilizers used throughout the farming process has a significant impact on the yield of the crop. It is important for farmers to make precise decisions about chemical use that are based on crop characteristics [5]. The usage of fertilizers, which depletes the plant's nutritional supply, is a significant contributor to the development of many acute illnesses.

The farmer should decide on an estimate of the amount of water he or she will require for agriculture ahead of time. There are numerous elements that influence water quality, including climate, season, soil type, crop variety, and growth stage [6]. When a crop is being cultivated, the majority of the water contained within it is lost through transpiration and evaporation.

In this study, the price of crops is taken into consideration. Farmers may make an informed decision about when to sell their plants after they have the price information for the crop in their possession. The maturity of fruit can be determined using the sensors built into a smartphone. Photographs of green fruits are taken by the camera in order to determine their level of ripeness. Producers and sellers can collaborate to determine when a thing is ready to be marketed by utilising this technological advancement [7]. The agriculture-related difficulties are depicted in the figure.

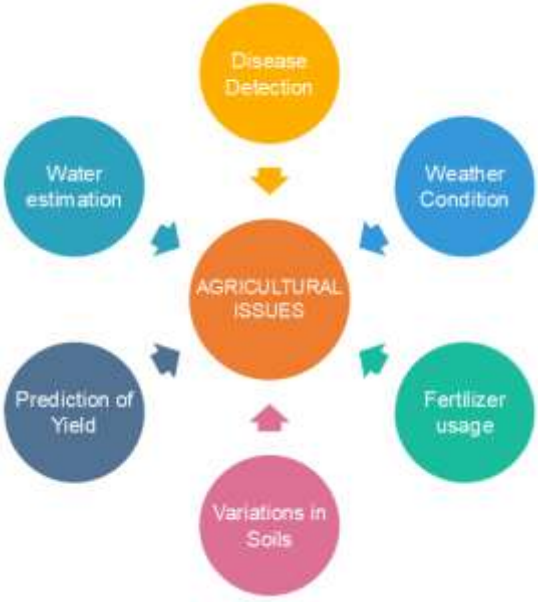


**Fig. 1: Issue influencing in the Agriculture**

## II. BACKGROUND

Farmers in rural areas are still struggling to achieve their bare essential requirements. Farmers in rural areas struggle despite their best efforts because they don't have access to excellent soil (fertilisers) or seed, and their crops are afflicted by diseases and pests. Yet, despite this, they continue to rely on antiquated and inefficient watering techniques.

Farmers are frequently unable to find a market that would allow them to sell their products on time, which makes it difficult for them to earn a fair price for their produce. This is especially true for farmers who grow vegetables and fruits [8]. They are unable to make a sufficient income because they are reliant on middlemen who take advantage of their illiteracy or lack of understanding of the market. Farmers in agriculture are employing data mining techniques to address the aforementioned difficulties and create a high level of productivity.

In order to achieve this, the Data Mining method must first identify and extract useful information from a large amount of data. The procedure then converts the existing data set into a unique human-understandable format that may be used for some future purpose. Solutions to agricultural challenges can be found through data mining techniques [9]. In this work, the k-means and k-nearest neighbour algorithms, as well as other weather factors, are used to predict pollution in the atmosphere, and the results are presented.

Agribusiness metrics, environmental variables, and geographic characteristics are all covered by these data sets. It is required to analyse these data in order to uncover meaningful trends that can then be utilised to evaluate agricultural productivity. Through the use of satellites and the internet, it is possible to find links or patterns among dozens of fields in relational databases, allowing for more accurate pattern detection [10]. Upon completion of processing, the system will deliver results that are tailored to the user's needs, such as the amount of water required, the type of fertiliser that should be used, and the current market price for the product, as well as information on how to properly store the produce in cold storage after harvest. The amount of water required by a crop is calculated by the system based on soil conditions, crop stage, and other elements such as temperature and humidity. The application of fertiliser is dictated by the condition of the soil and the state of the crop in question. Micronutrients and macronutrients are both critical for the health of the soil ecosystem. Environmental variables such as humidity, pollution, temperature, and so on have a significant impact on the application of pesticides. Several physical and environmental factors have an impact on crop production, including the use of water, fertiliser, and pesticide. Market data that is up-to-date and accurate is essential.

**Fig. 2: Process of Knowledge discover system**

It is a set of techniques and algorithms that is employed solely for the goal of extracting information from and patterning data that is referred to as "data mining." It makes it easier to discover previously unknown and possibly exciting patterns in huge datasets[11], which can lead to more interesting discoveries. It is the process of data mining [12] that analyses and summarises data from many perspectives. It is also referred to as knowledge discovery in some circles. Research, forecasting, and classification are just a few of the applications for this "mined" data in the agriculture industry. It is necessary to acquire data mining techniques in order to execute effective data analysis. Data mining methods in the agricultural industry are to be examined in this study.

## III. DATAMINING TECHNIQUES

In agriculture and related industries, a variety of data mining approaches are being employed. A few techniques are mentioned in this section. To classify soil datasets, GA Trees, Fuzzy classification rules, and fuzzy C-Means algorithms can all be employed, among other things. Data mining classification methodologies such as Nearest Neighbor, Neural Networks,Regression, Bayesian techniques, and Support Vector Machines are all in use, as are a variety of data mining classification strategies [13].

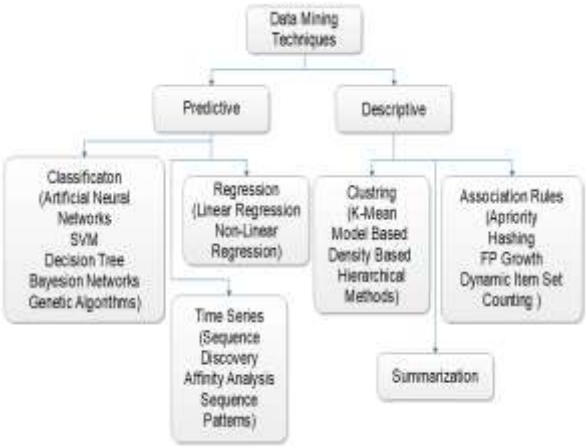


**Fig. 3: Data Mining Techniques**

In most cases, the purpose of data mining technology is to extract meaningful information from enormous databases and then do further research on that information. But there are exceptions.

In supervised learning, the classification algorithm is grouped together with the term classification algorithm. The use of labelled samples, as well as the construction of classifiers based on specific quantitative standards, are both required components of supervised learning techniques [14]. Based on the values of similar attributes, a data set's data objects are divided into pre-created class clusters. Categorization approaches such as the decision tree methodology and the neural network algorithm have become increasingly popular.

For the most part, the goal of a clustering algorithm is to sort data into smaller, more manageable chunks. As shown in the example above, if data objects are clustered together, it means that they share a high degree of similarity. The degree of similarity between them falls below the predetermined threshold [15] when they are separated into various groups. Depending on how far something is measured, how dense something is measured, and so on, there are many different categories to choose from. When it comes to clustering, an approach called unsupervised machine learning is applied.

Scientists such as Rakesh Apwal were among the first to suggest association analysis, which is a method of examining the links between different individuals in a dataset [16]. It is possible to discover the hidden network of associations between data item persons and their attributes, as well aspreviously unknown, useful, and relevant information or patterns, by employing data association analysis.

Agrawal and Srikant were the first to suggest a sequence pattern, according to their research. A law or trend can be used to describe the progression of time or another series [17].

In [18] Deviation analysis can be used to identify, define, and further analyse objects that vary from the norm or standard. Depending on the object features, In some cases, the deviation may yield valuable information, and analysis results may differ from what was anticipated. Pest management, farm management, and crop management systems all benefit from the data generated by Decision Support Systems (DSS). These systems are quite sluggish. As a result, improved Internet of Things-based technologies could assist farmers in making better crop fertilisation options [19]. Many authors have made use of data mining techniques with small samples. The soil type, canal network, weather, and crop kind are all taken into consideration by the decision support system model. In India, agricultural management decision support systems are widely used in the field of agriculture. Additionally, the uncertainty of expected events contributes to the level of concern. Crop productivity is one example of an activity that has yielded good results when DSS has been used.

## IV. LITRATURE SURVEY

In [20] built an intelligent framework for diverse items that makes use of time series models to estimate the short-term market size of the products. The system necessitates a number of activities, including the collecting of online selling information, the pre-processing of raw materials, and the usage of an ARIMA design. The efficiency measurements Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE) have been employed in the technical prediction accuracy study to determine the accuracy of technical predictions. PriceMe's website provided the sales data that was used in this report. They also compared and contrasted the ARIMA system with the Moving Averagemodel, as well (MA). In the instance of the MA system, the anticipated patterns described by a flat line are easily discernible from the actual patterns. The ARIMA system did not do well when it came to projecting long-term patterns.

In [21] has presented a novel decision-making help framework for agricultural commodity price forecasting, which may be found in [21]. Farmers benefited from this programme since it allowed them to anticipate receiving a significant sum for their crops and projecting the best harvest value. Farmers can also use this to test the worth of different crops based on previous results. Farmers will be able to make better decisions as a result of this strategy, allowing them to command higher market prices for their crops.

In [22], a decision tree method was utilised to forecast soil fertility using historical data. It was discovered that the performance of the J48 decision tree method might be improved by collecting data from a private soil testing facility in Pune and applying attribute selection and boosting techniques to it. J48 is a Java implementation of the C4.5 algorithm that is available as open source software. It is a statistical classifier based on the Id3 algorithm, which is commonly used in machine learning applications. It operates on the basis of the concept of information entropy. Using C4.5 is generated, with each node dividing the classes according to the amount of information gained. The property with the greatest normalised information gain is chosen as a splitting criterion. Predicted soil fertility levels ranged from very low to somewhat high depending on their forecasts of what would happen. A further improvement of 96.73 percent was achieved by using the selection and boosting technique, according to study authors.

Another problem, according to [23], is to supply logistics in rural areas without boosting farmer's prices or cash on delivery payments. Each crop type has its own fertiliser policy, which has been documented. If the temperature has reached the desired temperature range for the crop's sowing date and the temperature has reached the desired temperature range for the crop's sowing date, the farmer will send out notifications about the application of fertiliser, herbicide as scheduled, disease pesticide, and weather alerts. The crop sowing concepts that are required are dependent on the type of soil and geographic area. The farmer has been provided with the most recent national crop pricing in order to add value to his operation. Using GPS, this system incorporates new Internet and mobile communications networks to provide safe and efficient agriculture operations.

Several authors [24] have written about data mining tools and approaches in agriculture. K-Nearest Neighbor clustering, K-Means clustering, Support Vector Machines and Artificial Neural Networks are examples of more modern data mining approaches. They are investigating the issue of agriculture price forecasts. This has grown into a very serious agricultural issue in recent years, and it can only be resolved with the help of the knowledge currently accessible. The researchers developed relevant information models that aided in the achievement of high precision and generality in the prediction of price movements.

Findings from the literature demonstrate that various data mining and big data analytics technologies are being used to forecast the outcome of agricultural data. Many authors have chosen not to make use of the massive amount of data available. When it comes to analysing enormous amounts of data, data mining techniques are woefully inadequate. As a result, the notion of big data analytics is applied in order to deal with them. Farmers are dissatisfied with the crop production options now accessible since the solutions are not tailored to the individual soil nutrient requirements. In the meantime, farmers continue to incur significant losses as a result of lower crop output, despite the large sums invested on agricultural maintenance. The most essential part of this study is the development of a revolutionary Smart Information System that can be accessed through a mobile device and provides appropriate solutions to farmers for enhancing productivity while also assisting in the preservation of agricultural land.

## V. APPLICATIONS OF AGRICULTURE DATA MINING

Engineering, medicine, education and marketing are just a few of the areas in which data mining has been used successfully. The best soil and climate

conditions for growing a particular crop, as well as the ideal time to conduct other agricultural tasks, are frequently sought for by farmers.

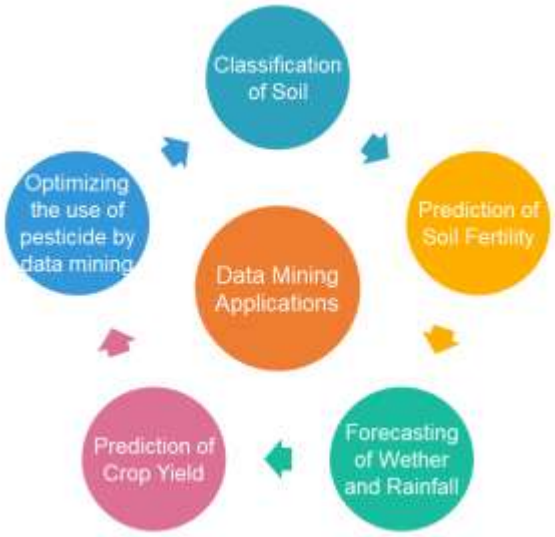


**Fig. 4: Applications of Agriculture data mining techniques**

Recent years have seen numerous studies looking into how data mining might benefit agricultural endeavours. The image depicts the various ways in which data mining techniques are put to use.

### *5.1 Classification of Soil*

When it comes to determining soil fertility, the increased clustering approach is really effective. With the use of GPS, the k-means approach is used to classify soil, and with the help of colour photographs, it is used to classify plant, soil, and residue regions. The decision tree method is also used to forecast soil fertility, which is another use. It is also possible to categorise soil profiles in big experimental datasets using nave Bayesian classification. Remote sensing techniques were used to assess plant stress, notably nutrient insufficiency, using spectral reflectance patterns in the visible and infrared ranges. This approach has the potential to lower fertiliser expenditures while increasing agricultural yields.

### *5.2 Weather and rain forecasting*

In order to mimic daily precipitation and other weather factors, the k-nearest neighbour approach can be utilised [25]. With the information gleaned, soil water features such as the lower and upper limits of plant water availability as well as plant extractable soil water can be determined. Moreover (PEWS). Because of remote sensing from space, it is now more easier to see woods and agricultural land than it was previously. The sheer volumes of potentially useful data generated by these sensors on a daily basis is staggering. This abundance of data also presents difficulties for academics in terms of data interpretation and classification. Scientific techniques such as k-means, k-nearest neighbour, and artificial neural networks are used to recognize photos captured remotely.

Rainfall prediction was accomplished through the use of artificial neural networks and the Box-Jenkins approach in [26]. It is being used in hydrology to predict daily water demand and flow using artificial neural networks.

In[27] forecasted the weather based on weather data and previously recorded parameters. Artificial neural networks and back propagation techniques can be used to forecast future environmental conditions if any of the recorded features change. State agricultural institutes and government kissan portals provide farmers with information about weather, crop sowing, disease and pest prevalence/prevention in various geographical regions and agro-ecosystems, as well as crop production and harvesting practises.

### *5.3 Prediction of Crop Yield*

Crop yield estimation and analysis are carried out using K-means clustering. Agribusiness data mining applications for crop yield prediction were described in [28]. Farmers' previous expertise with a particular land, crop, and environment was traditionally relied upon to anticipate yields. Additional information, such as the likelihood of membership and the grade of membership in fuzzy set theory, could be taken into account. Soybean blooming and maturity dates, as well as water resource variables, are predicted by a neural network.

How the climate impacts the primary kharif and rabi crops in Madhya Pradesh's Bhopal region. Relative humidity, temperature, and rainfall were found to be the most important determinants of soybean crop output using decision tree analysis. Paddy crop yields in Bangladesh were shown to be affected by rainfall, which was followed by relative evaporation and humidity. Weather conditions have a significant impact on wheat crop yield, with temperature, relative humidity, and rainfall all playing a role. Bayesian classification validated the results. The rules of this results helped to uncover the aspects that contribute to excellent agricultural productivity.

### *5.4 Prediction of Soil Fertility*

When it comes to agriculture, data mining techniques are very popular. Agronomic research has benefited from advances in computation, automation, and data mining. Data mining is becoming increasingly popular. But data mining in agricultural soil records is a very new study topic, having only been discovered in 2007. Data is harvested in the same way as crops are gathered in agriculture. Making inferences about information from massive amounts of data is a difficult task at the moment. The soil data in this study was analysedutilising data mining techniques.

### *5.5 Pesticide by use of data mining*

Farmers would benefit from the service since it would assist them in finding better pesticides and increasing their profitability. As a result, when farm revenue increases, so does India's overall income. Farmers will have an easier time determining which pesticides to apply in which situations since we used data mining to locate better pesticides. Farmers can find a solution to their problem by simply inquiring about pests that are specific to their land type, geographic location, crop, and state of health. If certain farmers are unable to discover the pesticides that have been advised in the future, they will be able to use the image update to locate them.

## VI. CONCLUSION

There have been incredible breakthroughs in the development of agricultural software programmes that enable for faster information collecting. Many farmers continue to employ antiquated practices, resulting in poorer yields and crop development that is highly dependent on weather and other factors. The availability of nutrients in the soil is critical to sustaining crop development and increasing productivity in agricultural fields. Farmers utilise soil fertility levels to evaluate the nutrient content of the soil, the soil type, the pH value, the EC (Electrical Conductivity) value, and the texture of the soil in order to determine the inadequacies of the soil. Data mining has recently sparked a great deal of attention since it is a novel approach to searching for hidden information in enormous volumes of data. For example, the Decision Tree is gaining in popularity because to its high data processing efficiency and simplicity. It is already widely used in a range of industries and is becoming increasingly popular. The yield of crops is predicted by water, soil texture, and climate. Our country must develop a vast organic agriculture production. Using data mining techniques in agriculture can cut food production costs and increase productivity, resulting in better business decisions.

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