International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 11 Issue: 03 | Mar 2024 www.irjet.net p-ISSN: 2395-0072

Crop Prediction for Indian Agriculture using Machine Learning and Deep Learning Classifiers

K.Tharani, R.Karthiga, S.K.Srinisa, Ms.A.Aruna,M.E.,

Student, Dept of AI&DS Muthayammal Engineering College Rasipuram, Tamil Nadu, India.
Student, Dept of AI&DS Muthayammal Engineering College Rasipuram, Tamil Nadu, India.
Student, Dept of AI&DS Muthayammal Engineering College Rasipuram, Tamil Nadu, India.
Assistant Professor, Dept of AI&DS Muthayammal Engineering College Rasipuram, Tamil Nadu, India.

Abstract - *Crop prediction is a process that uses deep learning to predict crop yields and other metrics based on a variety of factors such as weather, soil data, and crop history data. The goal of this mission is to provide farmers and other stakeholders with accurate and reliable information about desired crops that can help them make more informed decisions on planting, harvesting and other agricultural management. Crop forecasting problems present many challenges, including the need for accurate and timely data, the selection of features and characteristics for analysis, and the development of machine learning models suitable for forecasting. Additionally, forecast accuracy may be affected by factors such as regional differences in climate and soil, the presence of pests, and other environmental factors. To solve these problems, researchers and developers in the field of crop forecasting have developed different types of studies, including the generation of preliminary data, selection of features, selection of deep learning models, and performance evaluation. These techniques will involve the use of different types of data, such as weather data, soil data, and crop data, as well as various deep learning methods such as multilayer perceptron algorithms and convolutional neural networks algorithms. Ultimately, the success of crop forecasting depends on the system's ability to accurately and reliably analyze data from multiple sources and then predict crop yields and other metrics with accuracy. By solving these problems, crop forecasting has the potential to increase agricultural productivity and sustainability and support the development of more efficient and effective agriculture.*

Key Words: Machine Learning, Deep Learning, Crop prediction.

1.INTRODUCTION

In recent years, the integration of technologies such as deep learning and large-scale data analysis has changed many things, including agriculture. Accurate prediction of crop yield is important for optimizing agriculture, ensuring food security and reducing financial risk for farmers. Modern methods often rely on historical data and simple models and lack the ability to use rich data from a variety of sources such as satellite images, weather data, soil composition and health indicators of crops. This article presents a new way to analyze different types of agricultural data using deep learning for accurate crop prediction. Our method aims to capture relationships and patterns in agricultural ecosystems by integrating data from different sources, thus predicting crop yield more easily and in a timely manner. We explore the potential of deep learning, including convolutional neural networks (CNN), Multi layer perceptron (MLP), neural networks (RNN), and their variants, to process data in different letters. The introduction highlights the challenges associated with the integration of traditional crop forecasting techniques and highlights the opportunities offered by the combination of deep learning and multivariate data analysis. We discuss the importance of each data change in preserving different aspects of crop growth and underscore the need for capable and interpretable models that can unravel the complexities of agriculture. We also present a draft of the paper that includes the methodology, experimental setup, results, and discussion to provide readers with a method. Through this research, we aim to contribute to the advancement of agricultural technology by publishing a general crop prediction method that uses the power of deep learning and multiple data fusion. Our method has the potential to improve the decision-making processes of farmers, agricultural policy makers and other stakeholders by increasing the accuracy and efficiency of crop forecasting, ultimately contributing to agricultural sustainability and food security around the world.

2. PROBLEM STATEMENT

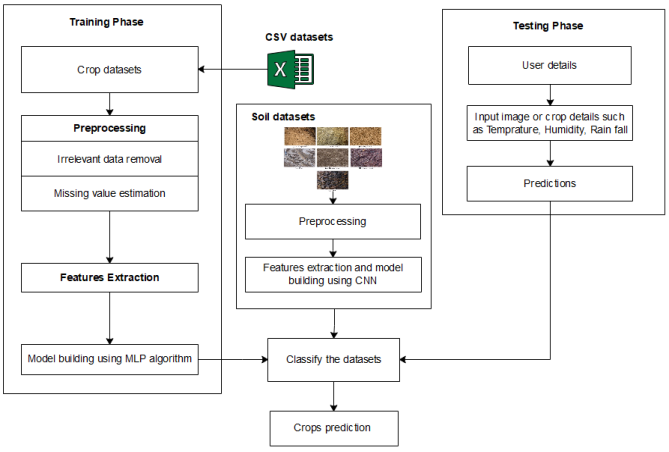
Crop prediction is a complex task influenced by many factors such as environment, soil quality and agricultural practices. Modern methods often rely on statistical models or simple machine learning methods that are difficult to capture relationships in multimodal data. Crop forecasting involves many challenges that are influenced by factors such as environment, soil properties, crop diversity and agricultural practices. Traditional machine learning models often struggle to capture complex relationships in complex agricultural systems, resulting in low accuracy. The main purpose of this research is to create an accurate and powerful crop prediction system that uses the power of deep learning to use different data sets.

3. WORKING

Our project prepares a simple, accurate and low-cost crop prediction system. We propose a deep learning method for crop prediction that performs best in crop prediction using a large dataset. This method uses deep neural networks to generate crop data such as soil data and text. In summary, deep learning models show promise in predicting crop yield based on environmental variables such as temperature, pH, precipitation, and soil information. Using neural networks to analyze large, complex data, these models can identify patterns and relationships that are difficult or difficult for humans to see. By training a model based on historical data and then using it to make predictions on new data, farmers and scientists can gain better insight into the crops most likely to thrive in specific environments.

4. SYSTEM IMPLEMENTATION

The application process is an important stage in the development of life and marks the transition from the creation and development of new or updated knowledge to its actual use. This process includes physical installation of hardware and software, configuring network settings, and troubleshooting system faults to ensure trouble-free operation. Data migration (if necessary) is an important step in transferring data from the existing system to the new system by completing a detailed analysis and processing. Conduct rigorous testing including unit, integration, testing, and user acceptance to identify and fix issues before full deployment. User training is an important part of the implementation and ensures that end users and support staff are knowledgeable about new functionality and supported by documentation, general and supporting information. Finally, integration can be done, allowing the new system to work with the old system temporarily, providing security for undetected issues before the migration is complete. This complete system is designed to make changes to new or updated information.



4.1. DATASETS ACQUISITION

In this model, we can export the crop yield dataset in CSV file format. and store the information in a database for future reference. Data sets include temperature, precipitation, pH, nitrogen, phosphorus and potassium values. The results are retrieved from the Kaggle website and the results are stored as numerical values. and upload soil data in image format from KAGGLE.

4.2. PREPROCESSING

Data pre-processing is an important step in the data mining process. The phrase "garbage in, garbage out" is particularly applicable to data mining and machine learning projects. Data preparation and filtering steps can take considerable amount of processing time. In this module, we can eliminate the irrelevant values and also estimate the missing values of data. Finally provide structured datasets. Then in soil image, we can analyze the noises and remove the noises using Median filtering algorithm.

Median filtering is a widely used technique for removing noise from images, including soil images. It works by replacing each pixel in an image with the median value of its neighbouring pixels. In the case of salt and pepper noise, which is common in soil images, median filtering can be particularly effective at removing the noise while preserving the edges and details of the image.

4.3. FEATURE EXTRACTION

Feature selection refers to the process of reducing and evaluating the actions of the material or finding the most important points. In this module, various features are selected from the loaded dataset. Use multiple crop records

to train data with many useful features. Rice, corn etc. We can train data for various crops such as Collect features such as color, shape and texture from ground data. To Design the

CNN architecture designed for terrain feature extraction tasks. This will include choosing the number and size of convolution and pooling operations, choosing the optimization function, and deciding on redundancy and optimization.

4.4. MODEL TRAINING

In this model, we can use multilayer perceptron algorithm to classify the data loaded. MLP algorithm is one of the most popular learning algorithms used in classification and regression problems. Crop prediction using the MLP (multilayer perceptron) algorithm is a machine learning technique that involves using radio waves to predict crop yields based on environmental data. The MLP algorithm is a neural network that can learn the relationship between

input variables and output predictions. During training, the weights of these connections are adjusted to minimize the

error between the prediction and the actual return. Once the MLP model is trained and validated, it can be used to predict future crop yields based on new inputs. Input data often includes information about weather, soil quality, crop types, and other important factors. The MLP model processes this input data and produces a prediction of the expected return. Then use the CNN algorithm to train the image. The data is divided into training set, validation set and testing set. The training process is used to train the CNN, and the validation process is used to tune the hyper parameters of the model and prevent over fitting. The testing procedure is used to evaluate the final performance of the model. Designing a CNN architecture suitable for classification of ground images. This will include choosing the number and size of convolution and pooling operations, choosing the optimization function, and deciding on redundancy and optimization. Train the CNN on training using backpropagation and gradient descent. Monitor your model's performance through the validation process and adjust hyper parameters as necessary to avoid over fitting.

4.5. CROP PREDICTION

Effective planning of land use and marketing policies requires a reasonable estimate of crop productivity. Estimates of crop yields have increased in recent years. The biggest impact on crop production is weather conditions. We can use deep learning to evaluate the data in this model. Finally, crop recommendations and information are provided to increase the accuracy. Project accuracy was the

calculated based on precision, regression, and F test. Once the model is validated, it can be deployed for use in the real world. In this model, we predict the return based on

user input and use the data as a model for classification. This may involve integrating the model into existing crop management systems or using it to make predictions for specific areas or regions.

5. EXISTING SYSTEM

Agriculture is an important part of the Indian economy and the country's economy is dependent on agriculture to achieve rural development. India's agricultural standards are affected by climate change, unpredictable weather conditions, dwindling water supply, excessive use of pesticides, etc. falls due to We explained the agricultural data to understand the production level. The main aim of this research project is to provide a method that effectively describes crop yield. Although many studies have presented statistical data on Indian agriculture, very few studies have investigated crop forecasts based on historical climate and production data. Classification algorithms can be used for many purposes, including classification, clustering, representative quantification, association level, prediction, prediction, control, and activation. The use of basic regression in current systems is a two-step approach. First of all, changes in the PCR method are stored and the size of the data is reduced and stored in a standard table. It extracts the maximum variation of the material and makes specific selections to reduce dimensionality. And find the factor in the direction that maximizes the distribution of observations; the other should maximize the distribution of the diagonal of the first factor. We can then rotate events vertically and continue the integration for larger files. PCR results represent the difference in low-dimensional data structure. Secondly, we tried to attack the structure of the components related to the situation. PCR effectively resolves multiple sources and collinearity issues.

DISADVANTAGES

Labeled databased classification, Provide high number of false positive, Binary classification can be occurred, Computational complexity.

6. PROPOSED SYSTEM

Predicting crop yield based on environment, soil, water and product has not been the subject of research. Deep learning models are widely used to extract important crops for prediction. Although these methods can solve the yield prediction problem, they have the following disadvantages: A direct nonlinear or linear map of raw data and crop yield cannot be created; The performance of this model depends on the quality of the extract. . Deep learning provides guidance and motivation for the above complaints.

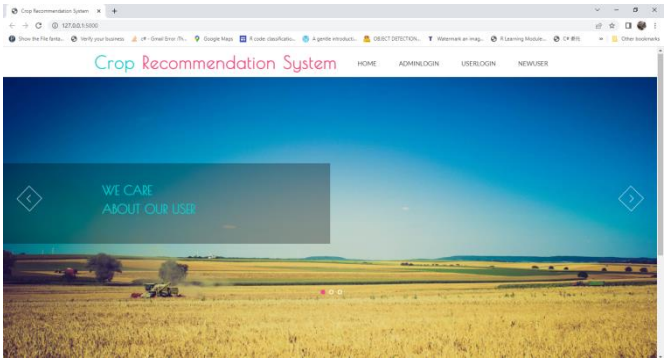
Deep learning combines reinforcement learning and deep learning skills to create a complete crop breeding system that can process original data for crop prediction. In this project, we use a deep neural network to predicting the yield of maize hybrids based on genotypic and environmental data, analyzing yield and yield differences. Deep neural networks are in the category of representational learning models that can find the basis for the representation of data without manually inputting features. Deep neural networks consist of many nonlinear layers that, transforming the raw data input into a higher-level, more abstract model at each layer. Therefore, as the network gets deeper, more features are extracted, which helps improve the accuracy of the results. Considering informality, deep neural networks are considered universal predictors; This means they can predict almost any task, even though it can be very difficult to find flaws.

ADVANTAGES

Accuracy is high, Parallel processing, Reduce number of false positive rate. Time and the computational complexity can be reduced. This system is user friendly.

7. SYSTEM DESCRIPTION

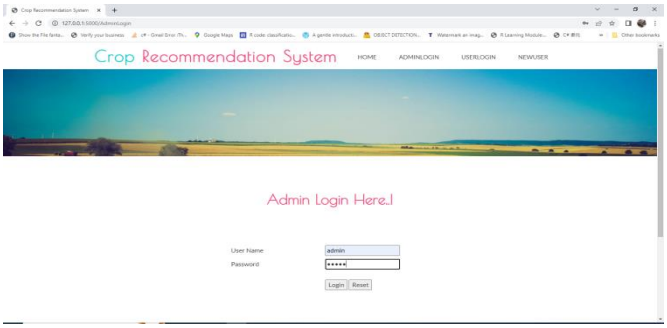
This system has 2 main modules and their submodules:



Administrator

Login:

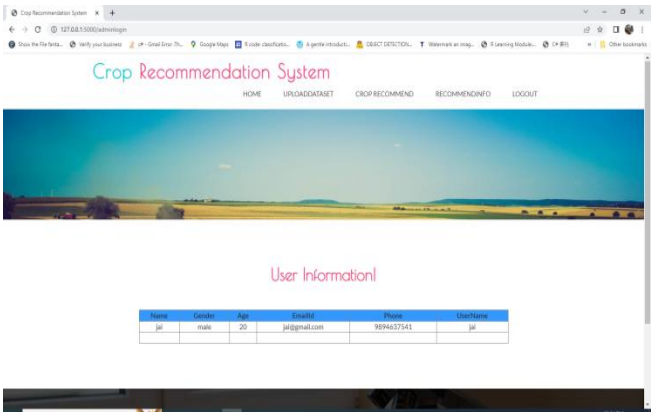
The administrator can log in using the username and password.



Manage Items:

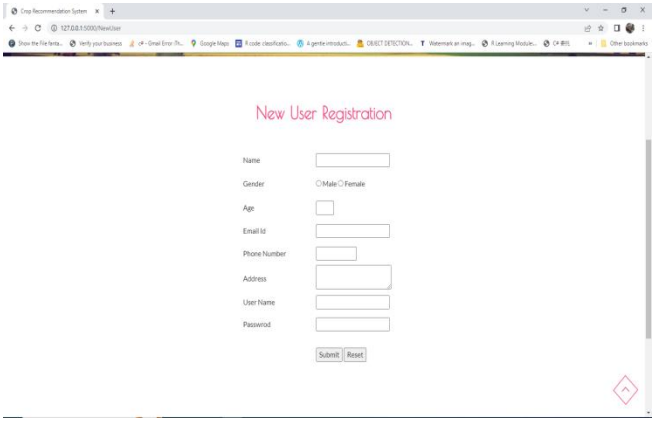
Adminis can view the user registration and their information.

User Information:

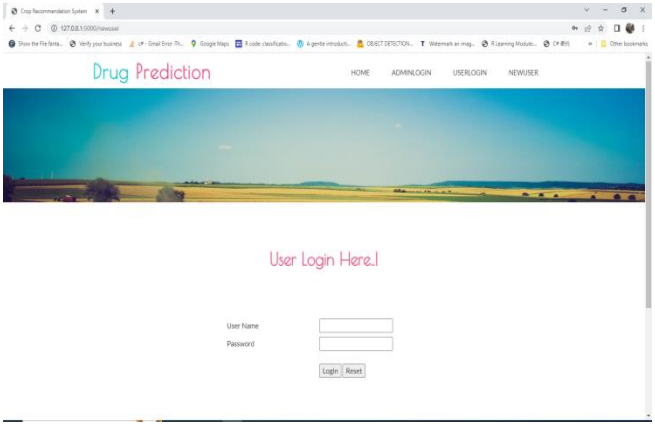


User Registration:

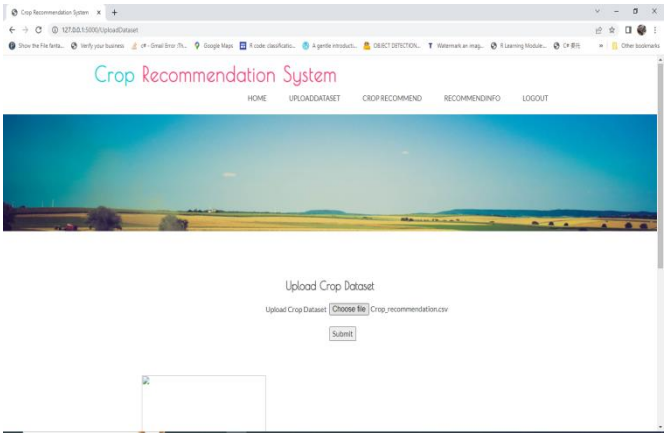
Users must first register to enter the system using their informations like Name, Gender, Age, Email id, Phone number, Address, User Name, Password.



User Login:

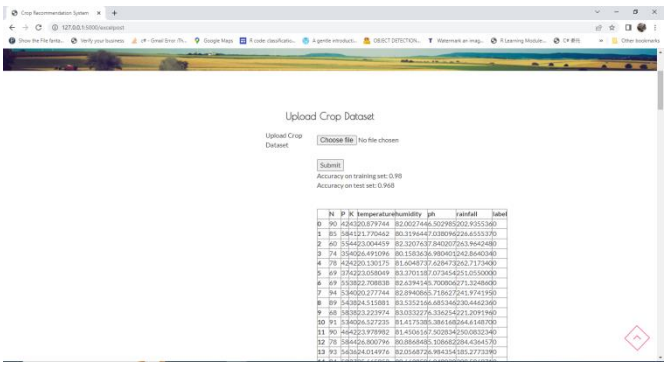


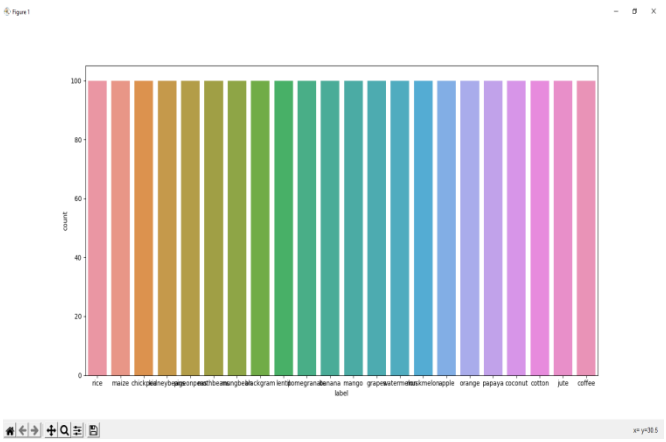
Crop Prediction : Users need to upload soil data or images of the land.



Crop Dataset :

It analyse data from a variety of sources, and then predict crop yields and other relevant metrics with a high degree of accuracy.





Application

This system aims to develop accurate crop prediction models using deep learning and multimodal data to improve agricultural decision-making.

Software Components

perating System	:	Windows OS
Front End	:	Python
IDE	:	Pycharm
Back End	:	MySQL
Application	:	Web Application

Hardware Components

Processor	:	Intel Processor 2.6.0 GHZ
RAM	:	4 GB
Hard disk	:	160 GB
Compact Disk	:	650 GB
Keyboard	:	Standard Keyboard
Monitor	:	15 inch color monitor

8. CONCLUSIONS

We displayed a deeplearning approach for trim expectation, which illustrated prevalent execution in Trim Challenge utilizing huge datasets of items. The approach utilized profound neural systems to make crop datasets such as soil and literary datasets. In conclusion, profound learning models offer a promising arrangement for foreseeing edit yields based on natural factors such as temperature, pH, precipitation, and soil information. By utilizing neural systems to dissect expansive and complex datasets, these models can recognize designs and connections that would be troublesome or outlandish for humans to perceive. By training the demonstrate on verifiable information and at that point utilizing it to make expectations on modern information, agriculturists and analysts can pick up profitable experiences into which crops are most likely to flourish beneath certain natural conditions. Be that as it may, there are still a few challenges to overcome, such as the require for high-quality and different information, the trouble of translating complex neural systems, and the potential for predisposition and mistakes in the preparing information. By and large, profound learning holds extraordinary guarantee for revolutionizing the field of trim expectation and making a difference to bolster a developing worldwide populace

REFERENCES

[1] Abbas, Farhat, et al.: Crop yield prediction through proximal sensing and machine learning algorithms.Agronomy 10.7:1046. (2020)

[2] Anantha, K. H., et al.: Impact of best management practices on sustainable crop production and climate resilience in smallholder farming systems of South Asia.Agricultural Systems 194: 103276. (2021)

[3] Bian, Chaofa, et al.: Prediction of Field-Scale Wheat Yield Using Machine Learning Method and Multi-Spectral UAV Data.Remote Sensing 14.6 (2022): 1474. (2019)

[4] Gao, H., Lu, J., Zhang, Y., Wang, L., & Xu, X. (2019). Deep learning for plant disease detection and diagnosis: A review. Plant Disease, 103(9), 2331-2342.

[5] Jiang, F., Ding, M., & Dai, H. (2021). Spatiotemporal prediction of crop yield using deep learning: A review. Information Processing in Agriculture, 8(2), 290-301.

[6] Jin, X., Kumar, L., Li, Z., Feng, H., & Xu, X. (2018). Deep learning: Individual maize segmentation from terrestrial lidar data using faster R-CNN and regional growth algorithms. Agricultural and Forest Meteorology, 256, 228-239.

[7] Kussul, N., Lavreniuk, M., Skakun, S., & Shelestov, A. (2017). Deep learning classification of land cover and

crop types using remote sensing data. IEEE Geoscience and Remote Sensing Letters, 14(5), 778-782.

[8] Liakos, K. G., Busato, P., Moshou, D., Pearson, S., Bochtis, D., & Machine, D. L. (2018). Machine learning in agriculture: A review. Sensors, 18(8), 2674.

[9] Liu, Y., Jain, A., Hamilton, H., Reinhardt, W., & Du, J. (2020). Crop yield prediction using deep convolutional neural networks. Computers and Electronics in Agriculture, 176, 105674.

[10] Milioto, A., Lottes, P., Stachniss, C., & Behley, J. (2020). Real-time semantic segmentation of crop and weed for precision agriculture robots leveraging background knowledge in CNNs. IEEE Robotics and Automation Letters, 5(2), 391-398.

[11] Mishra, Subhadra, Debahuti Mishra, and Gour Hari Santra.: Adaptive boosting of weak regressors for forecasting of crop production considering climatic variability: An empirical assessment.Journal of King Saud University-Computer and Information Sciences 32.8: 949-964. (2020)

[12] Mohanty, S. P., Hughes, D. P., & Salathé, M. (2016). Using deep learning for image-based plant disease detection. Frontiers in plant science, 7, 1419.

[13] Nishant, Potnuru Sai, et al.: Crop yield prediction based on indian agriculture using machine learning. 2020 International Conference for Emerging Technology (INCET),IEEE. (2020)

[14] Palanivel, Kodimalar, and Chellammal Surianarayanan.: An approach for prediction of crop yield using machine learning and big data techniques.International Journal of Computer Engineering and Technology 10.3: 110-118. (2019)

[15] Pandith, Vaishali, et al.: Performance evaluation of machine learning techniques for mustard crop yield prediction from soil analysis.Journal of Scientific Research 64.2: 394-398. (2020)

[16] Paudel, Dilli, et al.: Machine learning for large-scalem crop yield forecasting. Agricultural Systems 187:103016. (2021)

[17] Ramcharan, A., Baranowski, K., McCloskey, P., Ahmed, B., Legg, J., & Hughes, D. P. (2017). Deep learning for image-based cassava disease detection. Frontiers in plant science, 8, 1852.

[18] Roy, D. P., Wulder, M. A., Loveland, T. R., Woodcock, C. E., Allen, R. G., Anderson, M. C., ... & Zhu, Z. (2014). Landsat-8: Science and product vision for terrestrial global change research. Remote Sensing of Environment, 145, 154-172.

[19] Singh, A., & Ganapathysubramanian, B. (2017). Deep learning for plant stress phenotyping: trends and future perspectives. Trends in plant science, 22(7), 563-575.

[20] Talaviya, Tanha, et al.: Implementation of artificial intelligence in agriculture for optimisation of irrigation and application of pesticides and herbicides.Artificial Intelligence in Agriculture 4: 58-73. (2020)

[21] Van Klompenburg, Thomas, Ayalew Kassahun, and Cagatay Catal.: Crop yield prediction using machine learning: A systematic literature review.Computers and Electronics in Agriculture 177: 105709. (2020)

[22] Xiong, Y., Ma, W., Qiu, Y., Ma, X., Jiang, L., & Yang, G. (2020). Deep learning for high-dimensional remote sensing data in precision agriculture: A review. ISPRS Journal of Photogrammetry and Remote Sensing, 159, 294-308.

[23] Zhang, C., Zhang, J., Qi, C. R., Shi, B., & Wang, X. (2021). Spatial-temporal dynamic monitoring of crop growth conditions using deep learning: A review. ISPRS Journal of Photogrammetry and Remote Sensing, 171, 150-166.

[24] Zhang, Y., & Li, C. (2021). Deep learning based crop classification from high resolution remote sensing images: A review. Computers and Electronics in Agriculture, 187, 106311.

[25] Zou, Z., Wu, Q., Li, Q., & Cheng, G. (2018). A review of machine learning methods for crop yield prediction and N fertilizer optimization. Sustainability, 10(11), 4221.