A Survey on Agriculture Crop Yield Prediction Using Machine Learning

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ABSTRACT- Data Mining is the maximum plausible method of the prevailing virtual international for reading mass of records units to gain left out relationship. The approach used for the evaluation of statistical records over a time frame is the time collection evaluation. This method is clinical and dependable in forecasting occasions to observe over a period. Manufacturing excellence can be consistently achieved through the application of time series analysis. The prominent methodologies employed for this purpose include support vector machines. Support vector machine is the proposed ensemble version used to task the crop manufacturing over a time frame. This ensemble version is as compared to support vector machine strategies. Agriculture is a vital sector that feeds the world's growing population, and accurate crop yield prediction plays a crucial role in optimizing resource allocation and ensuring food security. Traditional methods of predicting crop yields often rely on historical data and manual observations, which are limited in accuracy and scalability.
Keywords: Agriculture, Crop prediction, Machine learning

1. INTRODUCTION

This extraction is the from statistics units become executed best via way of means of guide methods. But now with the incredible improvement of pc technology, series of statistics set, type and garage as splendidly increased. This has made massive alternate in Pattern recognition. In order to discover specific sample from the massive statistics units, the utility is advanced via way of means of the usage of unique automatic set of rules within side the area of Data mining. Machine getting to know has been advanced in Data Mining as a version in getting to know idea via way of means of the usage of the pc. Given massive statistics units, prediction of recent units of statistics are advanced the usage of getting to know idea via way of means of this version via way of means of schooling and testing. With the intention of predicting an outcome, growing a version with the item of producing type is popularly known as modeling. The type in statistics mining method is predicting the price of a goal variable via way of means of producing a version primarily based totally on few attributes express variable. By this method, type of a given statistics is primarily based totally on elegance labels and schooling. The time collection statistics is statistical statistics measured at a selected time c program language period over a period. The evaluation main to end this statistics for destiny prediction is known as time collection evaluation. A Giant vicinity for time collection evaluation is fashion in crop manufacturing.

II. ENHANCING CROP YIELD PREDICTION

Crop manufacturing fashion is usually recommended the usage of statistics mining predictive strategies consisting of Support Vector machines and Naive Bayes which also can be referred as classifier strategies within side the evaluation of time collection statistics units is used. For the cause of decreasing the mistake price and to growth the prediction accuracy, boosting is likewise carried out. The define of this painting is illustrated via way of means of the use of a determine on this section. At the start stage, this big records set is accomplished into pre-processing and is referred to as Data Pre-processing. Machine learning algorithms and techniques, coupled with advancements in data collection, have provided the agricultural industry with powerful tools to make more precise and data-driven predictions. By harnessing the vast amount of data generated by satellites, weather stations, soil sensors, and other sources, machine learning models can analyze complex patterns and relationships that impact crop growth and output. This transformation in crop yield prediction has the potential to revolutionize agriculture by enabling farmers to make informed decisions about planting, irrigation, fertilization, and harvesting, ultimately leading to increased crop yield.

III. ENSEMBLE MACHINE LEARNING

The massive collections of data stored on disparate structures very rapidly became overwhelming. This initial chaos has led to the creation of structured databases and database management systems (DBMS). The efficient database management systems have been very important assets for management of a large corpus of data and especially for effective and efficient retrieval of particular information from a large collection whenever needed. The More databases being used has led to a lot of different information being collected recently. It have far more information than we can handle: from business transactions and scientific data, to satellite pictures, text reports and military intelligence. Information retrieval is simply not enough anymore for decision- making. When we have a lot of data, we need new ways to help us make better decisions. This includes summarizing data automatically, getting the most important information, and finding patterns in raw

data. With a huge amount of data stored in files and databases, it's becoming more important, and sometimes necessary, to have strong tools to analyze and understand this data.

IV. DATA MINING TECHNIQUES

Data mining uses techniques that have been around for a long time, but they've only recently become reliable and scalable tools, often doing better than older statistical methods. Even though data mining is still new, it's becoming popular and widespread. However, before it becomes a regular, grown-up, and trusted field, there are still some issues to deal with. Some of these issues are talked about below. Keep in mind that these issues are not the only ones, and they are not listed in any particular order. Security is a big problem when data is collected and shared for making important decisions. Especially when gathering information for things like understanding customer behavior, profiling users, and connecting personal data with other information, a lot of private and sensitive data about people or companies is collected and stored. This becomes a problem because of the private nature of the data and the risk of illegal access. Also, data mining could reveal new hidden knowledge about individuals or groups that might go against privacy policies, especially if this information is
shared with others. Another problem that comes up is making sure that data mining is used in the right way.

Usually, linear algorithms are the standard. In a similar idea, instead of using the entire set of data, we can use a sample for mining. But, there are concerns about how complete the sample is and how we choose it. Other things to think about for performance are updating bit by bit and doing things in parallel. Without a doubt, doing things in parallel can help with the size issue if we can break the dataset into parts and then put the results together later. Updating bit by bit is important for combining results from doing things in parallel or updating data mining results when new data is available, without having to re - analyze the whole dataset. In agriculture crop yield prediction, data mining techniques play a pivotal role in extracting meaningful insights from diverse datasets. Farmers can employ various methods such as classification, regression, and clustering to analyze historical data on crop yields, soil properties, weather patterns, and farming practices. Classification techniques aid in categorizing crops based on growth patterns and environmental factors, enabling farmers to make informed decisions regarding crop selection and management strategies. Regression analysis helps predict crop yields based on parameters like temperature, rainfall, and soil nutrients, allowing for proactive planning and resource allocation. Additionally, clustering algorithms can identify distinct patterns within datasets, aiding in the identification of localized environmental conditions that may impact crop productivity.

PARAMETRIC FAILURES AND VARIABILITY IN INTEGRATED CIRCUITS

Process variations can be a cause of parametric failures. Various types of integrated circuits are speed-binned, meaning they are grouped based on their performance. Systematic issues, such as lithographic variation, which is pattern-dependent, can cause catastrophic line shortening, preventing gates from forming and resulting in functional failure. A milder form of lithographic variation, like gate length variation, can lead to gates on critical paths speeding up excessively, causing hold-time violations under specific voltage and temperature conditions. The analysis of chip failures and subsequent yield loss is an active area of research, and there is limited consensus on yield metrics and calculation methods in this domain. Using Monte Carlo simulations helps us handle different distributions and connections more effectively. In the analysis of timing in statistics, whether it's about space, logic, or other factors, correlations are crucial. Looking at it from a foundry's point of view (where things are made), it's challenging to understand the process completely—figuring out all the variations, how much they vary, calculating the connections between them, and determining how far they reach in space. It gets even trickier because many of these variations interact systematically with the layout and can't be easily separated into different parts within or between components. Despite this complexity, as the variations increase in scale and sources, using statistical power and performance analysis along with accurate modeling of systematic variations will make parametric yield analysis a standard part of the design approval process.

2. LITERATURE REVIEW

PATTERN BASED SEQUENCE CLASSIFICATION

Sequence classification is a big task in data mining.[1] It deals with sorting sequences into different groups using rules made from interesting patterns found in a set of labeled sequences and their classes. We measure how interesting a pattern is in a sequence group by looking at how often it appears and how well it sticks together within that group. We then use these patterns to make confident rules for classification. We have two ways to build a classifier. The first one is based on a better version of the current method that uses association rules for classification. The second way ranks the rules by how valuable they are for new data. Our experiments show that our rule-based classifiers are better than other similar ones in terms of accuracy and consistency. We also tried several models that use different pattern types as features to represent each

sequence as a feature list. Then apply a variety of machine learning algorithms for sequence classification, experimentally demonstrating that the patterns discover represent the sequences well, and prove effective for the classification task. The sequence classification method based on interesting patterns named SCIP. Through experimental evaluation, we show that the SCIP rule based classifiers in most cases provide higher classification accuracy compared to existing methods. The experimental results show that SCIP is not overly sensitive to the setting of a minimum support threshold or a minimum confidence threshold. [1] In SCIP method proved to be scalable, with runtimes dependent on the minimum support threshold and the number of data 13 objects. What is more, by using the discovered patterns as input for the number of learning-based classification algorithms, demonstrate that our pattern mining method is effective in finding informative patterns to represent the sequences, leading to classification accuracy that is in most cases higher than the baselines.

2.2 A BAYESIAN CLASSIFICATION APPROACH USING CLASSSPECIFIC FEATURES FOR TEXT CATEGORIZATION

To apply these class- dependent features for classification, follow Bag gens PDF Projection Theorem to reconstruct PDFs in raw data space from the class-specific PDFs in low-dimensional feature space, and build a Bayes classification rule. One noticeable significance of our approach is that most feature selection criteria, such as Information Gain (IG) and Maximum Discrimination (MD), can be easily incorporated into our approach.[2] It evaluate our method's classification performance on several real-world benchmark data sets, compared with the stateof-the-art feature selection approaches. The superior results demonstrate the effectiveness of the proposed approach and further indicate its wide potential applications in text categorization. Bayesian classification approach for automatic text categorization using class-specific features. In contrast to the conventional feature selection methods, it allows to choose the most important features for each class. To apply the class specific features for classification, derived a new naive Bayes rule following Bag gens toss's PDF Projection Theorem. One important advantage of our method is that many existing feature selection criteria can be easily incorporated. The experiments conducted on several data sets have shown promising performance improvement compared with the state of-the-art feature selection methods.

2.3 VISUALLY COMPARING WEATHER FEATURES IN FORECASTS

Meteorologists use visualization to understand and analyze weather forecasts, looking at how different weather features behave and relate to each other. [3] In a study with meteorologists who help make decisions, two main challenges in weather visualization were found and addressed. There was a problem with using inconsistent and not very effective visual methods across different types of visualizations. There was a lack of support for directly showing certain things visually. The study aimed to describe the problems and data related to forecasting the weather. To deal with these challenges, the researchers suggested using certain visual methods that combine existing ways meteorologists usually show things with effective visualization methods. They also introduced some techniques to start directly showing how different features interact in a forecast with multiple possibilities. All these ideas were put into a prototype tool, and the researchers talked about the practical challenges they faced when working with weather data. The study shared insights into the problems connected to forecasting the weather and suggested ways to improve how things are shown visually in this field. Outline a system for informed defaults that allow meteorologists without visualization expertise to generate a wide variety of effective visualizations based on current meteorological conventions and visualization principles.

2.4 ENTROPY-BASED COMBINING PREDICTION OF GREY TIME SERIES AND ITS APPLICATION

The prediction of unit crop yield is a crucial and extensively studied topic with significant implications for macroeconomic regulation and local agricultural adjustments. Grey system theory and neural networks have been separately applied to predict various fields with positive outcomes. [4] In the integration of Grey system theory and neural networks for unit crop yield prediction has been relatively unexplored, despite its potential applications. This paper introduces a novel combining prediction model for unit crop yield time series, based on the concept of information entropy. The model determines weights for the grey system forecasting model and RBF (radial basis function) neural network forecasting model. By combining the merits of both models, the proposed approach provides a comprehensive reflection of social production levels and environmental factors. This combined model is considered less risky in practice and more intuitive compared to traditional models. Accurate and rational predictions are crucial for decision-making in agriculture, benefiting farmers, markets, and public authorities. While combining models is often viewed as a successful alternative, it's important to note that the experimental results indicate that combining forecasts may not always outperform the best individual forecasts. Despite this, the proposed combining prediction model addresses the respective

merits and theoretical limitations of individual models, offering a comprehensive perspective on social production levels and environmental factors.

2.5 A COMBINATION OF FEATURE EXTRACTION METHODS WITH AN ENSEMBLE OF DIFFERENT CLASSIFIERS FOR PROTEIN STRUCTURAL CLASS PREDICTION PROBLEM

Gaining a deeper insight into the structural class of a specific protein offers valuable insights into its overall folding pattern and domain. [5] This understanding can directly contribute essential details about the protein's general tertiary structure, significantly influencing the determination of its function and aiding in drug design. Although pattern recognition-based approaches have made substantial improvements in addressing this issue, it remains an unsolved challenge in bioinformatics, requiring further attention and exploration. The suggested feature extraction methods are investigated for the most promising attributes, carefully chosen from a diverse set of physicochemical-based characteristics. Finally, by applying an ensemble of different classifiers namely, Adaboost.M1, Log it Boost, Naive Bayes, Multi-Layer Perceptron (MLP), and Support Vector Machine (SVM) enhancement of the protein structural class prediction accuracy for four popular benchmarks. For this, selected 15 different physicochemicalbased attributes and used each of these attributes to extract two kinds of features: 1) overlapped segmented distribution and 2) overlapped segmented autocorrelation. The classification results are reported using the 10- fold cross validation process. The proposed feature extraction method has been found to perform better than the previously reported results for the protein structural class prediction problem for all the four employed benchmarks. 20 This illustrates the importance of the physicochemical-based attributes (that have not been explored earlier for this task) as well as the overlapped segmented-based feature extraction procedure to provide more local and global discriminatory information to tackle the protein structural class prediction problem

2.6 CROP SELECTION METHOD TO MAXIMIZE CROP YIELD RATE USING MACHINE LEARNING TECHNIQUE

Agriculture planning plays a significant role in economic growth and food security of agro-based country. [6] Selection of crop(s) is an important issue for agriculture planning. It depends on various parameters such as production rate, market price and government policies. Many researchers studied prediction of yield rate of crop, prediction of weather, soil classification and crop classification for agriculture planning using statistics methods or machine learning techniques. If there is more than one option to plant a crop at a time using limited land resource, then selection of crop is a puzzle. This paper proposed a method named Crop Selection Method (CSM) to solve crop selection problem, and maximize net yield rate of crop over season and subsequently achieves maximum economic growth of the country. The proposed method may improve net yield rate of crops. Keywords— Climate, RGF (Regularized Greedy Forest), Soil composition, CSM (Crop Selection Method), GBDT (Gradient Boosted
Decision Tree), regularization, regression problem. This paper presents a technique named CSM to select sequence of crops to be planted over season. CSM method may improve net yield rate of crops to be planted over season. The proposed method resolves selection of crop (s) based on prediction yield rate influenced by parameters. Performance and accuracy of CSM method depends on predicted value of influenced parameters, so there is a need to adopt a prediction method with more accuracy and high performance.

3. EXISITING SYSTEM

The current system relies on using machine learning and deep learning to predict crop yields. Through a Systematic Literature Review (SLR), 50 studies were selected from 567 relevant papers, and their methods and features were analyzed. Key features for prediction included temperature, rainfall, and soil type, with Artificial Neural Networks (ANN) being the most widely used machine learning algorithm. Additionally, 30 deep learning based papers were identified, with Convolutional Neural Networks (CNN) emerging as the dominant deep learning algorithm, alongside Long Short Term Memory (LSTM) and Deep Neural Networks (DNN). This comprehensive analysis provides valuable insights for improving crop yield predictions and aiding decision-making in agriculture. The yield of crops as input to suggest a proper crop for farmers. Based on the soil analysis report, fertilizers have been recommended to farmers considering Nitrogen, Phosphorus, Potash and Sulphur nutrients. The incorporation of data fusion techniques has been instrumental in combining heterogeneous data sources, leading to a more holistic and comprehensive analysis of the factors influencing crop yield. By amalgamating diverse datasets and employing sophisticated feature engineering techniques, these systems have significantly improved the robustness and accuracy of crop yield prediction models.

4. PROPOSED SYSTEM

The proposed method forecasting of crop production is done by using the time series data set precisely than the existing models. By using Boost technique, ensemble models such as support vector machine are developed. To bring weak learners who are slow in learning, Prediction technique helps their understanding

when joined with Prediction will make superior classification by giving weak learners with appropriate training. A like method is used for Naive Bayes classifier in which Prediction based Naive Bayes (Naive) is used to generate superior classified data. Depicts the system implementation where the mass of historical crop production data and climate data is gathered and is made to data preprocessing. In the data preprocessing, the data's are combine and selected for the study. The models are generated by classifying the mass of input data by using support vector machine modeling techniques. By integrating data-driven methodologies, we aim to revolutionize the agricultural sector's productivity and sustainability. Our approach involves the utilization of various data sources, including historical crop yield data, climate information, soil characteristics, and satellite imagery. Through the implementation of advanced algorithms such as Random Forest, Support Vector Machines, and Neural Networks, we can effectively model the complex relationships between these diverse datasets and predict crop yields with a high degree of precision. Through the seamless integration of machine learning techniques, our proposed system strives to be a cornerstone advancement of sustainable efficient agricultural practices. These systems heavily rely on external factors such as weather patterns, which are subject to unpredictable changes and natural variations.

5. ARCHITECTURE DIAGRAM

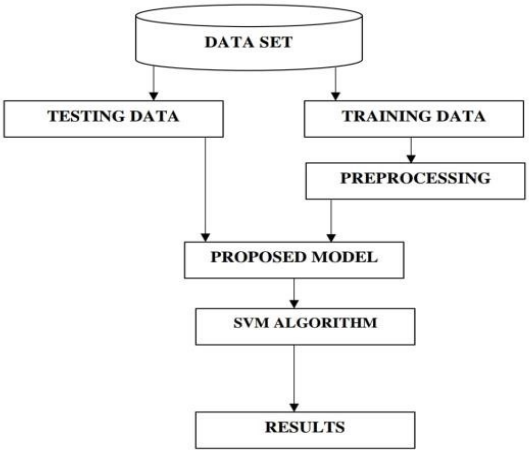

Fig no : 1

6. RESULT ANALYSIS

When using machine learning to predict crop yields, it's important to follow a step by-step approach for a thorough evaluation. First, we split the dataset into training, validation, and test sets. The training set helps the model learn, the validation set fine-tunes it, and the test set checks how well it does in the end. We then use common machine learning methods like regression models (such as linear regression, decision trees, and random forests) and neural networks. To see how good the models are, we use evaluation metrics like Mean Absolute Error (MAE), Mean Squared Error (MSE), Root Mean Squared Error (RMSE), and R-squared (R2), depending on the problem. We compare how well the models perform, and to make sure our results are reliable, we use cross-validation techniques like k-fold cross-validation. Visualization techniques, such as scatter plots and residual plots, aid in understanding the model's behaviour. Error analysis is crucial for identifying instances where the model may perform sub optimally, offering insights for potential enhancements. The model is rigorously tested on a separate test set to gauge its generalization capabilities. Deployment considerations, including scalability and interpretability, are taken into account if the model is intended for real-world application.

7. CONCLUSION

The time series analysis of crop yield prediction is subjected to analysis It may be concluded from the results that there is good amount of perfection in accuracy of prediction and also good amount of fall in the percentage of accuracy in the proposed techniques. Future research can enlighten the study whether by changing the technique produces better results or by increasing the input data set for the same technique results change in the findings. Importance of crop prediction is highly needed for agriculture and economy. Continuous research for improving new methods of prediction would be fruitful. This project is a beginning for further research in forecasting.

8. FUTURE WORK

Future work in crop yield prediction using machine learning holds great promise for addressing the evolving challenges in agriculture and ensuring food security. Integration of additional data sources: Explore the inclusion of emerging data sources such as remote sensing data, drones, and Internet of Things (IoT) sensors to provide more detailed and real-time information about crops and environmental conditions. Incorporate genetic and genomic information to better understand crop traits and their interaction with environmental factors, enabling the development of more precise predictive models.

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