International Journal for Modern Trends in Science and Technology, 9(03): 46-50, 2023

ISSN: 2455-3778 online
DOI: https://doi.org/10.46501/IJMTST0903006
Available online at: http://www.ijmtst.com/vol9issue03.html

Evaluation and Performance of Crop Recommendation System using Machine Learning

Yatam Annapurna[1] | D Srikar[2]

[1]PG Scholar, Department of CSE, BIET, Bhimavaram, W.G Dt., A.P., India.
[2]Associate Professor, Department of CSE, BIET, Bhimavaram, W.G Dt., A.P., India.

To Cite this Article
Yatam Annapurna and D Srikar. Evaluation and Performance of Crop Recommendation System using Machine Learning. International Journal for Modern Trends in Science and Technology 2023, 9(03), pp. 46-50. https://doi.org/10.46501/IJMTST0903006

Article Info
Received: 12 February 2023; Accepted: 05 March 2023; Published: 09 March 2023.

ABSTRACT

Many people in India see working the land as their major source of income. The cultivation of plants is crucial to the success of our nation. Inadequate or excessive usage of regular fertilizers causes low crop yields. Using just data collected from sensors, the suggested IoT and ML machine may do in-depth analyses of soil for quality assurance purposes. With this method, soil deterioration is mitigated and crop health is preserved. Soil temperature, moisture, pH, and NPK are all monitored by separate sensors. Soil NPK vitamins are also tracked by a separate set of sensors. The information collected by these sensors is sent to a microcontroller, where it is kept until it can be evaluated by a machine learning algorithm like Random Forest to determine what would provide the best harvest. Moreover, this research presents a procedure that centers on using a convolution neural network (CNN) as the primary technique of determining whether or not the plant is susceptible to illness.

1. INTRODUCTION

A significant percentage of India's population (58% or thereabouts) relies on farming to make ends meet. India is the world's second-largest producer of many different types of food, including rice and wheat, as well as a wide variety of agricultural-based textile raw materials, coconut, sugarcane, a wide variety of dried fruits, and an infinite variety of vegetables and fruits. To further enhance the country's economy, agriculture is essential. Site-specific farming, or precision agriculture, is one method among several that have been introduced to boost crop health while decreasing environmental impacts.

Improvements in agricultural productivity may be achieved by crop recommendations, one of precision agriculture's primary focuses. In order to maximise crop yield without excessive resource use, crop suggestions might be quite useful. Precision farming aims to maximise profits and reduce environmental impact. As an added bonus, it teaches farmers how to use precision farming techniques to anticipate and prepare for any potential crop illnesses. Soil, precipitation, humidity, and temperature data are some of the inputs used by these models. The system then recommends the best crop for the farmer's field based on the input data, increasing the potential harvest size and quality. Low crop yields, insufficient irrigation, and the depletion of soil nutrients and minerals are just some of the issues that have prompted the agricultural industry to use Machine Learning algorithms and the Internet of

Things. Intensity of sunlight sensors, moisture sensors, pH sensors, and temperature and humidity sensors are just a few examples of the sensors used in conjunction with Arduino microcontrollers to gather information about the natural world. By connecting the sensors to the Arduino Wifi Module, the collected data may be uploaded to a central database. It is possible to utilise the training data to teach the computer to anticipate the output, a process known as "supervised learning," which is a kind of machine learning. Some of the input data have been marked with the desired outcome, as seen by the labelled data. Algorithms belonging to the unsupervised learning subset of machine learning are used to prepare models to act autonomously by training them on data that has not been tagged. The goals of unsupervised learning are to classify data into manageable groups based on their similarities, and to present the data in a concise format. Systems use a wide variety of supervised learning algorithms and unsupervised learning algorithms, including Naive Bayes, Support Vector Machine (SVM), Decision Tree, KNN, Multiplayer-layer Perceptron, ID3, J48, JRIP, BPN, Random Forest, ANN, Linear Regression, Neural Network, Chaid, and Kohonen Self-Organizing Map. To create these models, researchers employ a wide range of approaches, including NLP, majority voting, and ensemble techniques. In machine learning, an ensemble approach is a way for combining many smaller models into a single, more accurate one.

2. LITERATURE REVIEW

1)Crop Selection Method to maximize crop yield rate using machine learning technique

Agricultural policy and planning are crucial to the prosperity and food safety of an agricultural economy. The choice of crop(s) has significant implications for agricultural planning. The production rate, market pricing, and government regulations are only a few of the variables that might affect the outcome. Using statistical approaches or machine learning techniques, many researchers have examined the prediction of agricultural production rate, weather prediction, soil classification, and crop classification for agriculture planning. Crop selection becomes a conundrum when more than one crop may be planted in a given season on a certain amount of land. In order to optimize net yield rate of crop throughout season and, by extension, achieve optimum economic development for the nation, the authors of this study suggest a system they call the Crop Selection Method (CSM). There is hope that the suggested strategy may increase the overall rate of crop output. Rural India's agricultural marketing system is in a terrible state of disrepair. Due to a lack of reliable marketing infrastructure, farmers sometimes have to rely on local dealers and intermediaries to dispose of their surplus harvest at a loss.

2)Efficient Crop Yield and Pesticide Prediction for Improving Agricultural Economy using DataMining

AUTHORS:RaoraneA.A.1,KulkarniR.V.2

Agriculture is a high-stakes industry. Factors such as climate, geography, biology, politics, and economics all have an impact on crop yields. Risks associated with these causes may be estimated using suitable mathematical or statistical techniques. Moreover, reliable data on the characteristics of past crop yields is a crucial input to the modeling process, which in turn aids farmers and government organizations in making informed policy decisions. Technology and storage advancements have made available enormous amounts of data. The difficulty has been in gleaning insights from this mountain of data, but recent advances in areas like data mining have opened a door from this information to more precise estimates of agricultural yields. The purpose of this investigation was to evaluate the efficacy of recent data mining methods by applying them to the many database variables to see whether any significant associations emerge.

3)SoilDataAnalysisUsingClassificationTechniquesandSoilAttributePrediction:

AUTHORS:JayGholap, AnuragIngole, JayeshGohilAutomation and data mining are only two examples of the ways in which technology has benefited agricultural study. Several off-the-shelf data mining system solutions and domain-specific data mining application softwares are already available, but data mining in agricultural soil data sets is still a relatively new study subject. Large data sets that are now "virtually harvested" alongside crops need to be examined and exploited to their full potential. The

purpose of this study is to apply data mining methods to a dataset containing information on soil. The paper is dedicated to the study of soil categorization via the use of existing algorithms. In addition, the use of regression for predicting as-yet-untested features and the introduction of automated soil sample categorization are also crucial goals.

3. PROBLEM STATEMENT

Almost 58% of the people in our country make their living in some way related to agriculture. According to the Economic Survey of 2016–17, the average monthly income of a farmer in 17 states is Rs.1700/-, leading to farmer suicides and the conversion of farmland for non-agricultural use. As a matter of fact, 48% of farmers don't want their children or grandchildren to continue farming but instead choose city life. This is because farmers often make poor decisions about the crops they grow, such as choosing an unsuitable crop for the available soil or planting out of season. There's a chance the farmer bought the property from someone else and made the choice without any direct involvement in the matter. Lower yield is an inevitable consequence of poor crop selection. In order to determine how feasible it is for a family to continue living comfortably in the current system while depending only on this income, we used a random forest method. but we can't be sure of the precise crop that's suggested.

Low Efficiency

The suggested harvests are not predictable.

The current setup does not permit the use of deep learning techniques.

4. PROPOSED WORK

Machine learning, a branch of AI that enables computers to "teach" themselves new skills without being given any specific instructions, is used to create the suggested system. Then the application will automatically become better in its accuracy. Several scientists are delving into this topic in an effort to help farmers make better crop choices by considering physical, environmental, and economic considerations. To determine which crop would provide the best results, artificial neural networks are used. To accurately predict crop yields, this project incorporates monthly meteorological data collected in real time. This methodology for predicting the future was implemented using a non-parametric statistical model and non-parametric regression techniques. In this research, we are feeding the algorithm a number of different datasets that we have gathered from government websites and the data mining platform Kaggle. After this first cleaning and sorting, the dataset is used to hone the accuracy of various machine learning models, such as neural networks and linear regression.

1. Reduction of problems can be done by implementing new techniques on agriculture
2. This application helps them to predict the yield
3. This will help the farmers which crop to be selected for their land or the region
4. We choose supervised learning algorithms.

Those are Nave Bayes, Support Vector Machine(SVM),K nearest neighbor algorithm (KNN) and Decision tree and Neural Network.

We apply above mentioned algorithms for our data set. We select one algorithm as our desired algorithm which provides best result for the dataset.

Algorithms: Support Vector Machine, and Naïve Bayes, Decision Tree, Linear Regression, K-Nearest Neighbor and Neural Network.

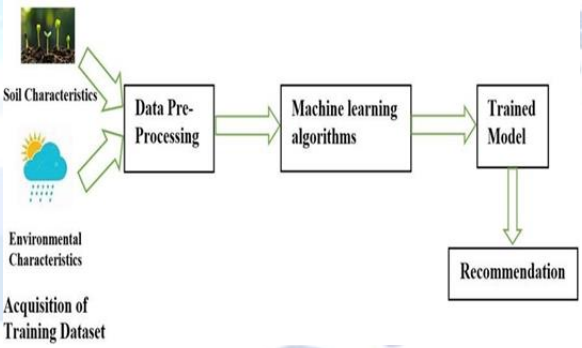

Fig 1: Proposed system architecture

5. METHODOLOGY

All factors relating to the soil and the surrounding environment have been taken into account in our suggested study. The crop's production depends on the kind of soil used, but the weather has no bearing on its success. Because of the suggested device's broad applicability.

1. DATAANALYSIS

The purpose of this analysis is to see whether there is a correlation between the various variables in the dataset.

Acquisition of Training Dataset: Various datasets are fed into the system from the official website [16] and Kegel [17]. The data set consists of

i) Production Dataset:

The dataset covers the whole country and contains the yields of 16 key crops in terms of kg per hectare. To have no harvest at all indicates that the crop is not cultivated in the nation in question.

ii) Crop cost data set: The value of each harvest is recorded here, in Indian rupees. on the basis of the hectare

iii) Modal rate of vegetables: Vegetable market prices over a span of two months are included in this dataset.

iv) Standard Price of Vegetables: The current crop market price in Indian Rupees per acre is included in this information.

V) Soil Nutrient Dataset: The properties in this data collection are organized into five columns: status; nitrogen content; phosphorus content; potassium content; and general pH.

Vi) Rain fall temperature data set: Included in this data collection are plant types, highs and lows in temperature and precipitation, as well as pH readings.

2. DATA PREPROCESSING

In order to make better use of data in machine learning algorithms, preprocessing is crucial. The goal of pre-processing is to recover any values that were accidentally deleted or otherwise disregarded by the system. The data collection contains values that are strings. In order for it to be accepted as data by the neural network, it must be transformed into numerical values.

3. DECISION TREE

Classification via decision trees is an example of greedy methods. It's a supervised learning framework in which classes and their labels are shown as branches on a tree. Most importantly, we can utilize the training prototype we create using the Decision Tree to estimate the magnitude or cost of the target variables by inferring their selection rules from historical data (training statistics)

4. LINEARREGRESSION

Using linear regression, we may fit a straight line between the independent variables (such as precipitation, temperature, and pH) and the dependent variable (yield) and then use that line to forecast the value of the crop. During the sell-off stage, the crops are ordered according to your price as determined by the linear regression version used. Use at the first level for a short amount of time moves you up the ranking.

5. RANDOM FOREST(RF)

To use ML rules, Random Forest employs a set of criteria. In the context of education, many choices are followed, and the results will be segmented according to the training set's type, class prediction, and regression. You can tell how precise a prediction is by the amount of shrubs. Elements of yield, as well as perception, temperature, and rainfall, are included in the data collection. Certain aspects of the dataset are used in the classroom. The remaining third of the data is disregarded. The remaining information is utilized for scientific experimentation

6. RESULT

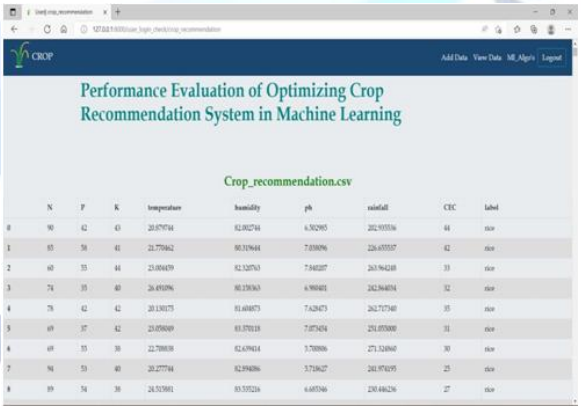

Fig 2: Uploaded datasets

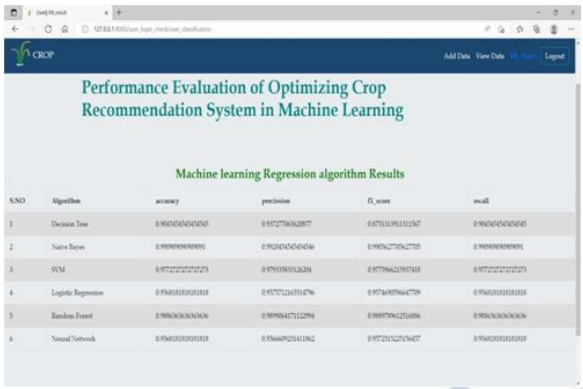

Fig 3: Regression algorithm results

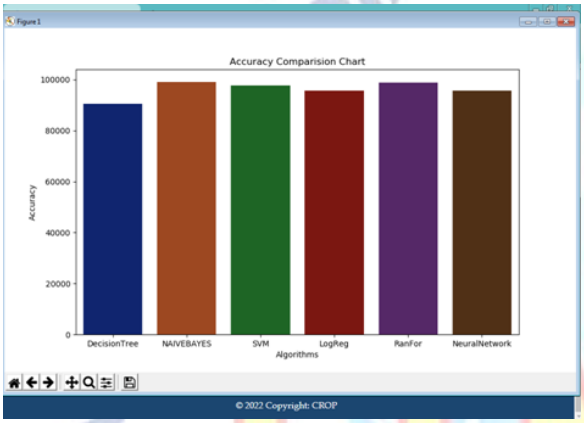

Fig 4: Accuracy results of DT, NB, SVM, LogReg, RanFor, NN

7. CONCLUSION

The suggested approach reduces the likelihood of crop failure and boosts output by delivering information that regular farmers don't keep track of. This also protects them from incurring any more losses. Planned for the future is a web interface and a mobile app that will allow millions of farmers throughout the nation to receive suggestions of crop production.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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