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Deep Learning Supported Food Security in Developing Countries

Dr. Pokkuluri Kiran Sree[1], SSSN Usha Devi N[2]

[1]*Professor, Dept of CSE, Shri Vishnu Engineering College for Women, Bhimavaram.*
[2]*Assistant Professor, Dept of CSE, University College of Engineering, JNTU Kakinada.*
Correspondence E-mail Id: *drkiransree@gmail.com*

Abstract

Technology support is vital for the growth of any country. Food Security, in particular, is vital for the growth of any country. Deep learning(DL) augmented methods have helped many countries like India, China, Australia etc. in health, agriculture, medical, education, and various field for a better economy. This mechanism was used in many countries for a better sanitary system in cities. The focus of this study is to explore the possibilities of DL in an Agrarian Economy. We have studied various papers & systems in the world and summarize the strengths of DL in this paper. After a thorough literature survey, we can conclude that deep learning offers a robust method to monitor the diseases of various crops, the yield of crops especially to Wheat, Maize, Sugarbeet, Barley, and Sunflowers thus enabling food security.

Introduction

The observation of yield development and execution during formative stages is a significant part of agrarian administration. It empowers the rancher to execute auspicious intercessions that guarantee ideal yields toward the finish of the period. Stress factors frequently keep crops from creating at the rate they are prepared[1] to do. The estimates of harvest region and yield are of fundamental significance to policymakers[5] for the arranging of horticultural creation and checking of nourishment supply. The potential connections among destitution and harvest yields, which rely on an assortment of components, for example, development rehearses, accessibility of water system, access to assets to purchase rural contributions for the appropriation of new innovation, can't be comprehended entirely without dependable appraisals of yield region and yields. Without solid data on crop profitability, the purposes for nourishment frailty of farming families can't be decisively recognized.

Literature Review

Artificial Neural Networks, as the name suggests, “neural” is the brain-inspired word. It works as the same way as the human brain works. In Neural networks, it consists of input, output and hidden layers,where the neurons are the input given to the ANN and it is

performed by hidden layers by some units and it is used by output layers to produce output. The accuracy of the neural networks increases as the data increases. They adapt to the complexity without knowing the principles of underlying layers. In artificial intelligence[4][9] and machine learning algorithms like ID3 and other optimizing algorithms are used in tomato crop detection. Tomato is widely used crop around the globe, its cultivated in almost all parts of the world. To design a expert system for Tomato crop[2][8] the taken help from the computer engineers to design and program and Agriculture scientist and the expert who have more knowledge in tomato cultivation.In maize cultivation, the machine learning techniques are used . Corn is also a popular crop and a main source of cereals along with rice genotypes which is adapted and well suited in drought situation which has to be grown under controlled situations and marginal law has to be implemented.

Information Mining Techniques: This method is utilized to dissect the gathered information to offer experiences to make a decision. By using the data or result got by the information mining procedures, we can diminish the hazard related with the farming by anticipating the harvest yield all the more unequivocally to harvest.To give effective outcome the Data mining procedure required an enormous measure of information to break down such a path in yield forecast it requires more knowledge [3][7] that related harvest yield. Weather data.soil properties and rural insights etc.

Design of the Dl Mechanism

The design of DL [6] method we adapted was represented in figure 1.

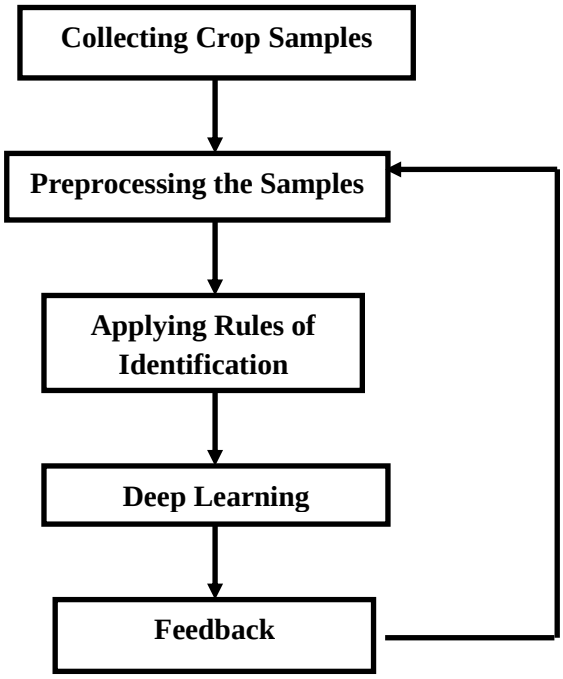

Figure 1.Architecture of General DL for Crop Prediction

We have collected 46 different types of crop parameters for processing. The parameter combination of the crops will be processed by fuzzy rules so that predictions will be more dynamic and also adaptable for the crops not trained also. After this process, we have cellular automata rules that initially process the data and passes this to a deep learning classifier. The deep learning classifier uses CNN convolution neural network to study the crop yield, diseases, and other parameters etc. The strength of the classifier lies in providing feedback to the end-customers of the system(farmers).

Results

We have tested our work with a wheat crop with 16 different parameters and observed the following inferences as shown in fig 2.

1. In India, the productivity of wheat crop before adapting DL is reported as 46, and after adopting DL is reported as 66, and we can observe an increase of 20%.
2. In China, the productivity of wheat crop before adapting DL is reported as 30, and after adopting DL is reported as 89, and we can observe an increase of 59%.
3. In Australia, the productivity of wheat crop before adapting DL is reported as 36, and after adopting DL is reported as 66, and we can observe an increase of 78%.

After being successful, we have adopted this framework to other crops Maize, Sugarbeet, Barley, and Sunflowers. The inferences are shown in fig3.

1. India Maize, Sugarbeet, Barley , Sunflowers productivity reported as 50, 68, 86 and 70, respectively. India reports high productivity for Barley.
2. China Maize, Sugarbeet, Barley , Sunflowers productivity reported as 45, 62, 82 and 85 respectively. China reports high productivity for Barley and Sunflower.

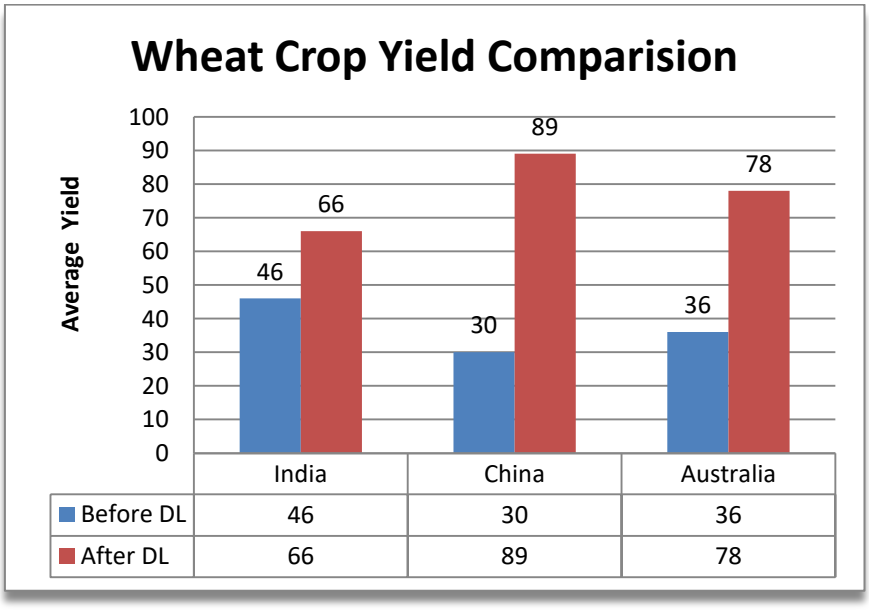

Figure 2.Wheat Crop Yield Comparison

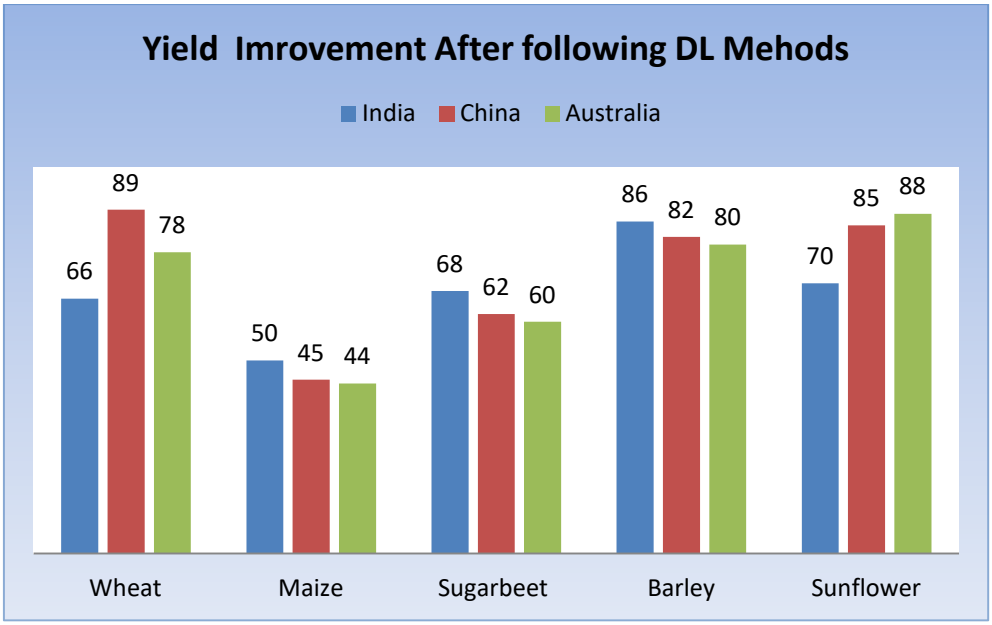

Figure 3.Yield Improvement After Intalllling DL methods

3. Australia Maize, Sugarbeet, Barley , Sunflowers productivity reported as 44,60,80 and 88 respectively. Australia reports high productivity for Barley and Sunflower

Conclusion

We have developed a novel framework on DL for crop prediction in Agrarian Economy. We understood that technology intervene with the conventional methods will improve the crop yield, thus having a better Agrarian Economy. As this work is tested on so many countries, this framework will also be helpful for Ukraine for the Wheat, Maize, Sugarbeet, Barley, and Sunflower crops. Thus we can conclude that DL can be utilized for enabling better food security to the countries.

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