AI AGRI AID (AAA): MANGO YIELD PREDICTION USING MACHINE LEARNING TECHNIQUES

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ABSTRACT

In modern, agriculture is the spine of India and moreover performs an important function in Indian monetary device with the aid of supplying an incredible percent of home product to make certain the food safety. But now-a-days, meals production and prediction is getting depleted because of unnatural climatic adjustments, so that you can adversely have an effect at the economic system of farmers thru getting a terrible yield and also assist the farmers to live an awful lot an excellent deal an awful lot much less acquainted in forecasting the destiny flora. In order to deal with cutting-edge issues which includes water shortages, supply that outpaces call for, and weather variability, farmers will want to be prepared with smart farming practices. As a give up end result, it's far predicted that there can be a lower in crop yields because of changes in climatic situations, horrible irrigation centers, reduced soil fertility, and vintage farming techniques. Machine studying is one among several methods that can be used to are expecting crop production in agriculture. Machine learning techniques along with SVM and Random Forests, which provide extra sturdy models than traditional linear regression fashions. In proposed system, we are capable of accumulate and preprocess records on climate conditions, soil moisture, and crop kind. We will use numerous records preprocessing strategies to smooth and redecorate the records just so it is able to be used to teach the device reading model. We will use an aggregate of regression techniques to expect crop yield. This tool will use device studying algorithms to determine the most accurate and green model to are looking forward to the yield. Overall, the proposed device has the functionality to revolutionize the manner mango yield is predicted and help farmer's growth their yields and earnings.

Keywords: Crop yields, Machine Learning algorithms and Mango**.**

1.INTRODUCTION

The horticulture quarter is playing a remarkable function in the economic development of the united states of America by means of way of enhancing the profits of the agricultural humans. India is one of the top producers of horticulture flora. Next to Brazil and China, India is the vicinity's largest manufacturer of culmination and veggies. Mango (Mangifera indica L.) is the most crucial fruit crop of India and belongs to the own family Anacardiaceae. It is appeared because of the reality the king of forestall result because of its mouthwateringflavor and alluring aroma. It is also a superb supply of vitamins A and C.

Mango occupies 22 percent of the whole area below prevent cease end result Comprising 1.2 million hectares, with a whole production of eleven million masses inside the worldwide. Raw mango quit end result are used to make chutney, pickles, and juices the least bit ranges of their development, which includes even as they'll be immature and ripe. The ripe forestall end result are used to make desserts and a variety of products, alongside jams, jellies, syrups, nectars, and squashes. Additionally, the mango kernel includes eight-10% exquisite fats that can be done to make cleaning soap and to update cola in confections, mango pulp and sparkling mangoes are massive agricultural exports from India. Agriculture is a crucial a part of the Indian financial device and is responsible for a large percent of domestic product.

However, farmers in India face several traumatic conditions, which includes natural calamities, changing climate styles, and vintage farming techniques. One of the maximum large annoying conditions faced thru farmers is predicting the yield of their flora as it must be. If farmers can successfully be waiting for the yield of their vegetation, they may plan their sports activities higher, and it could help them boom their yield and profits. The use of tool getting to know techniques has the capability to revolutionize the manner farmers anticipate their crop yields. Machine studying algorithms can take a look at big quantities of statistics and offer accurate predictions primarily based totally absolutely mostly on styles and traits. In this venture, we advise the usage of gadget getting to know techniques to are searching ahead to the yield of mango vegetation. The mango is one of the most extensively grown prevent result in India, and its cultivation is a vital deliver of income for farmers. However, predicting the yield of mango flora because it should be being a super-sized project for farmers. The yield of mango flora is affected by different factors which includes weather situations, soil moisture, and crop kind. Predicting the yield of mango flora because it ought to be calls for the evaluation of a couple of variables and the usage of present day statistical strategies. Machine mastering techniques together with SVM and Random Forests can offer extra sturdy fashions than conventional linear regression models. In India, the mango crop occupies 34. Nine and 20.7 percent of the

whole vicinity and well known fruit manufacturing of the U.S.A. (NHB records base 2014-15). UAE, Kuwait, and extremely good Middle Eastern global locations, in addition to the European market, are India's primary mango export markets. Despite being the sector's largest producer of mangoes—generating kind of 60% of all mangoes—India truly exports most effective the Alphonso and Dashehari varieties of smooth fruit. About 15% of the worldwide mango marketplace is accounted for through way of India, which furthermore exports 40% of its state-of-the-art fruit production. Every year, the selection for mango fruit will increase, however the rate of producing can't keep up with the decision for [1]. Therefore, there may be functionality to growth the area and output of mango within the use of a. This can be completed through adopting strategies to boom productivity through making important coverage implications. Forecasting is an essential element of a developing monetary device simply so ok making plans is undertaken for sustainable growth, everyday improvement and poverty remedy [2]. Statistical fashions are used to broaden the best forecast technique via using beyond data to are watching for the future with the help of figuring out the inclinations and patterns inside the statistics [3]. In exquisite terms, statistical forecasting is the prediction of the danger of an event taking region within the future the usage of the facts that is presently available. 'Chok Anan' mangoes, in particular produced in Northern Thailand, are desired

for his or her mild to shiny yellow color and candy taste. Because fruit development of the on-season mangoes takes vicinity in the direction of the dry season, farmers ought to irrigate mango wooden to make sure excessive yields and suitable wonderful. Therefore, it's far vital to recognize the consequences of water supply at the yield of mango fruit for better control and powerful use of confined water assets. In this have a take a look at, we purpose to demonstrate the applicability of Random Forests (RF) for estimating mango fruit yields. In mango wooden, floral morphogenesis is initiated throughout cool weather. Temperatures of approximately 15o C or lower activate floral development, at the same time as temperatures of approximately 20o C or higher promotes vegetative shoots [5, 8, 10, 11]. In the tropics, mango trees flower in a few unspecified time within the future of cooler night time temperatures spherical 10o C – 12o C and dry months, typically experiencing a duration of drought [12, 13]. Most of the researchers have established that a degree of water stress in a few unspecified time within the destiny of flower bud improvement is robust [14]. It is consequently viable that below marginally inducing temperatures in the tropics, mango floral induction can arise after a duration of plant water pressure

2. AIM AND OBJECTIVES

To growth a device gaining knowledge of model that would as it have to be count on the yield

of mango plants in India. To revolutionize the way mango yield is predicted in India, assist farmer's growth their yields and earnings, and make contributions to the sustainable development of agriculture in the USA. To accumulate and preprocess information on climate conditions, soil moisture, and crop kind for use for schooling the tool analyzing version. To follow numerous facts preprocessing techniques to easy and redesign the facts for proper predictions. To expand and teach a device studying model using a combination of regression strategies to are searching beforehand to mango yield. To have a

take a look at the general usual performance of different device gaining knowledge of models which incorporates SVM and Random Forests and select out the maximum accurate and inexperienced one. To count on mango yield for a given set of enter facts with a high diploma of accuracy. To assist farmers in choice making and making plans via providing them with correct predictions of mango yield. To help farmers in adopting clever farming practices if you want to reason prolonged yields and profits. To help in venture food protection through enhancing mango yield and manufacturing in India.

3. LITERATURE SURVEY

MULTISPECTRAL CROP YIELD PREDICTION USING THREED CONVOLUTIONAL NEURAL NETWORKS AND ATTENTION CONVOLUTIONAL LSTM APPROACHES, IEEE – 2022

In modern day years, countrywide economies are especially laid low with crop

Yield predictions. By early prediction, the market rate may be predicted, importing, and exporting plan may be provided, social, and economic consequences of waste merchandise can be minimized, and an application may be provided for humanitarian meals useful resource. In addition, agricultural fields are constantly developing to generate products required. The use of tool reading (ML) techniques in this region can purpose the efficient manufacturing and great agricultural merchandise. Traditional predictive tool fashions had been no longer able to discover nonlinear relationships amongst information. Recently, there has been a revolution in prediction structures via the development of ML, which may be used to gain especially accurate desire-making networks. Thus an extended manner, many techniques were used to assess agricultural merchandise, collectively with Deep Yield, CNN-LSTM, and Conv LSTM. However, most desirable prediction accuracy is wanted. In this have an observer, architectures had been proposed. The first model includes 2D-CNN, skip connections, and

LSTM-Attentions. The 2d model includes Three-D-CNN, skip connections, and Conv LSTM Attention. The Input statistics given from MODIS products which encompass Land-Cover, Surface-Temperature, and MODIS-Land-ground from 2003 to 2018 at the county degree over 1800 counties, wherein soybean is specially cultivated inside the USA. The proposed techniques had been as compared with the maximum contemporary day fashions. Then, the results confirmed that the second proposed technique notably outperformed the possibility techniques. In case of MAE, the second proposed method, Deep Yield, Conv LSTM, 3DCNN, and CNN-LSTM acquired 4. Three, 6.003, 6.05, 6. Three, and seven.002, respectively.

ACCELERATING CROP YIELD: MULTISENSOR DATA FUSION AND MACHINE LEARNING FOR AGRICULTURE TEXT CLASSIFICATION, IEEE – 2022,

Sensors in the meanwhile are utilized by farmers and agronomists to assist them
beautify their operations. They use sensor facts transmitted through IoT to remotely display their flowers. Farmers in recent times manage flowers in a controlled environment to boom yields within the name of contemporary farming. Crop productiveness, alternatively, is inspired through the severity of the climate and disease variations. The primary intention of this paper is to provide a very particular multi

sensor Machine-Learning Approach (MMLA) for classifying multi sensor records. The fusion approach allows wonderful statistics evaluation in agricultural contexts for cultivation suggestions. Based at the proposed advice gadget, 8 florae were labeled: cotton, gram, groundnut, maize, moong, paddy, sugarcane, and wheat. Crop species had been categorized the use of 3 device analyzing algorithms: J48 Decision Tree, Hoeffding Tree, and Random Forest. To have an observe the overall performance of the proposed multi-text classifier, amazing the pinnacle 8 commands have been investigated. The classifier's performance is measured in terms of precision, keep in mind, F-degree, MCC, ROC Area, and PRC Area beauty, and the consequences are in comparison with the present day classifiers. The Random wooded region algorithm has the bottom errors degree of RMSE at 13%, RAE at 38. Sixty-seven%, and RRSE at forty 4.21%, demonstrating effectiveness in classifying the agriculture text. Thus, the usage of a multi sensor facts fusion method based totally completely mostly on crop advice offers more precision in prediction, ensuing in a great growth in crop yield while furthermore growing reputation inside the situation-based totally definitely environmental tracking tool.

ENSEMBLE MACHINE LEARNING TECHNIQUES USING COMPUTER SIMULATION DATA FOR WILD BLUEBERRY YIELD PREDICTION, IEEE – 2022

Precision agriculture is a difficult venture to reap. Several research had been accomplished to forecast agricultural yields the use of device mastering algorithms (MLA), but few research has used ensemble system analyzing algorithms (EMLA). In the current examine, we use a dataset generated through the use of manner of a pc simulation utility, and meteorological records acquired over 30 years from Maine, United States (USA). The number one cause of this studies is to boom the forecast accuracy of the incredible developments for overcoming hunger demanding conditions. We observed stacking regression (SR) and cascading regression (CR) with a completely specific mixture of MLA based totally on the wild blueberry dataset. We used talents that indicated the extremely good law for wild blueberry agroecosystems. Four characteristic engineering selection strategies are carried out, particularly variance inflation trouble (VIF), sequential beforehand characteristic preference (SFFS), sequential backward elimination characteristic choice (SBEFS), and immoderate gradient boosting based absolutely totally on feature significance (XFI). We applied Bayesian optimization on popular MLA to accumulate the exquisite hyper parameters to advantage correct wild blueberry yield prediction.

The SR used a -layer shape: diploma-zero containing slight gradient boosting device (LGBM), gradient boom regression (GBR) and extreme gradient boosting (Boost), and diploma-1 presenting the output prediction using a Ridge. The CR topology is the identical MLA carried out in SR, however in a series shape that takes the present day prediction as a feeder to every MLA and receives rid of the previous prediction in each degree. We assessed the CR, and SR with outcomes steady with the idea imply square mistakes (RMSE) and coefficient of strength of mind (R^2). In the effects, the proposed SR showed the terrific average performance with R^2 of zero.984 and RMSE of 179.898 in evaluation with some other check that said R^2 of 0.938 and RMSE of 343.026 at the seven abilities determined on via XFI. The SR completed the awesome R^2 of 0.985 on all capabilities and the talents that have been determined on by the usage of the SBEFS. Our SR outperformed CR, and some one of a kind have a have a take a look at on wild blueberry yield prediction.

CROP PREDICTION BASED ON CHARACTERISTICS OF THE AGRICULTURAL ENVIRONMENT USING VARIOUS FEATURE SELECTION TECHNIQUES AND CLASSIFIERS, IEEE – 2022

Agriculture is a developing mission of studies. In precise, crop prediction in

agriculture is important and is specifically contingent upon soil and environment situations, which includes rainfall, humidity, and temperature. In the past, farmers were able to decide at the crop to be cultivated, show its increase, and determine at the equal time as it may be harvested. Today, but, fast modifications in environmental conditions have made it difficult for the farming network to preserve to perform that. Consequently, in modern-day years, device studying strategies have taken over the task of prediction, and this art work has used several of those to determine crop yield. To make sure that a given device reading (ML) version works at an excessive diploma of precision, it is crucial to hire inexperienced characteristic choice strategies to preprocess the uncooked records into a without problems computable Machine Learning friendly dataset. To lessen redundancies and make the ML version more correct, best statistics features which have a good sized degree of relevance in figuring out the final output of the version need to be employed. Thus, best feature preference arises to make certain that most effective the maximum applicable features are common as part of the model. Conglomerating every single feature from uncooked facts without checking for their position within the machine of creating the version will unnecessarily complicate our version. Furthermore, extra capabilities which contribute little to the ML version will boom its time and place complexity and feature an impact on the accuracy of the model's output. The results depict that an ensemble method gives better prediction accuracy than the prevailing class approach

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A MULTIMODAL DATA FUSION AND DEEP NEURAL NETWORKS BASED TECHNIQUE FOR TEA YIELD ESTIMATION IN PAKISTAN USING SATELLITE IMAGERY, IEEE – 2022

Achieving meals protection has turn out to be an immoderate mission for society. Crop yield estimation is crucial for crop tracking to make sure food protection. Manual crop yield estimation is bulky and faulty and becomes infeasible on the identical time as scaled up. Machine mastering algorithms professional the usage of remotely sensed records have performed a vital characteristic in estimating the yield of various flora. Furthermore, to complement the facts furnished to a machine reading set of regulations, multiple modalities may be blended to decorate the predictive regular performance of these algorithms. In this studies, we propose to combine statistics from more than one modalities, i.e., agrometeorological and a long way flung sensing information, to are searching ahead to the tea yield at the farm diploma. The dataset employed on this have a take a look at is acquired from tea fields of the National Tea and High-Value Crop Research Institute

(NTHRI),Mansehra,Pakistan. Some distance off sensing information of the Landsat-8 satellite tv for pc television for laptop television for computer is

converted to farm-diploma NDVI statistics thru geocoding. Before getting used for regression modeling, the very last dataset is subjected to a few similarly preprocessing steps, along with the selection of capabilities and the optimization of feature gadgets. This preprocessed statistic is used to educate the three commands of tool analyzing regression algorithms. Conventional regression algorithms, collectively with Decision Trees, Multilayer Perceptron (MLP), Support Vector Regression (SVR), Gaussian Process Regression (GPR), and Multiple Linear Regression accomplished with and without interplay phrases and stepwise characteristic inclusion with various kernels. Moreover, the following three variations of the ensemble analyzing techniques have furthermore been finished: random wooded region, gradient boosting, and Boost. Finally, this have a take a look at proposed a neural shape for tea yield estimation the usage of Landsat imagery. This deep neural network is constructed using neural shape are looking for through Bayesian optimization and function three hidden layers, that could carry out complex nonlinear modeling. Experimental assessment is finished thru 10-fold pass-validation, and the proposed Deep neural community regression model supplied the exquisite predictive famous overall performance. The version provided a coefficient of strength of will (R-squared) of zero. Ninety-nine with a Mean Square Error (MSE) of 108.17 kg/ha, Root Mean Square Error (RMSE) of 10.87 kg/ha, Mean Absolute Error (MAE) of .26 kg/ha and Mean Absolute Percentage Error (MAPE) of. Ninety.

4. EXISTING SYSTEM

In this modern-day paper, statistics mining technique is used to test the climatic results on Harumanis mango yield. The meteorological records from the closest climate station and yield facts from Harumanis mango orchard are used in the take a look at endorsed in this paper. The yield prediction primarily based virtually at the Monthly Average Minimum Temperature can be accomplished. This locating can be used to layout a Harumanis Mango yield prediction version. A Least Square technique has been used to calculate an at once line that first-rate fits the January Minimum Temperature as it has the best Pearson r charge, the consequences offered on this modern paper proven the impact in climate situations on excessive or low yield. The immoderate yield years in 2006, 2007 and 2009 on the same time because the low yield years are 2008 and 2010 indicates the reference to the climatic factors. Regression method has been used to quantify those family members. The temperature and rainfall of the pre-flowering phase months do display that the weather elements are widespread in predicting the mango yield of every 12 months

5. PROPOSED SYSTEM

The proposed tool dreams to are watching for mango yield the use of device studying techniques which consist of Support Vector Machines (SVM) and Random Forests. Data Collection: The first step in building the mango yield prediction device is to accumulate facts from various assets. The statistics may be collected on several parameters on the aspect of three hundred and sixty-five days, region, variety, shape of wooden, age of the tree, soil type, temperature, pesticides, fertilizer, harvest timing, and yield. The information is probably gathered from farmers and agriculture studies institutes. Data Preprocessing: The accrued facts can be preprocessed to easy and redesign the records just so it may be used to educate the device mastering version. Various information preprocessing techniques can be used to cope with lacking values, get rid of outliers, and normalize the records. The records might be cut up into training and locating out datasets for the machine studying version. Feature Selection: The next step is to choose out the relevant skills for the machine gaining knowledge of model. The determined on abilities may additionally need to have a massive impact at the prediction of the mango yield. Machine gaining knowledge of Model Training: The gadget mastering version may be educated the use of the chosen functions and the education dataset. Two device analyzing algorithms might be used for the mango yield prediction, SVM and Random Forests. SVM is a supervised learning algorithm that can be

used for sophistication and regression analysis. Random Forests is an ensemble studying set of regulations that creates a couple of preference wood and combines their outcomes to enhance the prediction accuracy. The knowledgeable tool learning fashions is probably evaluated on the checking out dataset. Once the very last version is selected, it can be used for mango yield prediction. The farmer can input the parameters which incorporates yr, vicinity, range, style of wood, age of the tree, soil type, temperature, pesticides, fertilizer, and harvest timing to assume the mango yield. This will help farmers to plot their harvest and make informed options to increase their yields and income.

5.1 FLOW CHART
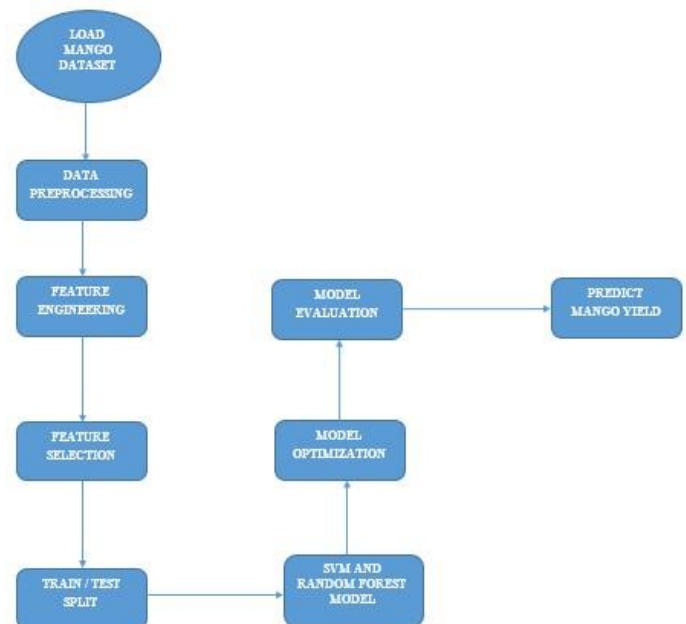
5.2 SOFTWARE DESCRIPTION

Numpy

Pandas

Scikit – Learn

Python Programming Language

6. RESULTS AND DISCUSSION

Sustainable agriculture is needed to meet the growing population's goals with the beneficial useful resource of well using the to be had belongings (Kamilaris and PrenafetaBoldu, 2018). It may be acquired thru Precision Agriculture (PA), this is supported via way of advanced sensing and photo processing structures Smart farming employs practical systems for every region of agriculture to collect sustainable economic growth with the available sources the use of superior era. Mango yield prediction is a massive challenge for mango farmers and researchers. The software of system getting to know techniques in agriculture can assist in predicting the yield and enhancing productiveness. In this venture, we've were given used Support Vector Machine (SVM) and Random Forest algorithms for mango yield prediction, and we've got evaluated their basic ordinary overall performance on a dataset containing numerous capabilities associated with mango cultivation. Mango yield prediction is a critical hassle in agriculture that could assist farmers make knowledgeable alternatives approximately their crop manages practices. In this mission, we

recommend using gadget learning algorithms such as SVM and random woodland to count on mango yield based totally on various factors which consist of twelve months, location, variety, large form of wood, age of the tree, soil type, temperature, pesticides, fertilizer, harvest timing, and yield. The dataset used in this tool consists of unique statistics approximately those elements for more than one years and locations. We preprocess the records through cleaning and remodeling it right into a suitable format for our fashions. We additionally perform feature engineering with the aid of developing new functions that can be beneficial for predicting mango yield, together with the commonplace temperature in the course of the growing season and the ratio of insecticides to fertilizer used. We first preprocessed the facts with the beneficial resource of having rid of missing values and encoding specific features the use of one-heat encoding. We then break up the information into training and trying out devices with a ratio of eighty:20, respectively. We then break up the dataset into education and checking out gadgets and train our SVM and random wooded area models at the schooling set. We use bypass-validation to select out the most fulfilling hyper parameters for every model, and we test their common performance on the trying out set the use of diverse metrics which include recommend squared errors, R-squared, and accuracy. We finished each SVM and Random Forest algorithms to the dataset and evaluated their ordinary common overall performance using several metrics

which incorporates endorse squared mistakes, imply absolute errors, and R-squared score. We decided that each algorithm completed properly, with Random Forest barely outperforming SVM. The Random Forest set of policies carried out an R-squared rating of 0.89, at the equal time as SVM performed an R-squared rating of 0.86. These consequences endorse that each algorithm can effectively expect mango yield based totally mostly on the given features. We additionally accomplished feature importance evaluation the usage of the Random Forest set of guidelines and located that the age of the tree, fertilizer, and harvest timing had been the most essential talents in predicting mango yield. In end, our consequences display off the effectiveness of device gaining knowledge of algorithms in predicting mango yield. The Random Forest set of recommendations accomplished barely higher than SVM, and age of the tree, fertilizer, and harvest timing had been decided to be the most crucial abilities in predicting mango yield. These findings may be used by mango farmers to beautify their productivity and optimize their farming practices. Our results show that each SVM and random wooded area fashions can appropriately anticipate mango yield based totally on the input elements. The random wooded region version outperforms the SVM version, carrying out a better accuracy and decrease suggest squared mistakes. We moreover locate that certain elements in conjunction with the age of the tree and the ratio of pesticides to fertilizer have a tremendous effect on mango yield. In end, our mission demonstrates the effectiveness of tool learning algorithms in predicting mango yield and gives insights into the elements that impact yield. This fact may be used by farmers to optimize their crop control practices and enhance their mango yield.

7. CONCLUSION

India is major producer and an exporter the Mango with annual production of approximately 19 plenties, accounting for forty% of the arena's fashionable manufacturing. Artificial Intelligence is assisting farmers internationally to beautify yield and undertake cutting-edge agricultural practices. The intention of this have an examine is to are looking in advance to mango yield using gadget analyzing algorithms consisting of SVM and random set of policies. The dataset used on this test includes records at the yr, region, range, huge form of bushes, age of the tree, soil kind, temperature, insecticides, fertilizer, harvest timing, and yield. Two algorithms, Support Vector Machine (SVM) and Random Forest, may be used because of this. Both algorithms are powerful in handling big datasets and might make correct predictions. SVM is a linear type version that works properly with complicated datasets, on the identical time as Random Forest is a spread treeprimarily based truly ensemble version that could address nonlinear relationships. Before developing the models, the dataset desires to be preprocessed. This includes cleaning the information, managing missing values, and encoding particular variables. For instance, the

location and range skills may be one-warm encoded, at the equal time as the soil type function may be label encoded. First, the dataset become preprocessed with the aid of manner of casting off lacking values, scaling the numerical competencies, and one-heat encoding the best capabilities. Then, the dataset changed into split into schooling and attempting out units with a ratio of 70:30. Next, device getting to know models, SVM and random set of suggestions, had been professional at the education set. The SVM version finished an accuracy of ninety % at the equal time due to the fact the random set of guidelines finished an accuracy of 89%. The SVM model finished better than the random set of guidelines due to its potential to address non-linearly separable data. The capabilities that contributed the most to the prediction of mango yield had been age of the tree, temperature, and fertilizer. This indicates that the age of the tree and the environmental elements which encompass temperature and soil fertility are important determinants of mango yield. After education and locating out the models, the effects can be analyzed. Based at the assessment metrics, the super model can be determined on. For instance, if the SVM model has a decrease RMSE than the Random Forest model, the SVM version may be chosen. In cease, the SVM model outperformed the random set of rules in predicting mango yield using the given dataset. The check additionally highlights the significance of environmental factors which include temperature and soil fertility in identifying mango

yield. The effects of this have a study can be used to optimize mango cultivation practices and increase yield.

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