**MADRAS INSTITUTE OF TECHNOLOGY**

**DEPARTMENT OF COMPUTER TECHNOLOGY**

**CS6611 CREATIVE AND INNOVATIVE PROJECT**

**CropForEst - A Machine learning based crop yield estimation and profitability analysis for precision agriculture.**

**Zeroth Review**

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**PROBLEM STATEMENT:**

The agriculture industry faces a significant challenge in predicting crop yield production and crop demand accurately. The traditional methods of predicting crop yield and demand are time-consuming and can be prone to errors, leading to inefficient use of resources and revenue loss. There is a need for predicting the most suitable crop based on various influential factors and forecasting the profitability.

**OBJECTIVE:**

* To develop an intelligent platform that uses machine learning algorithms to estimate the most suitable crop for cultivation in a given area based on environmental factors.
* To forecast market demand and pricing trends for the identified crop, with the aim of increasing profitability for farmers and stakeholders in the agriculture industry.

**LITERATURE SURVEY:**

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| **Publication** | **Methodology** | **Outcome** |
| Crop Yield Prediction Using Deep Reinforcement Learning Model for Sustainable Agrarian Applications  **Authors**: D. Elavarasan and P. M. D. Vincent  **Journal**: IEEE Access, vol. 8, pp. 86886-86901, 2020 | * An RNN-based feature processing is combined with Deep Recurrent Q-Network model based self-experimental analysis is constructed to forecast the crop yield. * Forecast is done based on major climatic factors, soil parameters dataset extracted from Indian Meteorological department’s portal. | * The results of DRQN model were compared with other ANN, BAN models using certain evaluation metrics like error, variance score and it’s outperformed all of them with 94% accuracy. * The probability density of actual and predicted yield were also measured. |
| Estimation of crop yield from combined optical and SAR imagery using gaussian kernel regression  **Authors**: Alebele, Yeshanbele and Wang, Wenhui and Yu, Weiguo and Zhang, Xue and Yao, Xia and Tian, Yongchao and Zhu, Yan and Cao, Weixing and Cheng, Tao  **Journal**: IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing | * Estimation methods selected based on the tradeoff between the performance in terms of given target parameters, interpretability of results, and computational time. * Multiple linear regression, random forest, and neural network are mostly used | * Using Gaussian Linear regression model , a range of crop yield predicted from an unknown distribution. * GPR attempts to approximate the target output f(x) where by interpreting it as a probability distribution function. |
| Improvised Extreme Learning Machine for Crop prediction.  Authors: S. Vashisht, P. Kumar and M. C. Trivedi  Journal: 2022 3rd International Conference on Intelligent Engineering and Management (ICIEM), London, United Kingdom, 2022 | * The proposed approach uses a two stage process to predict crop yield. First stage - PSO algorithm is used to optimize the input weights and biases of the EML algorithm, which is a type of feedforward network with a single hidden layer. * Second stage - Optimised EML model is used to predict the crop yield based on the input features. | This technique has been found to outperform traditional methods of crop yield prediction that use only one or two spectral bands resulting in improved accuracy of crop yield |
| Agricultural Monitoring, an Automatic Procedure for Crop Mapping and Yield Estimation: The Great Rift Valley of Kenya Case  Authors: R. Luciani, G. Laneve and M. J  Journal: IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 12, no. 7, pp. 2196-2208, July 2019, | * Satellite images to extract spectral information and vegetation indices for crop classification. * Random Forest (RF) and Support Vector Machines (SVM) classifiers used to classify the crops and estimate their yield. | Accurate and efficient crop monitoring and yield estimation, which can aid in decision-making for agricultural practices and food security in the Great Rift Valley and other regions with similar characteristics. |
| Multispectral Crop Yield Prediction Using 3D-Convolutional Neural Networks and Attention Convolutional LSTM Approaches  Authors: S. M. M. Nejad, D. Abbasi-Moghadam, A. Sharifi, N. Farmonov, K. Amankulova and M. Lászlź  Journal: IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 16 | * The method involves the use of 3D-CNNs to extract features. The 3D-CNNs are used to extract features from the multispectral images, which are then fed into the AC-LSTM. * The AC-LSTM captures the temporal dependencies in the data by using attention mechanisms to weight the input at each time step. | This technique has been found to outperform traditional methods of crop yield prediction that use only one or two spectral bands. Potential to improve the accuracy of crop yield prediction. |
| Exploiting Hierarchical Features for Crop Yield Prediction Based on 3-D Convolutional Neural Networks and Multikernel Gaussian Process  Authors: M. Qiao et al.  Journal: IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 14 | * The proposed approach uses 3D-Convolutional Neural Networks (CNNs) to extract hierarchical features. * Then a Multikernel Gaussian Process (MKGP) which is a non- parametric regression is used to model it. * R-squared value of 0.7 is achieved, indicating a strong correlation between the predicted and actual crop yield. | * The proposed approach can effectively capture the complex relationships between the multispectral data and the crop yield, leading to accurate and efficient crop yield prediction. * The method can aid in decision-making for agricultural practices and food security. |
| Crop yield estimation at field scales by assimilating time series of sentinel-2 data into a modified CASA-WOFOST Coupled model  Authors: F. Ji, J. Meng, Z. Cheng, H. Fang and Y. Wang  Journal: IEEE Transactions on Geoscience and Remote Sensing, vol. 60 | * A coupled CASA-WOFOST integrated model is proposed  to improve the precision, reliability and stability of crop yield estimation. * Ensemble Kalman Filter (EnKF) is used for data assimilation in 2 steps : forecasting and updating. * R2, RMSE, NRMSE, NSE, absolute error and relative error results to evaluate the performance of the models in yield simulation. | The coupled model was better than the individual CASA and WOFOST models based on almost all evaluation metrics. |
| Prediction of land suitability for crop cultivation based on soil and environmental characteristics using modified recursive feature elimination technique with various classifiers.  Authors: G. Mariammal, A. Suruliandi, S. P. Raja and E. Poongothai  Journal: IEEE Transactions on Computational Social Systems, vol. 8 | * A new mode of feature selection : Modified recursive feature elimination is proposed which helps to select and rank features while the bagging technique helps accurately predict a suitable crop for the given conditions. * Performance is evaluated using precision metrics like accuracy, F1 score, etc. and the dataset containing the soil and environmental features is preprocessed to remove redundant data. | Training samples are trained with the classifier and unknown samples provided to validate the trained classifier. A major breakthrough in the algorithm is the recursive feature used to eliminate the redundant fields in the dataset. |

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