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Machine Learning and IoT based Crop Cultivation on Atmospheric Data

Dr. Nanda Ashwin
Professor, Department of Information Science and Engineering, Bangalore, India

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ABSTRACT

In cutting edge brilliant cultivating and the Internet of Things (IoT), traditional straightforward meters are amazingly exceptionally communicated. What's more, it digitalizes the scope of data, the meter readings. The information can be sent far away that manual works. The complete populace is extending exceptionally quick and the interest for food is expanding enthusiastically with the populace.

Standard ranchers' techniques are not adequate to fulfill developing need and, in this manner, need to frustrate the dirt by progressively utilizing dangerous pesticides. This has a great deal to do with the cultivating practice and in the end the dirt remaining parts unfertile. This place of business different classes of robotization, like IoT, Wireless Communications, Machine Learning, Depp Learning, and Artificial Intelligence.

We Design and Develop an IOT empowered far off dampness estimation gadget. Furthermore, Utilization of different Machine Learning Algorithms for exact forecast of harvest dependent on the current informational index given by Agricultural specialists.

Keywords- Paddy crop classification, Linear Regression, and Lasso Regression

I. INTRODUCTION

The machines were sent during the modern transformation as a substitute for human work in the nineteenth century. In the long run, with the development in Information Technology in the twentieth century, after the coming of PCs, the advancement of Artificial Intelligence fueled machines was started. In the continuous time, it is a fact that Artificial Intelligence is gradually yet unequivocally supplanting human work. Man-made reasoning signifies the impersonation of human knowledge in machines that are intended to think like people and recreate their conduct, for example, learning and critical thinking. AI is a subset of man-made brainpower as displayed in Fig. 1. AI is the apparatus used to recognize, comprehend and examine an example in the information. One of the significant spaces of exploration in this high level mechanical universe of software engineering is Artificial Intelligence.

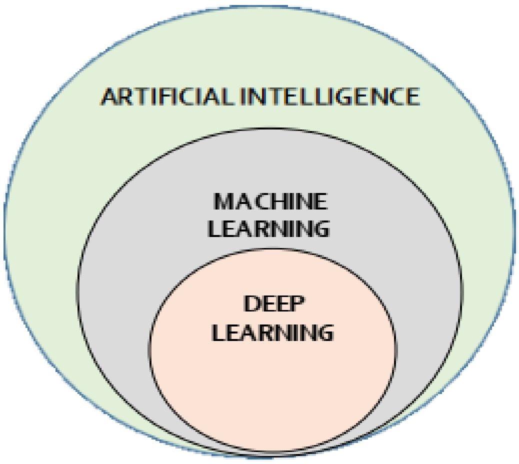

Fig 1. Subset of AI

Horticulture area has seen huge advancements over past many years bringing about progress and expansion in crop creation, agribusiness measure robotization and powerful asset use. Over the most recent twenty years, implanted PCs, particular sensors, Global Positioning Systems and actuators have empowered the incorporation numerous electromechanical machines explicitly agrarian robots to farming space. The appearance of new advances like mechanical technology, man-made brainpower and AI has offered us more chance to foster a total new scope of arrangements and items to work on rural practice.

Rice is perhaps the main staple yields for enormous population around the world. In any case, there stays an extreme deficiency of rice, principally as a result of irritations that diminish the yield and low-level motorization that contributes toward low proficiency of the rice creation measure. Hence, it is progressively requested for new apparatuses and techniques to meet the goals of working on the administration and usefulness of the rice area and too diminishing antagonistic ecological impacts.

Such advances incorporate designated splashing and site-explicit treatment, motorized weeding, and rural apparatus route. To improve the attainability and viability of these devices, it is important to get the area data of individual harvest plants precisely.

Robotized and exact rice plant confinement is vital for the automation of rice creation, which can work with designated showering, site-explicit treatment, and motorized weeding and so on Existing methodologies took on hitherto have primarily centered around between column weed recognition or rice seedling line identification. By the by, strategies for intra-line individual rice plant situating keeps on confronting significant difficulties prompted by the particular paddy field conditions or complex morphology of rice plant.

Independent Agriculture

Otherwise called "Accuracy Agriculture" has its underlying foundations in advancements as far back as 1970s and 1980s. It concerns the utilization of farming assets in an enhanced manner to get expanded the yields contrasted with customary horticultural practices. Numerous specialists, designers and researchers have created different independent farming vehicles previously yet they have not been so exceptionally effective as it comes up short on the capacity to rival the intricacy of this present reality. The vast majority of them accepted a refined modern way of cultivating where everything was known before hand and the machines could work in the predefined way – similar as a heritage creation line. The methodology is currently to foster canny machines that are adequately proficient to work in unmodified or common habitat. Independent horticulture relies intensely upon Engineering, innovation, natural and actual sciences. Mechanization of horticulture has diminished a lot of manual work and expanded effectiveness and efficiency in ranches.

Effect of Robotics in Agriculture

Horticulture is turning into a cutting edge industry attracting new freedoms terms of innovation use and item advancements. With the headway of the innovation, entrance of something similar to farming space has additionally expanded with the coming of agri bots and particular agrarian machines. Horticultural stage can be extensively characterized in to area and errand. Undertaking explicit robots are intended to play out a particular assignment on a predefined crop, while nonexclusive robots are intended to play out a few errands across various spaces. With the advances in innovation, horticultural robots are presently fit for performing different cultivating activities like yield exploring nuisance and weed-control, water and pesticide splashing, reaping and so on A water/pesticide sprayer robot might not have authority over the measure of water/pesticide to be splashed dependent on the dirt conditions and harvest type. Despite the fact that robots have become part of the rural practices, they are not smart enough to take their own choice dependent on different physical, regular and ecological components.

Advancement of Agricultural Robots

Innovative work of horticultural robots can be dates as ahead of schedule as 1920s, with exploration to fuse programmed vehicle in agrarian practices. Examination work on agrarian robots cover wide range of uses and address wide assortment of difficulties. The utilization of agrarian robots might incorporate assignments from a straightforward programmed collecting to cutting edge observing of rural activities through AI based development algorithmic preparing strategies. An overall survey on ongoing headways in rural robots will zero in chiefly on (I) Pesticide Spraying and Weed Control (ii) Agricultural Land exploring and Data Collection (iii) Autonomous Harvesting.

Reception of Machine Learning Algorithms in Agricultural Practices

AI has advanced with high performing processing calculations alongside Robotics and Artificial knowledge advances. This has set out new open doors to disentangle, evaluate, and comprehend information escalated measures in agrarian functional conditions. AI application in agro-ranch can be broadly found in regions like yield discovery, illness recognition, weed identification, water system arranging, soil condition, nature of harvest and climate forecast. After yield one can discover AI utilized in dissecting the produce newness (foods grown from the ground newness), timeframe of realistic usability, produce quality, market investigation and so forth.

The major objectives of this paper are listed as follows:

- Design and Develop an IOT enabled remote humidity measurement device.
- Utilization of Machine Learning Algorithms for accurate prediction of crop based on the existing data set provided by Agricultural authorities.

The rest of sections present in the paper are organized as follows: Section II reviews some of the existing techniques related to data samples prediction and privacy preservation with its own benefits and demerits. Section III provides a clear description about the proposed Regression techniques for data samples prediction. Section IV evaluates the performance of the proposed technique by analyzing various measures, and it compares the estimated results with the traditional techniques for proving the superiority. Finally, the paper is concluded and its future work is stated in Section V.

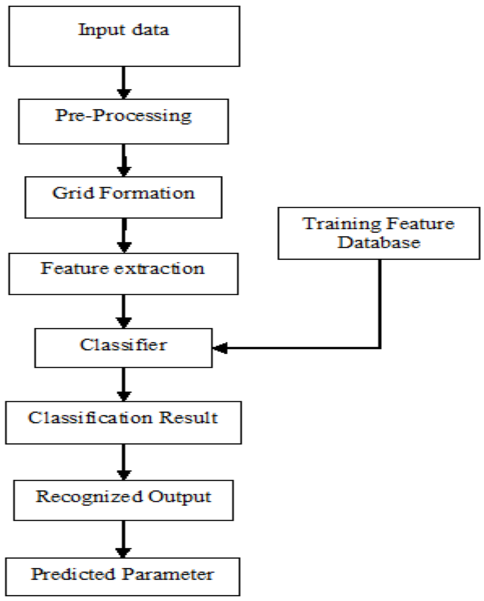

Fig 2. Basic Architecture of the Model

II. RELATED WORK

This section reviews the existing works related to improve the prediction and data forecasting rate of data samples architecture. Also, the benefits and demerits of each prediction mechanism were discussed in detail.

The possibility of agribusiness and the cultivating business depends intensely on imaginative ideas and innovative advancements to strengthen yields and further developed use of assets with the assistance of eccentric figuring instruments. Yield models and dynamic instruments are being logically utilized in the rural field to further develop creation and asset use proficiency, there is a tremendous extension for Artificial Intelligence to change agribusiness by incorporating cutting edge innovations to conjecture farming efficiency [2].

In farming the main utilization of agribusiness was passed on in 1983 [3]. To tackle the current challenges in agribusiness numerous strategies have been proposed, beginning from information base to the choice emotionally supportive networks [4]. Among these explanations, frameworks that utilize Artificial Intelligence are enormous entertainers as long as the heartiness and precision are concerned. Climatic change, expansion in the expense of productions , diminishing water supply for water system and comprehensive drop in the ranch labor force have raised a lost of ruckus to the agribusiness creation frameworks over a most recent couple of many years [5].

Furthermore, the issue of supply frameworks and food creation is undermined because of the COVID-19 pandemic, [6]. Such factors are a danger to the manageability of the climate, of the present and the future food source chain [7]. Significant creations are consistently a need to remain in front of the tireless environmental change [8]. The reasonable issue here is by what intends to collect satisfactory amount of nourishment for the steadily developing populace.

The exploration researchers are constantly applying state-ofthe-workmanship mastery and finding better approaches to acclimatize them into farming framework [5].

There have been various investigations led in the horticulture field utilizing computerized reasoning, and it is acquiring accommodation cultivating. Panpatte et Al. [9] proposed keen cultivating practices to limit the deficiency of ranchers due to natural vulnerabilities and gave answer for better return. Utilizing man-made consciousness stages they have assembled enormous measure of datasets from different sites and alongside this utilizing Internet of Things (IoT) constant dataset is gathered, then, at that point, this gathered information has been examined with exactness to empower the ranchers for resolving every one of the questionable issues looked by ranchers in the agribusiness area.

Vinoy Koshy Thomas et Al. [10] exhibited a plant acknowledgment and suggestion framework utilizing the Convolutional Neural Network (CNN) beginning v3 model. Their gave framework showed has a proposal highlight that can be utilized to recognize comparable plants that can be planted around there. For plant acknowledgment they have utilized commencement v3 model, by extricating highlights from pictures they have perceived plants. For exploratory investigation they have given 10 leaf pictures and out of that 7 were perceived right. The general precision of their Neural organization was 70 %.

G.Ramyalakshmi et Al. [11] have fostered a framework which will foresee the yields dependent on ranchers, soil type and rainstorm. Then, at that point, it will propose the rundown of harvests as per their feedback and soil's pH level. For this proposal framework they have utilized arbitrary woods calculation. In their proposed framework In this calculation is likewise been utilized to discover the infections and bugs showed up on the yield plants dependent on their side effects. In their model for irregular woodland calculation last forecast will be considered as best likelihood.

Pooja Akulwar [12] have done review on horticultural land that develops strawberry and citrus crop. The dataset contains in excess of 1,000 strawberry pictures and citrus pictures which is caught with camera. On the gathered dataset creator have done some preprocessing and element extraction part, then, at that point, Convolutional Neural Network have been applied. In the wake of recognizing the harvest type, crop illness has been identified. To compute the harvest yield, there is need to eliminate infected harvest as it will add to awful creation or influence creation. In this manner, great harvest is chosen and yield is anticipated utilizing AI calculation. For exploratory outcome creator have prepared model on Citrus Canker and it have result that Blackspot is 31.29 % identified.

Shima Ramesh et Al. [13] have carried out Random Forest Algorithm alongside HoG include extraction on the named dataset. Their goal of this calculation was to perceive anomalies that happen on plants in their nurseries or common habitat. They have taken those pictures wo have plain foundation to wipe out impediment. The calculation was appeared differently in relation to other AI models for precision. Utilizing Random woodland classifier, they prepared their model utilizing 160 pictures of papaya leaves. The model could group around 112 pictures right for example around 70 % precision.

III. Proposed Methodology

This section presents the detailed description about the proposed temperature geometry features based positional verification system. The major aim focused on this work is to improve the recognition accuracy of forecasting based on the feature representation of the data. For this purpose, a novel technique such as ensembling of Linear and Lasso regression techniques are proposed. The overall flow of the proposed system is depicted, which includes the following stages:

- Preprocessing,
- Pattern Validation and Classification.

The Block Diagram of Proposed Work is shown in the fig 3. Remote Sensing of land and soil features of crops and ML Based Prediction for Better Harvesting of Crop.

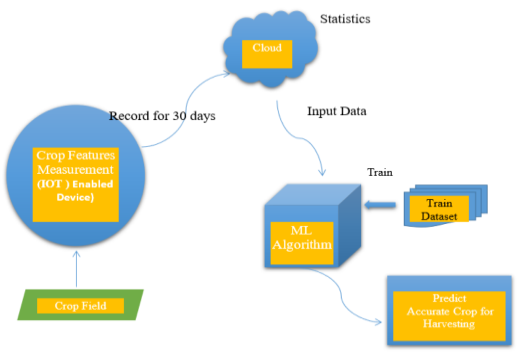

Fig 3. Block Diagram of the Porposed System

Step 1: Record the properties of the crop on or off field.

Dataset may have following attributes

- Soil Parameters:
- Soil Type
- Soil Ph value
- Climatic Parameters:
- Humidity
- Temperature
- Wind
- Rainfall
- Production
- Cost of cultivation

Step 2: Feed all the data to cloud.

Step 3: Train the Machine Learning Algorithm from the standard set of features data of crops prepared.

Step 4: Input the stored data from the cloud for our crops to Machine Learning algorithm.

Step 5: Start Compare the present scenario data with Pre determined data.

Step 6: From previous step predict the accurate crop for better Harvesting.

IV. RESULTS

This section evaluates the performance of the proposed temperature feature classification system by using various evaluation measures. The performance of the proposed work can be validate by comparing the result of classification and optimization model with the other existing methods by analyzing the statistical parameters. This was implemented and tested in the Python tool in the version of 3.8. For the temperature flow analysis, the position and the coordinates information are selected according to the coverage area and simulated by generating the random position changes and creating the missing of data scenario in different modules. This was validated with the existing methods for the dataset of Portuguese humidity administration database that is referred in paper [23]. This contains the temperature information in the Portuguese humidity and in that some data are made as the missing value to predict and forecast the data. Here, the data collection was updating since 2012 for every change in the humidity feature update. For this analysis, there are 2890 collections of humidity sections / instances were arrange to analyse the performance of proposed work comparing with the other state-of-art methods. The performance results are discussed in the following sub-sections.

Performance Indicators

The commonly used measures for evaluating the results of data classification system are sensitivity, specificity, jaccard, dice, precision, recall, F1-measure, Matthews Correlation Coefficient (MCC), and error rate, kappa coefficient, and accuracy, which are calculated as follows:

$$Sensitivity = \frac{TP}{TP + FN} \quad (1)$$

$$Specificity = \frac{TN}{TN + FP} \quad (2)$$

$$Jaccard\_Similarity = \frac{TP}{TP + FN + FP} \quad (3)$$

$$Dice\_Overlap = \frac{2TP}{FP + 2TP + FN} \quad (4)$$

$$\Pr ecision = \frac{TP}{TP + FP} \quad (5)$$

$$\operatorname{Re} call = \frac{TP}{TP + FN} \quad (6)$$

$$F1\_Score = \frac{2 \times \Pr ecision \times \operatorname{Re} call}{\Pr ecision + \operatorname{Re} call} \quad (7)$$

$$MCC = \frac{TP \times TN - FP \times FN}{\sqrt{(TP + FP)(TP + FN)(TN + FP)(TN + FN)}} \quad (8)$$

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \quad (9)$$

$$Error\_Rate = 1 - Accuracy \quad (10)$$

$$Kappa\_Coeff = \frac{P_o - P_e}{1 - P_e} \quad (11)$$

Where, TP – True Positive, TN – True Negative, FP – False Positive, FN – False Negative. Fig 4 and Table 1 compares the values of sensitivity, specificity, precision, F1-score and MCC of both existing [23] and proposed techniques. From the evaluation, it is analyzed that the proposed technique provides an increased performance values, when compared to the existing technique. Because, it efficiently extracts the patterns by using geometrical feature extraction technique.

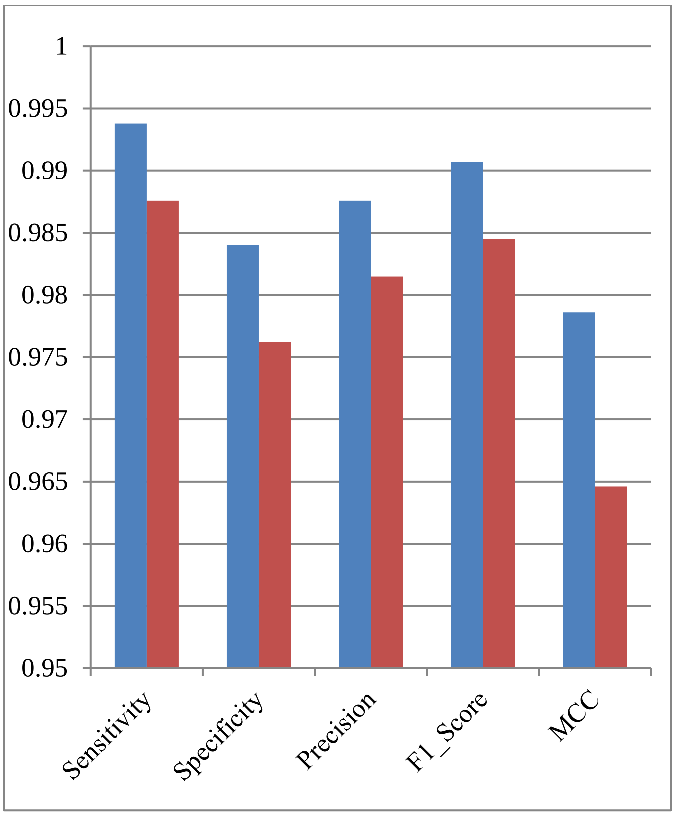

Fig 4. Performance Measure

Table 1. Performance evaluation of existing and proposed techniques

Parameters	*Proposed*	*TrAdaBoost*
Sensitivity	0.9938	0.9876
Specificity	0.984	0.9762
Precision	0.9876	0.9815
F1_Score	0.9907	0.9845
MCC	0.9786	0.9646
Accuracy	0.98	0.973
Kappa Coefficient	0.975	0.971
Error rate	0.02	0.027
FPR	0.012	0.015

Table 2. AUC analysis

Methods	*AUC*
MCC	0.601407
CSM	0.572018
MDC	0.865575
Bayes	0.739617
CS	0.937389
Exsting	0.922684
Proposed	0.965011

Accuracy Analysis

Table 3 evaluates the accuracy of existing and proposed classification techniques, where the proposed technique accurately classifies the temperature data based on the extracted patterns and geometrical features of the input data. Moreover, the accuracy of the classifier can be determined based on its efficiency in classified label as 0 or 1. From the evaluation, it is analyzed that the proposed classification technique provides an increased accuracy, when compared to the existing techniques.

Table 3. Accuracy analysis

Methods	*Accuracy*
MCC	0.85
CSM	0.86
MDC	0.846
Bayes	0.842
CS	0.878
Existing	0.953
Proposed	0.98

True Positive Rate and False Positive Rate

Fig 8 shows the Receiver Operating Characteristics (ROC) of the existing and proposed techniques with respect to the values of True Positive Rate (TPR) and False Positive Rate (FPR). The FPR of classification technique is estimated by the subtraction of specificity from the value 'one'. This analysis shows that the curve reaches the maximum sensitivity value with minimum FPR value.

The overall experimental analysis results depicted that the proposed geometric feature extraction based classification technique provides an improved results compared than the other techniques.

V. CONCLUSION

This paper proposed a new pattern extraction based classification method for temperature feature data forecasting and recognition. For this purpose, various data processing techniques are employed in this work at the stages of preprocessing, block separation, pattern extraction, and classification.

In the proposed work, a useful collect proposition system using classifier models were introduced. From the yield outlines the best period of planting, plant advancement and gathering of plant can similarly be found close by assumption for crops. Decision tree shows horrendous appearance when datasets is having more assortments gives ideal result over decision tree for such datasets. Furthermore, anticipate the precise yield for reaping dependent on examination of Various ML Algorithms.

In future, this work can be extended by implementing a new classification technique for temperature feature data forecasting system.

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