International Journal of Scientific Research in Computer Science, Engineering and Information Technology
ISSN : 2456-3307 (www.ijsrcseit.com)
doi : https://doi.org/10.32628/CSEIT239017

A Review on Sustainable Agriculture and Production- Challenges and Opportunities

Muthu Virumeshwaran T, Saran Kirthic R, Dr. Saranya K G
Department of Computer Science and Engineering, PSG College of Technology, Peelamedu, Coimabtore, India

Article Info
Publication Issue :
Volume 9, Issue 1
January-February-2023

Page Number : 164-171

Article History
Accepted: 10 Jan 2023
Published: 31 Jan 2023

ABSTRACT

"Sustainable agriculture" as legally defined in the U.S. Code Title 7, Section 3103 means an integrated system of plant production practices. It has point-specific application that will over the long term goals like satisfy people's food and fiber requirements, enhance quality of environment and the natural resource base upon which the agricultural economydepends, make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls, sustain the economic viability of farm operations. enhance the quality of life of farmers who are the major contributors in the Nation's economy

1.The impact of the Green Revolution is now waning, just as the demand for food is increasing.

2.Changes in temperature, atmospheric carbon dioxide (CO2), and the frequency and intensity of extreme weather could have significant impacts on crop yields.

3.Plant diseases will have significant effect on crop yield if not checked properly. This paper provides an overview on challenges and opportunities associated with climate change, plant diseases and food demand.

Keywords: Sustainability, Sustainable development, Explainable AI, Artificial Intelligence

I. INTRODUCTION

The structure of the agricultural sector is typically perceived as disorganized and fragmented, so the lack of effective regulation in the sector also contributes to the exploitation of farmers and very low It's visually recognized as one of the reasons why it works on profit margins. Lack of farmers' understanding of costs and prices One of the main reasons for the lack of opportunistic cost management in the industry is the lack of prioritization of cost management by farmers due to lack of equipment knowledge. To understand the potential for collaboration, the producer needs to be open to innovation in cost control and contracting technology, and his one bargaining point of contract pricing with retailers where producers fail. I have. Changes in temperature, atmospheric carbon dioxide (CO2), and the frequency and intensity of extreme weather events can have a significant impact on crop yields. For a particular crop, the impact of temperature rise will depend on the optimum temperature for crop growth and

reproduction. In some regions, warming could benefit the types of crops normally grown there, or harm farmers by switching to crops that are now grown in warmer regions. In addition, yields decrease when high temperatures exceed the crop's optimum temperature. Plant diseases have been known since the times that predate the earliest inscriptions. Fossil evidence suggests that the plant suffered from the disease 250 million years ago. From the beginning of recorded history, the Bible and other early inscriptions mention diseases such as rust, mould, and rot that caused famine and other countries' precipitous economic decline. Such plant disease losses can have economic consequences. As a result, revenues for crop growers and traders fall, and prices rise for consumers.

II. Related Works

S.No	Title	Techniques	Advantages	Limitations
1	Implications of climate change for agricultural productivity in the early twenty-first century	Alternative crop rotation techniques	Fertility, crop yield is increased	Obligatory crop diversification
2	The Applicability of Big Data in Climate Change Research: The Importance of System of Systems Thinking	Big data analytics		Low efficiency when data is noisy
3	Aligning artificial intelligence with climate change mitigation	AI -ML		avoidance of extreme climate conditions
4	Weather Prediction Using Machine Learning	Machine learning	useful if we have unanticipated values to consider.	Imperfect in noisy data
5	Weather Prediction using Advanced Machine Learning Techniques	Fine Gaussian SVM	Works better with better dimensions	Not suitable for large data

Table 2.1 Predicting Climate Change using AI

S.No	Title	Techniques	Advantages	Limitations
1	Plant Disease Prediction using Image Processing Techniques-A Review	Bayes, SVM, Ostu's, PNN and K-Means	Performance is enhanced as dataset changed	When dataset is higher the training time is higher
2	Cucumber Disease Detection Using Artificial Neural Network	ANN (Artificial Neural Network)	ANN Achieves 80.45% Accuracy	Works only with numerical data
3	Machine Vision Based Classification of Tobacco Leaves for Automatic Harvesting	K-NN Classifier	classification of tobacco leaves using a fusion of different texture and colour features,	Slow as the data is getting larger
4	Detection of plant leaf diseases using the image segmentation and soft computing techniques	SVM (Support Vector Machine)	SVM Achieves 95.71% Accuracy	When dataset is higher the training time is higher And less availability of data
5	A Survey on Plant Leaf Disease Identification	A neural network, PCA, Genetic Algorithms	PNN Presents Faster Response	Difficult to calculate covariance

Table 2.2 Prediction of Plant Diseases using AI

S.No	Title	Techniques	Advantages	Limitations
1	Computer vision technology in agricultural automation	Computer vision	low cost, high efficiency and high precision.	with the rapid development of agricultural automation, the demand for professionals will continue to grow. Finally, the robust performance of related technologies in various complex environments will also face challenges

2	Computer control of greenhouse climate	Computation of mathematical models	the instantaneous greenhouse climate, short term plant growth and longterm crop development.	avoidance of extreme climate conditions
3	Internet-of-Leaf-Things (IoLT) for Monitoring of the Growth of Crops in Smart Agriculture	IoT, image processing and machine learning technologies	The model shows a great potential with an accuracy of around 98% to predict the growth of the leaves	
4	Computer vision-based phenotyping for improvement of plant productivity: a machine learning perspective		enable us to dissect complex traits and determine visual signatures related to traits in plants. show more accurate performance compared with traditional approaches	

Table 2.3 Crop Yield and Productivity

S.No	Title	Techniques	Advantages	Limitations
1	Cost-effectiveness of the common agricultural policy and environmental policy in country districts: Spatial spillovers of pollution, bio-uniformity and green schemes in Poland	Common agricultural policy, Composite environmental quality index	AP are more effective than municipal schemes, which are internally inconsistent to some extent.	It is apparently not the case because in Central-Eastern Europe, small farms may be those that need relatively more incentives to participate in green schemes in comparison to large farms

2	A Bayesian network framework for project cost, benefit and risk analysis with an agricultural development case study	Bayesian networks	Bayesian Networks are more extensible than other networks and learning methods. Adding a new piece in the network requires only a few probabilities and a few edges in the graph.	The network is expensive to build. It performs poorly on high dimensional data.
3	An Agile AI and IoT-Augmented Smart Farming: A Cost-Effective Cognitive Weather Station	Support Vector Machine (SVM), Artificial Neural Network (ANN), or Recurrent Neural Network (RNN).		

Table 2.4 Cost Effectiveness in Agriculture

III. CHALLENGES ASSOCIATED WITH THE SUSTAINABLE AGRICULTURE AND PRODUCTION

The present system suffers from Noisy data Extreme Climate conditions, Expensive model building, Educating/motivating agricultural professionals to use, performance degrades when high dimensional data is applied. Hence there is a need to develop a cost effective, easy to use technology for sustainable agriculture production.

3.1 Opportunities to improve the prediction of weather

Interpretable and explainable AI (XAI) models for weather forecasting. Weather application is a utility that gives you access to all reports related to weather for any region. The location is detected via GPS, the server configuration can automatically detect the area and share weather records such as temperature, wind direction, precipitation and humidity. To convert your environment, you need to select the options below to get information. The device uses an advanced regressor, Random Forest Regression (RFR), as it involves many decision bushes when making decisions. Establishment/recovery strategies, including Ridge Regression (Ridge), Auxiliary Vector (SVR), Multilayer Perceptron (MLPR), and More Tree Regression (ETR).

We guarantee that. Shows occasional plants that can grow in suitable climatic conditions. This engine uses existing facts for specific geographic regions to provide accurate climate forecasts for specific geographic regions and climates. As a result, farmers have a clear picture of what the climate will be like during the harvesting process, and as a result can plan an effective harvest.

3.2 Opportunities to improve the prediction of plant diseases

Application users take pictures of plant leaves with mobile digital cameras. Captured images are processed using pre-trained models built into the utility. The software then uses the photo to indicate whether the plant is healthy or sick using a modelled ML algorithm. The result could be the name of the disease and how to cure it. If the illness is too severe to deal

with, you may have the opportunity to name the nearest agricultural sector. The system incorporates a set of neural network architectures to effectively classify snapshots and associated commitments. It can also be trained with input photos of different sizes to improve accuracy. With the constant advent of inexpensive digital cameras and the prevalence of smart phones among plant breeders in the industry, the development of image analysis-based computerized disease detection mobile software has become invaluable for early detection and prevention of disease. can be a useful tool. Provide customers with information and treatment on detected diseases. The cellular app serves as a tool for farmers and plant breeders to identify plant diseases quickly and in an environmentally friendly manner and facilitate decision-making on disease management.

3.3 Opportunities to improve the crop yield:

Farmland provides many facts every day about temperature, soil, water use, weather conditions and more. This mobile application leverages this information using synthetic intelligence and real-time mode knowledge systems to generate actionable insights such as: The XAI system is designed to improve overall harvest comfort and accuracy, known as precision agriculture. XAI generation uses bad pabulum detection from farm. The XAI sensor can find weeds nearby so you can use the permitted amount of herbicide to remove them. This minimizes herbicide use and saves you money. This intelligent application of his XAI can be incorporated into sprayers that can significantly reduce the number of chemicals used in the field, thus improving the quality of produce and making it more cost-effective.

IV. XAI Enabled Sustainable Agriculture

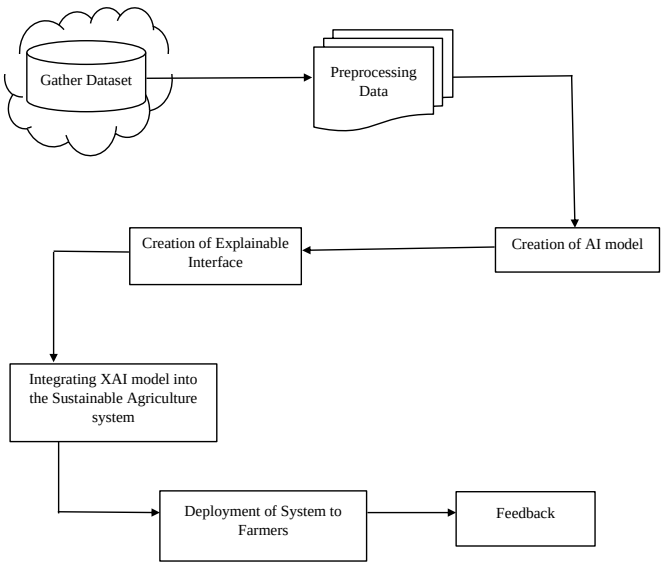

Figure 4.1 Framework for Sustainable Agriculture and Production using XAI

The gathering of dataset is the first and foremost step in the system. This includes gathering dataset of previous weather data and data of pest affected area. Then the pre-processing of data is done and thus the only required attributes are considered for the AI model. Then the creation of AI model for prediction of weather and plant diseases is modelled by using the required algorithms. Then an Explainable AI interface is also built so that it gives a clear idea of how the decision is made by the system. Then integrating the AI model into the Sustainable agriculture. Deployment of the system is done and then feedback from the farmers is received for further improvements.

V. CONCLUSION

Thus, to attain a sustainable agriculture to satisfy human needs for food and fiber, we have to develop a system which helps us jhovercome the current challenges like yield of crops, climatic changes, plant

disease and cost efficiency and to achieve the significance of sustainable agriculture to achieve this state computer technologies are very helpful and effective. We have implemented XAI to solve and face the existing challenges of agriculture. The system uses a set of XAI algorithms and undergoes processing and prediction of the data collected from the field and suggests all the precautions and steps to be taken prior to the damage itself helping the human race to experience sustainable agriculture.

VI. REFERENCES

[1]. Jemma Gornall, RichardBetts,Eleanor Burke, Robin Clark, Joanne Camp, Kate Willettand Andrew Wiltshire, 27 September 2010 ,Implications of climate change for agricultural productivity in the early twenty-first century .

[2]. Sebestyén V, Czvetkó T and Abonyi J (2021) The Applicability of Big Data in Climate Change Research: The Importance of System of Systems Thinking. Front. Environ. Sci. 9:619092. doi: 10.3389/fenvs.2021.619092

[3]. Kaack, L.H., Donti, P.L., Strubell, E. et al. Aligning artificial intelligence with climate change mitigation. Nat. Clim. Chang. 12, 518–527 (2022). https://doi.org/10.1038/s41558-022-01377-7

[4]. N. Singh, S. Chaturvedi and S. Akhter, "Weather Forecasting Using Machine Learning Algorithm," 2019 International Conference on Signal Processing and Communication (ICSC), 2019, pp. 171-174, doi: 10.1109/ICSC45622.2019.8938211

[5]. G. Hemalatha et al 2021 J. Phys.: Conf. Ser. 2089 012059 DOI 10.1088/1742-6596/2089/1/012059

[6]. Sujeet Varshney et al, International Journal of Computer Science and Mobile Computing, Vol.5 Issue.5, May- 2016, pg. 394-398

[7]. P. Pawar, V. Turkar and P. Patil, "Cucumber disease detection using artificial neural network," 2016 International Conference on Inventive Computation Technologies (ICICT), 2016, pp. 1-5, doi: 10.1109/INVENTIVE.2016.7830151.

[8]. D. S. Guru, P. B. Mallikarjuna, S. Manjunath & M. M. Shenoi (2012) Machine Vision Based Classification Of Tobacco Leaves For Automatic Harvesting, Intelligent Automation & Soft Computing, 18:5, 581-590, DOI: 10.1080/10798587.2012.10643267

[9]. Vijai Singh, A.K. Misra,Detection of plant leaf diseases using image segmentation and soft computing techniques,Information Processing in Agriculture,Volume 4, Issue 1,2017,Pages 41-49,ISSN 2214-3173,https://doi.org/10.1016/j.inpa.2016.10.005

[10]. Sneha Patel, Dr. U.K. Jaliya and Pranay Patel, “A Survey on Plant Leaf Disease Detection”, International Journal forModern Trends in Science and Technology, Vol. 06, Issue 04, April 2020, pp.:129-134

[11]. Hongkun Tian, Tianhai Wang, Yadong Liu, Xi Qiao, YanzhouLi,Computer vision technology in agricultural automation —A review,Information Processing in Agriculture,Volume 7, Issue 1,2020,Pages 1-19,ISSN 2214-3173,https://doi.org/10.1016/j.inpa.2019.09.006

[12]. S. Kumar, G. Chowdhary, V. Udutalapally, D. Das and S. P. Mohanty, "gCrop: Internet-of-Leaf-Things (IoLT) for Monitoring of the Growth of Crops in Smart Agriculture," 2019 IEEE International Symposium on Smart Electronic Systems (iSES) (Formerly iNiS), 2019, pp. 53-56, doi: 10.1109/iSES47678.2019.00024.

[13]. Keiichi Mochida, Satoru Koda, Komaki Inoue, Takashi Hirayama, Shojiro Tanaka, Ryuei Nishii, Farid Melgani, Computer vision-based phenotyping for improvement of plant productivity: a machine learning perspective, GigaScience, Volume 8, Issue 1, January 2019,

giy153,
https://doi.org/10.1093/gigascience/giy153

Cite this article as :

Muthu Virumeshwaran T, Saran Kirthic R, Dr. Saranya K G "A Review on Sustainable Agriculture and Production- Challenges and Opportunities", International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), ISSN : 2456-3307, Volume 9, Issue 1, pp.164-171, January-February-2023. Available at doi : https://doi.org/10.32628/CSEIT239017
Journal URL : https://ijsrcseit.com/CSEIT239017