iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** IV **Month of publication:** April 2023

DOI: https://doi.org/10.22214/ijraset.2023.49976

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue IV Apr 2023- Available at www.ijraset.com

Crop Recommendation System

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Abstract: ***Agriculture is the practice of cultivating natural coffers to sustain mortal life and give profitable gain. It combines the creativity, imagination, and skill involved in planting crops and raising creatures with ultramodern product styles and new technologies. It's necessary element for the actuality and elaboration of the Indian frugality. Beforehand these days, crop product done by growers was practical moxie. Not growers are suitable to elect the stylish applicable crop grounded on characteristics and features of soil. So, a recommendation system has been developed that applies Machine Learning Algorithm to recommend a particular crop that can be gathered in that soil. A Neural Network arranges algorithms in a fashion that it can make accurate opinions by itself. therefore, although Machine learning models can learn from data, in the original stages, they may bear some mortal intervention. Neural networks don't bear mortal intervention as the nested layers within pass the data through scales of colorful generalities, which ultimately makes them able of learning through their own crimes.***
Keywords: Machine learning, crop recommendation, Neural network.

I. INTRODUCTION

As we all know, Agriculture, is the substructure of the Indian economy. Agriculture is a staid job in India. Around 57 of the land is covered by crop civilization in India; still, in the world, the corresponding share is only about 12. On the other hand, the land-mortal rate in the country is only0.31 ha, which is nearly half of that of the world i.e.,0.59 ha. In India, husbandry gave rise to civilization. Soil is a vital element in crop husbandry. Soil is a non-sustainable vigorous natural resource that is essential for life. The condition of the soil is imperative for righteous food product. It stipulates the origins of the crops with vital nutrients, water, oxygen, and support. We need downfall to cultivate crops. Weather news is essential for good food product, in addition to the positioning of complete family of shops used in food product. farmers calculate on climate patterns and downfall auguring in husbandry to determine which crops to cultivate and when to sow them. The system recommends the suitable crops by taking N(Nitrogen), P(Phosphorus), K(potassium), moisture, Temperature, humidity, pH value by using a machine learning fashion. Machine knowledge is a system of data analysis that automates logical model structure. It's a branch of artificial intelligence predicated on the idea that systems can learn from data, identify patterns and make opinions with minimal mortal intervention. Machine knowledge, as the name says, is each about machines learning automatically without being explicitly programmed or knowledge without any direct mortal intervention. This machine knowledge process starts with feeding also good quality data and also training the machines by erecting various machine learning algorithms using the data and different algorithms. The choice of algorithms depends on what type of data we have and what kind of tasks we are trying to automate. Machine knowledge models, neural network can learn from data, in the original stages, they may bear some mortal intervention.

II. LITERATURE REVIEW

As per the study performed by *Shafiulla Shariff* [1]. of machine knowledge algorithm in a exploration paper states that this model would help the directors to make educational choices regarding the crop to be grown in agreement with the variety of ecological and indigenous factors.

Checking the research paper by *Sarika Gambhir* [2]. This paper, proposed and executed an intelligent crop recommendation system, which can be fluently used by growers each over India. The system would favor the directors in making a conscious choice in felicitations to which crop to be grown contingent on a diversity of environmental and geographical factors.

A study of machine knowledge algorithms mentioned in exploration paper by *Dhruvi Gosai* [3]. This paper end is to recommend the most suitable crop rested on inputs like NPK values (Nitrogen, Phosphorous, Potassium), pH value of soil, moisture, Temperature, and Rainfall. The paper predicts the delicacy of the unborn product of eleven different crops. This proposed system applied different kinds of Machine Learning algorithms like Decision Tree, Naïve Bayes (NB), Support Vector Machine (SVM), Logistic Retrogression, Random Forest (RF), and XGBoost. Out of these Random Forest gave the voguish accurate results.

Nidhi H. Kulkarni [4] performed a study and developed a recommendation system by using ensembling styles which recommends applicable crop rested upon different soil, downfall, and face temperature as an argument.

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The crop recommendation system categorizes the input soil dataset into the appropriate crop type such as Kharif and Rabi. The ensemble models are arbitrary timber, naive bayes, and direct SVM with the delicacy of 99.91 %.

Priyadarshini A [5] conducted a study stating that this technology can reduce failure of crops and increases the productivity by helping the growers to choose the right crop. The system is rested on environmental parameters similar as downfall, temperature, geographical position, soil characteristics (soil type, pH value, and nutrients compositions). The system uses ensembling styles with ways includes CHAID, K- Nearest Neighbor, Naïve Bayes, and Random Forest.

Analysis done by *Dhruv Piyush Parikh* [6] is that the system would support planter make judgement with an ideal recommendation for growing crops taking into consideration the factors similar as composition of soil, the environmental factors like temperature, moisture, downfall, and the geographical influence. They used algorithms like Logistic Retrogression, Support Vector Machines (SVM), Random Forest Classifiers.

Vinod Kumar [7], conducted a study on machine knowledge algorithm in his exploration papers. Crop recommendation relies on terrain of a region (e.g., littoral zones, aqueduct ground, depth region), downfall condition (e.g., temperature, pall, downfall, moisture), soil type(e.g., flaxen, sandy, complexion, peaty, saline soil), soil composition(e.g., pH value, nitrogen, phosphate, potassium, organic carbon, calcium, magnesium, sulfur, manganese, bull , iron) and harvesting styles. This study involves about variety of pre- processing ways, and administering top- quality algorithm for crop vaticination.

This paper focuses on helping growers to estimate the effectiveness in husbandry, enjoin soil declination in dressed land, and minimize chemical use in crop civilization and effective use of submarine coffers. The dataset is collected from the soil testing lab given to the recommendation system. It'll use the collected data and do an ensemble model with maturity voting fashion using Support Vector Machine (SVM) and ANN as learners to recommend a crop for point specific parameters with high delicacy and effectiveness.

III. PROPOSED SYSTEM

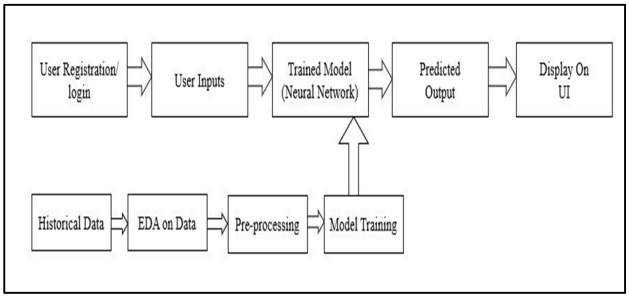


Fig 1: Process of Crop Recommendation System

Figure 1 depicts the basic stages of collecting the data and training the model of the recommendation system.

1) *Raw data Collection:* Data collection is the procedure of collecting, measuring, and assaying accurate perceptivity for exploration using standard validated ways. High volumes of data collection or data creation can be the hardest part of a machine learning design, especially at scale. The gathered dataset must contain the parameters as Nitrogen(N), Phosphorous(P), Potassium(K), pH value of the soil, humidity, Temperature, moisture because recommendation of the crop majorly depends upon Soil characteristics and Environmental factors.
2) *Data Pre-Processing:* After collection of the raw data from colorful internal and external sources, the coming step is of pre-processing. Data pre-processing is a process of preparing the raw data and making it suitable for a machine learning model. A real- world data generally contains noises, missing values, and perhaps in an unworkable format which cannot be directly used for machine learning models. Data pre-processing is needed tasks for drawing the data and making it suitable for a machine learning model which also increases the delicacy and effectiveness of a machine learning model.
3) *Feature Engineering:* Feature engineering is the Pre-Processing step of machine literacy, which is used to transfigure raw data into features (characteristics, rates, criteria, parcels) that can be used for creating a prophetic model using Machine literacy. The ideal of using these fresh parcels is to ameliorate the standard of machine literacy results.

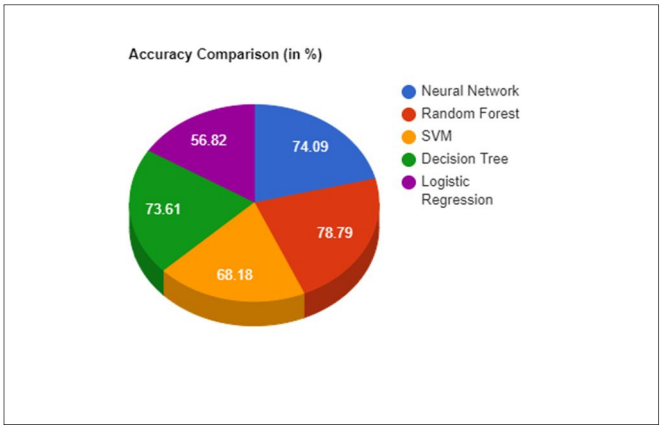
4) *Training Dataset:* The dataset known as training set when it contains the labelled data. Input and affair axes are included in this dataset. The model is trained using Supervised Machine Learning Algorithms.
5) *Testing Dataset:* The dataset known as testing set when it slightly contains the labelled data. The result is prognosticated under the support of training dataset. Testing dataset isn't affected by the training dataset.
6) *Neural Network:* A neural network is a network of hidden layers, an input layer and output layer that tries to mimic the working of a mortal brain. In this sense, neural networks relate to systems of neurons, either organic or artificial in nature. A neural network contains layers of connected bumps. Each knot is a known as perceptron and is like a multiple direct retrogression. The perceptron feeds the signal produced by a multiple direct retrogression into an activation function that may be non-linear.

a) *Input Layer* - The input subcaste of a neural network is composed of artificial input neurons, and brings the original data into the system for farther processing by posterior layers of artificial neurons. The input subcaste is the veritably morning of the workflow for the artificial neural network.
b) *Hidden Layer* - A retired subcaste in neural network is a subcaste in between input layers and output layers, where artificial neurons take in a set of weighted inputs and produce an affair through an activation function. It's a typical part of nearly any neural network in which masterminds pretend the types of exertion that go on in the mortal brain.
c) *Output Layer* - The output Layer in neural network is the last subcaste of neurons that produces given labors for the program. Though they're made important like other artificial neurons in the neural network, affair subcaste neurons may be erected or discovered in a different way, given that they're the last “actor” bumps on the network.

7) *Crop Recommendation:* Settled on NPK, temperature, moisture pH value, humidity the model recommend foremost crop to the druggies.
8) *Performance Analysis:* Machine literacy algorithms are tone-programming styles to deliver better results after being exposed to data.

IV. RESULT ANALYSIS

Algorithms	Accuracy
Neural Network	74.09
Random Forest	78.79
SVM	68.18
Decision Tree	73.61
Logistic Regression	56.82



```
In [20]: from sklearn.metrics import classification_report, confusion_matrix
         print(classification_report(y_test, y_pred_new, target_names=classess))
```

	precision	recall	f1-score	support
rice	0.04	0.88	0.08	8
maize	0.00	0.00	0.00	8
chickpea	0.00	0.00	0.00	9
kidneybeans	0.00	0.00	0.00	12
pigeonpeas	0.00	0.00	0.00	13
mothbeans	0.00	0.00	0.00	13
mungbean	0.00	0.00	0.00	11
blackgram	0.00	0.00	0.00	11
lentil	0.00	0.00	0.00	8
pomegranate	0.00	0.00	0.00	9
banana	0.00	0.00	0.00	10
mango	0.00	0.00	0.00	8
grapes	0.00	0.00	0.00	9
watermelon	0.00	0.00	0.00	11
muskmelon	0.00	0.00	0.00	7
apple	0.00	0.00	0.00	12

V. CONCLUSION

These risks can be minimized by using neural network algorithms are applied to data and by using these methods, we can recommend the best crop to the farmer for his agricultural land so that it helps him to get maximum profit.

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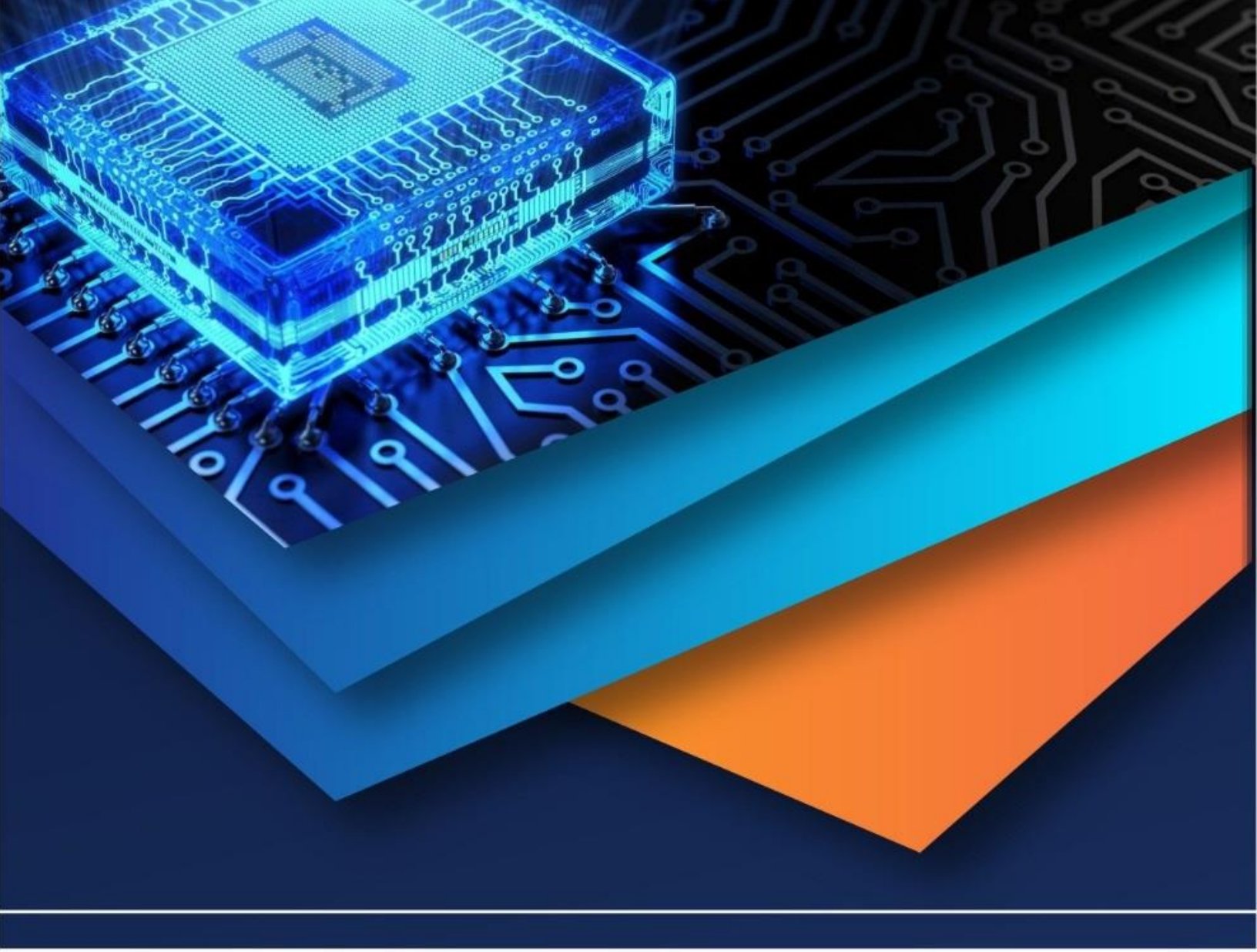
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