



# Smart Soil Detection With Pseudo Rgb Color Matching On Machine Learning Trained Feature

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**Abstract:** Agriculture is the most stream on which ranchers depend. Numerous overviews have demonstrated that low rate of agriculturists is proliferate over a long time. The most reasons for the increment in soil crop fertility loss are climate conditions, obligations, need of points of interest around the soil. In a few farther regions agriculturists need data almost soil quality, soil supplements, soil composition and may select off-base edit to sow which comes about in less abdicate. So as to overcome the issues confronted by ranchers we are attempting to actualize a demonstrate utilizing with pseudo color matching system with trained features classification of Artificial Neural Networks (ANN) and Random Forest which predicts the soil quality taking input as a few critical parameters related to soil. This paper basically centers on anticipating the crop abdicate utilizing the ANN combined with Random Forest which is totally a program arrangement additionally prescribes appropriate fertilizers to pick up tall surrender of crops. Soil pictures are captured with the assistance of Smartphone and store all the pictures as soil dataset. Soil pictures are prepared through the diverse steps of advanced picture preparing counting soil picture upgrade, soil picture segmentation, and soil picture highlight extraction. Amid the highlight extraction, Tone, Immersion and Esteem of the soil picture are calculated with store Immersion and Tone additionally Immersion as an file for the include vector of the soil pictures. Expectation of soil pH is done with the assistance pseudo color matching system of Straight Relapse, Neural network, and Random Forest Relapse. The coefficient of the straight relapse is 0.859 for the Immersion include of the soil picture. The relapse coefficient of KNN is 0.89326 for K=5 with an RMSE esteem 0.1311. It is found that ANN continuously gives distant better; a much better; a higher; a stronger; an improved" an improved result as compare to another one.

**Keyword:** Ranchers, soil supplements, pseudo color matching, Artificial Neural Network, Random Forest, Critical Parameters, random Forest, store immersion, relapse.

## I. INTRODUCTION

India is exceptionally much wealthy in development. In later times, Picture handling procedures are utilized in several ranges of investigates counting wellbeing and farming. But the application of picture preparing strategies within the horticulture recorded is constrained and particularly in Assam, India. The most figure of any cultivating is soil. The Soil has diverse properties. Among the diverse physical and chemical properties of soil, soil's chemical properties continuously play an critical part in cultivating. Soil pH is one of the major variables to be considered some time recently doing any development. A soil with 5.5 to 7.0 pH level is continuously great for development.

Agriculturists continuously tried their soil pH either in soil pH research facility or utilizing soil pH color charts. In some cases, an expert helps agriculturists to decide the soil pH. But getting master sees in all times isn't conceivable for all the times.

Once more all these strategies require time, labor and expertness. Soil pH assurance utilizing soil pH chart isn't an adequate handle because it takes human discernment and needs expertness. This paper presented a computerized picture based framework which can precisely anticipate the pH of the soil with the assistance of diverse machine learning approaches counting straight relapse, ANN and Irregular Woodland. In Assam, most of the agriculturists are from rustic regions. So keeping in intellect, soil pictures zone captured utilizing Smartphone and after that pictures are prepared through the distinctive picture handling steps for soil pH Expectation.

In this paper, we show a comprehensive survey of the application of ML in farming. A number of pertinent papers are displayed that underscore key and interesting highlights of prevalent ML models. The structure of the show work is as takes after: the ML wording, definition, learning errands, and examination are at first given in Segment 2, beside the foremost well known learning models and calculations. Segment 3 presents the executed strategy for the collection and categorization of the displayed works. At long last, in Area 4, the advantages derived from the implementation of ML in agritechology are recorded, as well as end of the desires within the space. Since of the huge number of shortened forms utilized within the relative logical works.

## II. LITERATURE SURVEY

The author presents [1]. Appropriate soil water sum is a compulsory condition for perfect plant development. Moreover, water being a vital component for life food, there's the prerequisite to outwit its excessive use. Irrigation may be a preeminent buyer of water. This calls for the got to control water supply for water system purposes. Field ought to not one or the other be overirrigated nor under-irrigated. Soil Observing is one device to supply soil data. Over time, frameworks have been connected so as to approach enlist this point of which computerized strategy are the foremost acknowledged as they allow information to be assembled at tall determination with less work request. Estimate of the current structure lock in micro-processor based frameworks. These frameworks give a few mechanical amazing but are high-priced, expansive, difficult to maintain and less invited by the mechanically untrained administrators within the peaceful plot.

Unmistakable and near-infrared (VNIR) diffuse reflectance spectroscopy (DRS) [3] has demonstrated to be compelling apparatuses of estimation of soil properties. Relapse models are more often than not calibrated on the complete datasets without its stratification. This paper examines how clustering of the soil spectra expectation of essential soil properties progresses: substance of sand, clay, soil natural carbon (SOC) and add up to nitrogen, as well as the caution trade capacity (CEC) and add up to replaceable bases (TEB). The investigation was performed on a set of 212 soil tests collected from surface skylines all through the range of arable lands in Poland. Ghastly estimations were done utilizing ASD

Fildspec Master with attached Source Test MugLite within the wavelength run of 350-2500 nm. To begin with, fractional slightest squares (PLS) relapse models utilizing the raw spectra and their to begin with subsidiaries were calibrated on the complete dataset.

With the moving hill in sandy arrive of Northwest Liaoning [2] territory as the inquire about question, its water variety in soil was reenacted and examined based on a BP Neural Organize show. With foremost meteorologic components that influence soil water, such as precipitation and dissipation, as the input factors and the water substance in soil as the yield variable, a soil-water expectation show based on BP NN was built. Comes about appear that the BP NN demonstrate accomplished tall exactness, with cruel supreme blunder of 0.35 and cruel relative mistake of 11.53%. The BP NN forecast demonstrates for moving rise gives an unused approach for the soil water securing.

The joining of inaccessible detecting (RS) [3] information into advanced soil models has appeared victory to move forward soil forecasts. In any case, the impacts of multi resolution symbolism on modeling of biogeochemical soil properties in sea-going environments are still ineffectively caught on. The targets of this ponder were the taking after: 1) to create forecast models for soil add up to phosphorus (TP) and add up to nitrogen (TN) utilizing RS pictures and natural subordinate information at three diverse resolutions; 2) to recognize controlling variables of the spatial dissemination of soil TP and TN; and 3) to illustrate the impacts of diverse spatial resolutions of RS pictures on inferential modeling. Soil centers were collected (n = 108) from the beat 10 cm in a subtropical wetland: Water Preservation Area-2A, the Florida Everglades, USA. [4] The ghostly information and inferred records from RS pictures, which have diverse spatial resolutions, included the taking after: MODIS (500 m resampled to 250 m), Landsat ETM+ (30 m), and SPOT (10 m).

In this work [5], the proposed framework can offer assistance ranchers by making them mindful almost their soil conditions. Ranchers can maximize crops abdicate by knowing extent of supplements display within the soil. Soil harmfulness influences the soil supplements which by implication influences crops wellbeing. The proposed framework predicts the level of poisonous quality show within the soil and makes agriculturist mindful almost it. Numerous agriculturists are depending on precipitation which is the one of the figure for destitute development and diminishes crops surrender. Hence the proposed framework suggests the rancher around the trim, ripeness of soil, level of poisonous quality and water supply. For this suggestion framework, sensor's precision is exceptionally critical as well as classification calculation. For classification, choice tree J48 calculation is utilized which is basic to actualize and having more precision as compared with other classification calculations. Issue of control supply can be overcome by utilizing sun oriented board framework.

### III. METHODOLOGY

In our proposed framework, an android based soil forecast framework is actualized. Here the client will fair take the picture input and after that the information will be chosen. Hence the client will get the soil points of interest and the edit forecast subtle elements utilizing this framework with supplements which in a roundabout way influences crops wellbeing. The proposed framework predicts the level of poisonous quality display within the soil and makes rancher mindful approximately it. Numerous agriculturists are depending on precipitation which is the one of that calculate for destitute development and diminishes crops surrender. Hence the proposed framework suggests the agriculturist almost the edit, ripeness of soil, level of harmfulness and water supply. For this proposal framework, sensor's precision is exceptionally critical as well as classification calculation. For classification, ANN and arbitrary woodland calculation is utilized which is basic to actualize and having more exactness as compared with other classification calculations.

#### 3.1 Image Acquisition

The images are captured with camera (DXC3000A, Sony Enterprise, Japan) associated to a PC. Camera was settled over the light vestibule on a copy adhere, which gave straightforward vertical advancement to finely tune the position of camera concerning soil parts. Pictures were captured utilizing the computer program Matrox Intellicam for Windows and spared in bmp organize. Brightening source was a fluorescent light tube, which given indeed brightening over the field of see. Computerized imaging or advanced picture securing is the creation of a carefully encoded representation of the visual characteristics of an question such as a physical scene or the insides structure of an question. The pictures are created by the combination of an "illumination" source and the. Reflection or assimilation of vitality from that source by the components of the "scene" being imaged for the framework. The picture will be made as an input when they are taken in this scene.



Fig 1. Image acquisition

#### (ii) RGB Color Model

In this module, RGB fragments are isolated. The parcel of RGB component from input color picture test is called extraction of RGB highlights. The RGB color demonstrates will be the client recognizable proof where the picture will be recognized with the three colors. Ruddy, Green and Blue are the primaries color of an picture those pixel values are get calculated utilizing this picture handling method. The color pixels are carried with the color code esteem which are get coordinated when the advanced pictures are get handled. The one of a kind color values of the pictures are getting recognized for the simpler division. The pictures were handled for extraction of the middle values within the Ruddy, Green and Blue groups of the RGB color space; Tint, Immersion and Esteem of the HSV color space; and values of the advanced numbers of a panchromatic picture gotten from the RGB groups. It was watched the obscuring of the soil with the

increment of dampness. For each sort of soil, a demonstration with best fit was watched and to utilize these models for forecast purposes.



Fig 2. RGB Color model

### 3.3 Pre- Processing

As a Machine Learning Design, information pre-processing or information cleansing could be a pivotal step and most of the ML engineers spend a great sum of time in information pre-processing some time recently building the demonstrate. A few cases for information pre-processing incorporates exception discovery, lost esteem medicines and evacuate the undesirable or boisterous data. Similarly, Picture pre-processing is the term for operations on pictures at the lowest level of reflection. These operations don't increment picture data substance but they diminish it on the off chance that entropy is an data degree. The point of pre-processing is an enhancement of the picture information that stifles undesired mutilations or upgrades a few picture highlights significant for encourage preparing and investigation errand. **Gray Scale Conversion**

There are a number of commonly utilized strategies to change over an RGB picture to a grayscale picture such as normal strategy and weighted method. The Normal strategy takes the normal esteem of R, G, and B as the grayscale value.

$$\text{Grayscale} = (R + G + B) / 3 \quad (1.1)$$

Theoretically, the equation is 100% rectify. But when composing code, you will experience uint8 flood blunder — the whole of R, G, and B is more prominent than 255. To maintain a strategic distance from the special case, R, G, and B ought to be calculated respectively.

The normal strategy is straightforward but doesn't work as well as anticipated. The reason being that human eyeballs respond in an unexpected way to RGB. Eyes are most delicate to green light, less touchy to ruddy light, and the slightest delicate to blue light. In this manner, the three colors should have distinctive weights within the conveyance. That brings us to the weighted strategy.

### Median Filtering

Median sifting may be a nonlinear prepare valuable in diminishing incautious, or saltandpepper clamor. In a middle channel, a window slides along the picture, and the middle concentrated esteem of the pixels inside the window gets to be the yield concentrated of the pixel being prepared.

### 3.4 Image Segmentation

Image segmentation is an vital however troublesome computer vision assignment, because it requires to a few degree a semantic understanding of the picture. Generally speaking, it is the method of apportioning the picture into disjoint districts, each one being homogeneous and associated with regard to a few properties, such as gray-value, color, surface, movement. It can be separated into three distinctive but complementary stages, i.e.,

- 1) region/feature extraction; and
- 2) Division calculation application

Each one being critical for the ultimate division result. Among the assortment of division strategies, the morphological watershed change has demonstrated to be exceptionally capable and successful, particularly when coupled with nonlinear multistate morphological administrators. The watershed lines related to the markers are developed. Watershed change can be geographically depicted as a flooding prepare, where the picture capacities is considered as a topographic surface submerged in water. The markers serve as flooding sources, from where waves begin radiating shaping different lakes. At focuses where distinctive waves meet, a dam is raised to dodge lake blending, which is in truth the watershed line that isolates the picture into distinctive locales. In scientific morphology, flooding has been actualized by means of drenching recreation and various leveled queues.



Fig 3. Image Segmentation

### 3.5 Pseudo coloring

Pseudo-color handling may be a procedure that maps each of the dim levels of a dark and white picture into an allotted color. This colored picture, when shown, can make the recognizable proof of certain highlights less demanding for the eyewitness. The mappings are computationally straightforward and quick.

Pseudo-color plans can too be planned to protect or expel escalated data. Since the nature of the first dark and white picture can decide the victory or disappointment of a specific color plot, it is fundamental to discover a levelheaded approach to the plan and choice of the color maps. The paper will portray a few strategies of planning color plans that utilize thoughts from the areas of colorimetric and visual recognition.



Fig 4. Pseudo Coloring

### 3.6 Feature Extraction

The design is fundamental depiction of a commentary or a quantitative or a component of eagerness for an image. And one or more descriptors of a question or a substance of picture from the design or design is a course of action of descriptors. Highlights in design affirmation composing are called descriptors. They include is essential for isolating a lesson of objects from another lesson. A technique is utilized to delineating the objects and the objects highlights are highlighted. Extraction of highlights from the article/element of an picture produces portrayal of picture.

#### 3.6.1 Color Features

In this, RGB sections are isolated. The parcel of RGB component from input color picture test is called extraction of RGB highlights.

$$R_n = \frac{R}{(R + G + B)} \quad (1)$$

$$G_n = \frac{G}{(R + G + B)} \quad (2)$$

$$B_n = \frac{B}{(R + G + B)} \quad (3)$$

#### 3.6.2 Boundary Description Features

Within the microstructure of a material soil has the foremost trademark highlight. They can have shape and character, different sizes, starting from soils in a clean, strong arrangement and completing with greatly troublesome soils which are to some degree in homogeneous bundles of other, correspondingly arranged components. The highlights of Inquiry picture and the preparing pictures are extricated utilizing the color quantization; Gabor channel and Law cover S5S5. At that point, the Inquiry picture of the soil is coordinated with the preparing pictures in database. Based on the coordinating of Inquiry picture and preparing picture

the soil with most elevated coordinating proportion is given as yield is utilized for Recreation reason. The dataset which comprises of more than hundred soil pictures such as alluvial soil, Clay soil, Dark soil, ruddy soil, waterway soil, ocean soil.

1. Read the texture (M×N)
2. Apply the required preprocessing method on the given texture Method
3.  $wcount = (\text{size of the texture}) / (\text{size of the window})$
4. IF Method = sequence
  - i.  $i=1; j=1; count = 1;$
  - ii. Read the window of P×Q from the pixel (i,j) size
  - iii. From this window, calculate various Law's mask features
 If  $count > wcount$  Apply "classification"
   
Else
   
 $i=i \times P, j=j \times Q, count=count+1$  goto 2
   
Else "method = random"
  - i. Set the values of a, b and M,  $count=1$
  - ii.  $y(n+1) = ((a * y(n)) + b) \% M$
  - iii. From the preprocessed image, read the window of size P×Q from the pixel  $y(n+1)$
5. Read the window of P×Q from the pixel (i,j) size
6. From this window, calculate various Law's mask features
7. If  $count > wcount$  Apply "classification" Else
   
Count = count +1 Goto 2



Fig 5. Feature Extraction

### 3.7 Classification

The classification of the system is maintained with the Artificial Neural Network and Random Forest.

#### Artificial Neural Network (ANN):

Artificial Neural Networks (ANN) comprises of three layers specifically input layer, covered up layer and yield layer. A neural arrange demonstrate can have more than one covered up layer. The precision would be tall in the event that the number of covered up layers is tall. The essential representation of neural systems is depicted. We are utilizing back propagation strategy to construct and prepare a neural arrange demonstrate. The preparing of the Back propagation organize (BPN) is worn out three stages- the bolster forward of the input preparing design, the calculation and back propagation of the blunder and updating of weights. The most point of the neural arrange demonstrate is to train the show to realize a adjust between the capacity of a demonstrate to reply and its capacity to deliver sensible responses to the input that's comparative but not indistinguishable to the one that's utilized in training. In straightforward terms preparing a show by giving a number of designs and after that test the show employing a modern information which is comparable to that display within the dataset but not indistinguishable. We are going include covered up layers one by one utilizing thick work.

**Output\_Layer:** It is basically the number of hubs generated with the neural network.

- Want to include to the yield layer.
- In Neural Arrange we got to relegate weights to
- Each mode which is nothing but significance of that hub. At the time of initialization, weights ought to be close.
- To and we'll arbitrarily initialize weights utilizing uniform work.

**Input\_Layer:** This parameter is required as it were for first layer as demonstrate doesn't know the number of our input variables.

Taking pH values of soil, sort of soil, pH rate, most extreme temperature and least temperature as input parameters preprocess the dataset and plan a organized dataset which machine can get it. The yield to be decided is the supplement substance (N, P, K) within the soil. Spilt the dataset into two parts prepare information and test information. We consider approximately 70% of the information as prepare information and 30% of the information as test information. Construct a neural arrange demonstrate utilizing backpropagation strategy taking input layers depending upon the number of input parameters, number of covered up layers of our choice, and yield layer. Any number of covered up layers can be taken. More the number of covered up layers greater is the exactness. There's another stage of the issue which incorporates foreseeing the trim to be sown in specific arrive or soil. For this take trim title, supplements required for a edit to deliver tall surrender in another dataset. Take supplements as input parameters and edit title as yield parameter which is to be anticipated. Preprocess this dataset and part the dataset into two parts prepare information and test information. Comparable to the over show construct another demonstrate and from this get the trim title as yield.

**Random Forest:**

Spatial expectation of soil properties utilizing Arbitrary Timberland show is utilized for classification. Arbitrary Woodland demonstrate (RFM) could be a expansion of relapse tree show which works based on gathering of a number of classification and relapse trees by implies of two levels of randomization for each tree within the forest. This module comprises of Machine learning demonstrate that's built to assist rancher get it the quality of his soil by considering different Soil supplements (both large scale as well as smaller scale supplements) and based on these parameters the taking after show is made. • Substance of different soil nutrient (EC, K, pH, Mn, Zn, S, P, B, OC) are the highlight factors, whereas the review of soil supplement measure is the target variable.

- Quantized rank of the soil large scale as well as small scale supplements is the most objective of the demonstrate. • Preprocessing of the dataset is done. • Relapse calculation (direct relapse) is connected.
- Fetched work is minimized by the calculation, angle plummet is connected and suitable learning rate is chosen.
- Root Cruel Squared blunder between the anticipated esteem and genuine esteem is calculated

Random Forest may be a directed learning calculation. Arbitrary woodland builds multiple decision trees and blends them together to urge a more exact and steady expectation. By utilizing this algorithm, ready to include arbitrariness to our demonstrate. Random forest looks for the foremost imperative parameter among all whereas doing part of any hub, at that point from the subset of irregular highlights it looks for the leading among them. This inevitably creates a show which has higher precision in wide differing qualities [4]. In this calculation only selective features are taken under consideration for the part of a hub. The trees can be made more irregular, by utilizing arbitrary edges for the include set instead of looking for the most excellent edges conceivable. The preparing calculation for arbitrary timberlands applies the common procedure of bootstrap amassing, or sacking, to tree learners. Given a preparing set where,

X = x1, ... xn with responses

Y = y1, ..., yn, continuously bagging b times by selecting a random sample with

replacement of the training set and fitting trees to these samples.

For, b = 1,.....,B: 1. Sampling, with replacement these n training sets from Yb, Xb. 2. And training a regression tree fb on Yb and Xb. after this process is complete, unknown samples x' predictions are applied by taking average of these predictions from all individual regression trees on x'



Fig 6. Classification

### 3.8 Soil Prediction

The system has various calculations in Machine learning which can be utilized to anticipate the soil quality and edit surrender. But we have chosen Back proliferation calculation to anticipate the soil quality since of its tall precision compared to other calculations. We will take as numerous input parameters to urge more accurate output. We consider taking pH values of soil, sort of soil, supplements substance within the soil, pH rate, greatest temperature and least temperature as the input parameters. We primarily concentrate on taking Nitrogen (N), Phosphorous (P), and Potassium (K) as supplements of soil. Zinc (Zn), Press (Fe), Manganese (Mn), Boron (B) substance in soil can moreover be taken as another input parameter to pick up indeed more exactness. Back proliferation calculation could be a strategy utilized in manufactured neural systems commonly to prepare profound neural systems. The loss function gives us the distinction between the required yield and framework output. Based on this distinction ready to proliferate back to diminish the misfortune work. The dataset must contain columns counting the traits pH values of soil, pH rate, sort of soil, Nitrogen (N), Phosphorous (P), and Potassium (K) substance within the soil, Zinc (Zn), Press (Fe), Manganese (Mn), Boron (B) substance in soil, greatest temperature and least temperature. After the dataset is learnt by the show, the demonstrate will be able to deliver us the yield supplement substance (N, P, K) within the soil when given pH as input. The soil abdicate can be anticipated utilizing the client frameworks which are all included.



Fig 7. Soil prediction

### IV. RESULT AND DISCUSSION

The point of view of this paper is to center as it were on agriculture and cultivating. As we are progressing in innovation day by day there could be a require of utilizing the advances to induce the problems faced by ranchers done right. One such explore is the idea presented over. The thought proposed primarily centers on two things. Here we utilize the Mean Squared Error (MSE) and Percentage Error (PE) to assess the proficiency and execution of our fertilizer proposal framework. As appeared in Table 4, the recommendation model based on the Artificial Neural Network (DNN) beats the Standard Neural Network classifier with an exactness rise to to 95.1 % (Urea), 95.05 % (MOP) and 96.7 % (Lime). Our demonstration highlights the genuine plausibility for forecasting the application rate of fertilizers for soil crop. This comes about are promising to explore neural organize fertilizer proposal strategies and to progress the profound learning classifiers.

Table 1. Represents the accuracy of the existing and proposed algorithm

Algorithm	Accuracy
ANN	98.5
Random Forest	92
SVM	85
Naïve Bayes	66

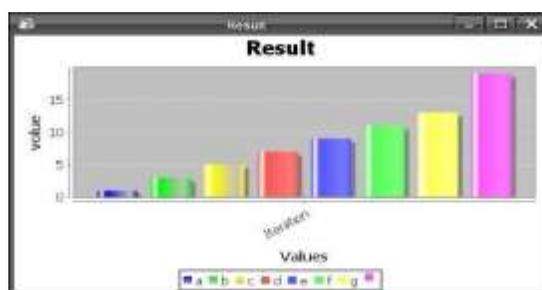


Fig 8. Result

The framework that we have built is based on the multiple image datasets as well as the diverse calculations are used to increment the execution of the framework. We recognized the result from the applying calculations. The accuracy of each calculation is given within the taking after table

## V. CONCLUSION AND FUTURE ENHANCEMENT

In this paper we have proposed a framework that employments Neural Systems to foresee the soil quality and edit abdicate. The reason behind utilizing neural systems is for more precise comes about. This framework can diminish the troubles confronted by ranchers to a few degree by making a difference them to select the trim to be sown depending on the soil quality. The framework can be encouraged improved to include the usefulness of location of edit illnesses by utilizing picture preparing. For this we ought to collect the pictures of ailing crops and prepare the machine to identify any kind of infection by utilizing picture handling. The thought displayed in this paper can offer assistance increment the economy of agribusiness segment and decrease the suicide rate of ranchers. Analyzing soil quality is the essential assignment in horticulture since it is the root for encourages steps we take. Considering the soil conditions and climate conditions as input parameters we are attempting to foresee the supplement substance (N, P, and K) within the soil. Following step is utilizing the supplement substance within the soil as input and foreseeing a appropriate edit for the soil. With this thought agriculturists require not battle to choose which crop to develop. In this manner ready to spare time, totally dodge the utilization of equipment and require not consider support figure since it is totally a computer program arrangement.

For further inquire about the plant malady with the weed and the climatic soil abdicate can be anticipated. The trim expectation can be made with the next soil introduction and algorithm.

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