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Survey Paper on Prediction of Crop yield and Suitable Crop

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ABSTRACT: This survey paper endeavours to enhance the precision of crop prediction by leveraging the distinct characteristics of the agricultural environment. Through a comprehensive analysis of diverse environmental factors such as climate, soil attributes, and weather conditions, this study aims to identify key features crucial for accurate crop yield estimation. Multiple feature selection techniques will be employed to discern the most influential factors. The predictive models will then be constructed using various classifiers, allowing for a comparative evaluation of their performance. The findings of this research contribute valuable insights into optimizing crop prediction models and advancing sustainable agricultural practices.

KEYWORDS: Agriculture, classification, crop prediction, feature selection, Machine Learning.

I. INTRODUCTION

In the rapidly evolving landscape of agriculture, the transformative approach of precision farming has emerged, utilizing technology to optimize crop yields and resource utilization. This research endeavors to contribute to this domain by conducting a comprehensive analysis of feature selection techniques and classifiers, aiming to enhance the precision and reliability of crop prediction models. The significance of this research lies in its potential to refine decision-making processes for farmers, enabling more informed and efficient agricultural practices. Through discerning the most impactful environmental factors affecting crop growth and leveraging advanced machine learning techniques, the goal is to create robust models capable of predicting crop outcomes with a high degree of accuracy. The study navigates through various feature selection methodologies, exploring the strengths and limitations of filter, wrapper, and embedded techniques. Simultaneously, it embraces a diverse set of classifiers, ranging from interpretable decision trees to sophisticated neural networks. The iterative nature of the analysis ensures a thorough examination of the interplay between feature selection and classification, aiming for a synergy that elevates the predictive prowess of the models. As we embark on this journey at the intersection of agriculture and machine learning, the outcomes hold promise not only for optimizing crop management but also for contributing valuable insights to the broader field of precision agriculture. Through meticulous experimentation and analysis, we anticipate uncovering strategies that empower farmers with actionable predictions, ultimately fostering sustainable and efficient agricultural practices.

II. RELATED WORK

The purpose of this paper is to provide a thorough literature review and retrospective on Response Surface Methodology (RSM). Examining the past development of RSM, we seek to identify its inception, significant turning points, and path forward. The latest developments in RSM methodology, including enhancements in computational tools, statistical methods, and experimental design, will be examined closely. Additionally, we will examine the vast range of RSM applications in other disciplines, illuminating its flexibility and ability to meet particular issues in a variety of domains. In order to provide a more nuanced view, a critical analysis will be conducted, examining the method's strengths and weaknesses. Furthermore, we will look into how RSM has affected decision-making processes and advanced particular industries, as well as how it has affected research and industrial practices. In summary, we will highlight current developments in RSM research and suggest possible future paths. Our goal is to provide insights that could help practitioners and scholars make sense of this constantly changing methodology[1].

The study presents the primary general classes of algorithms in this category, along with an outline of the justifications for employing ranking feature selection techniques. Additionally, a brief history of ranking method problems is provided. The focus then shifts to specific algorithms that leverage rough sets and random forests. Furthermore, a recently developed technique based on decision tree models is introduced: Generational Feature Elimination (GFE). This approach is predicated on feature occurrences in decision trees generated in successive generations at certain levels. Comprehensive details regarding its unique characteristics and performance outcomes in contrast to other methods are also provided. Both a synthetic benchmark dataset and real-world datasets are used in the experiments [2].

The new DSSAT/CSM design and the methods for modelling the four main scientific components—soil, crop, weather, and management—are presented in this work. The report also outlines the procedures and data needs for model evaluation. We present a summary of the hundreds of published Research that have employed the DSSAT crop models for different purposes. The benefits of the newly redesigned DSSAT/CSM will present significant chances for increased collaboration in multidisciplinary research and the application of knowledge to address issues at the field, farm and higher levels for both its developers and other members of the scientific community[3].

Developing an artificial neural network (ANN) system for predicting rice production in hilly areas is underway, aligning with precision agriculture and sustainable farming techniques. This innovative technology leverages ANNs to accurately estimate rice harvests, offering invaluable assistance to farmers facing challenges in difficult mountainous terrain. The primary goal is to provide farmers with a tool that mitigates hazards arising from challenging topography and erratic weather patterns, while simultaneously optimizing the use of resources such as water, fertilizer, and pesticides. The method focuses on enhancing agricultural resilience through the implementation of adaptive farming techniques based on insights from neural networks. This empowers farmers to make well-informed decisions tailored to the specific constraints of mountainous landscapes. Furthermore, the system aspires to catalyze research and innovation by showcasing the application of artificial intelligence to intricate agricultural problems. The overarching objective is to promote sustainable development and elevate the standard of living for farmers in these areas, underscoring the socioeconomic impacts of implementing such a system [4].

We used data from NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) in association with county-level data from the United States Department of Agriculture (USDA) to develop empirical models predicting maize and soybean yield in the Central United States. As part of our analysis, we also tested the ability of MODIS to capture inter-annual variability in yields[5].

Using publicly accessible Landsat and MODIS satellite photos, we created a methodology in this work to estimate the area and wheat yield for Punjab Province around six weeks before to harvest. Regressing reported yield values against time series of four distinct peak-season MODIS-derived vegetation indices yielded the wheat yield. We also explored using a regression-tree method to derive wheat area from the same MODIS time series. WDRVI outperformed the four assessed indices in terms of yield forecast accuracy and consistency when compared to the NDVI, EVI2, and saturation-adjusted normalised difference vegetation index (SANDVI). When utilising six or more years of training data, the district-level RMSE values for anticipated versus reported yield were shown to be the lowest[6].

These days, predicting yield is highly popular among farmers, especially when it comes to choosing the right crops to plant. This makes estimating crop yields a challenging but intriguing subject. In the past, yield prediction was done by taking the farmer's field and crop experience into account. This paper provides a system that predicts the category of the analysed soil datasets using data mining techniques. The category that is thus forecasted will show crop yields. In a formalised classification rule, the problem of crop yield prediction is addressed by applying the K-Nearest Neighbour and Naive Bayes approaches[7].

The study area is an official test site of the Joint Experiment of Crop Assessment and Monitoring (JECAM) and is located in an intensely agricultural used area in Northern Germany. Classification results were produced for the growing seasons 2015 and 2016. The overall accuracy in 2015 amounted to 89.49%. A challenge remains the distinct separation of wheat and rye, whereas barley, rapeseed, potato, corn and sugar beet are classified with high accuracies. The overall accuracy in 2016 was lower (77.19%) due to unfavourable weather conditions[8].

In this study, we explore the potential application of multi-temporal Sentinel-2 satellite images for the detection of heavy metal-induced stress, specifically Cd stress, in rice crops across four study areas in Zhuzhou City, Hunan

Province, China. The comparison involves seven Sentinel-2 images acquired during 2016 and 2017, juxtaposed with hyper-spectral data, chlorophyll content, rice leaf area index, and soil heavy metal concentrations gathered from 2014 to 2017 in situ. The identification of stressed rice plants from their unstressed counterparts was facilitated by utilizing vegetation indices (VIs) associated with red edge bands. These VIs served as sensitive indicators, showcasing their effectiveness in distinguishing between stressed and unstressed rice. Furthermore, the coefficients of spatio-temporal variation (CSTV), derived from the VIs, played a crucial role in discriminating crops subjected to pollution from heavy metals and other environmental stressors [9].

In this work, we conducted an extensive Electromagnetic Induction (EMI) survey across a 1 km² region split among 51 agricultural fields where prior research had clearly demonstrated a relationship between soil characteristics and crop production. Every location had a total of nine apparent electrical conductivity (ECA) values tested, with the depth of inquiry varying from 0–0.2 to 0–2.7 m. Four sub-areas with distinctive sediments and ECA were determined using an a priori interpretation based on the combination of ECA maps and known soil maps. Next, regions with comparable soil qualities were identified on the ECA maps using a supervised classification algorithm [10].

III. LIMITATIONS OF BEING WORK:

The dynamic nature of agricultural systems poses another limitation. Factors such as changing weather patterns, evolving soil conditions, and adaptive farming techniques introduce complexities that may not be fully captured by our models. Moreover, the interplay between environmental features influencing crop growth is intricate, and our selected feature selection techniques may inherently simplify these interactions, potentially leading to an oversimplified representation.

IV. BEING WORK

The landscape of crop prediction in precision agriculture has been extensively explored through a variety of studies, each contributing unique perspectives and methodologies. In a comprehensive review conducted by [Authors] (Year), the applications of machine learning in precision agriculture were meticulously examined. This foundational work not only outlined the diverse models and datasets employed in the field but also shed light on the overarching challenges faced. Their insights serve as a solid basis for our study, offering a panoramic understanding of the applications of machine learning in agricultural contexts.

V. CONCLUSION AND FUTURE WORK

In amalgamating these diverse perspectives, our study aims to contribute not merely as an addition to the existing body of knowledge but as a catalyst for advancement. As we delve into the dynamic interplay of feature selection techniques and classifiers, we embark on a journey to refine predictive models that resonate with the intricacies of precision agriculture. Through iterative analysis, we aspire to offer practical solutions, empowering farmers with actionable insights for sustainable and efficient crop management. The echoes of existing works reverberate in our methodologies, and it is with a commitment to building upon these foundations that we step into the realm of precision agriculture, where the future of crop prediction unfolds.

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