ADVANCED AI TECHNIQUES TO INFLATE AGRONOMY

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PROBLEM STATEMENT

- Agricultural and rural development through improved knowledge and communication is a key component of e-agriculture.
- Due to a lack of knowledge and expertise regarding optimal crop selection and yielding techniques, modern farmers can lose out on high potential production levels while facing food shortages.

OBJECTIVES

- By analyzing different associated attributes such as location, pH value, amount of rainfall, as well as nutrients such as Nitrogen (N), Phosphorous (P), and Potassium (K), to design an Agro-alliance system to predict the suitable crop, best fertilizer and the approximate yield .
- It willallow farmers to cultivate a wider variety of crops, increase their profit margins, and reduce soil pollution.

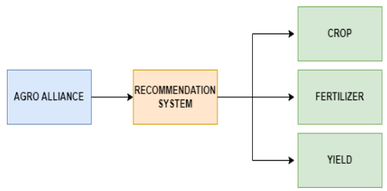

Fig.1 Proposed system

DATASET

- For crop recommendation, the dataset with attributes N, P, K, rainfall, temperature, humidity, pH, etc.. are used, whereas in fertilizer prediction additional features like soil type and crop are included.
- In crop yield prediction a new dataset was created by merging 4 other different datasets of rainfall data, temperature data, yield data and pesticide data with selected features. The newly created dataset contains the attributes year country, item, rainfall, temperature and pesticides.

METHODOLOGY

- Stacking generalization is an ensemble learning model that combines high-layer models with lower-layer models to improve the predictions.
- It creates a Meta-Model, which consist of a set of predictions from machine learning base models (weak learners) through K-fold cross validation.
- To complete the Meta-Model training, an additional machine learning model is used (”final learner”).
- In the case of regression, outputs from the underlying models are real values, whereas in the case of classification, outputs from the underlying models are probability values, probability like values, or class labels.
- For the preparation of the meta-model training dataset, k-fold cross-validation of the base models is usually conducted, using out-offold predictions as the basis.
- Inputs to the base models may also be included in the training data for the meta-model.
- As a result, it can provide insight into how to best combine the predictions from the meta-model.

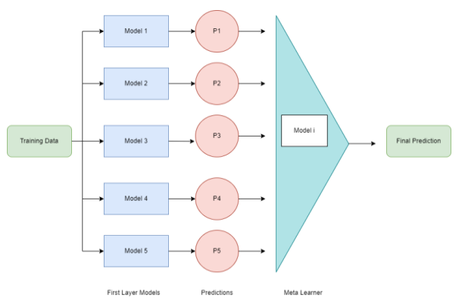

Fig.2 Stacked Generalization model

AGRO-ALLIANCE SYSTEM

- For crop and fertilizer recommendations, Stacking classifiers are used, where multiple classifiers predictions are used as new features for training a metaclassifier.
  - First layer algorithms : SVM, RF, Gaussian NB, KNN, and Logistic regression
  - Meta-classifier : logistic regression.
- Crop yields are predicted using stacking regressions, which combine predictors into a single linear equation to improve prediction accuracy.
  - First layer algorithms : SVM, RF, Bayesian Ridge, KNN and Linear regression
  - Meta model : linear regression
- The goal of using this method is usually to get the most accurate output estimations.
- The stacked generalization technique (Stacking) which can provide better performance than a single contributing model by reducing spread and dispersion in predictions.

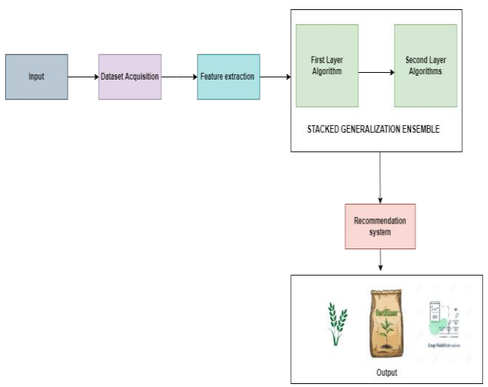

Fig.3 Agro-alliance system

RESULT & ANALYSIS

- Comparison with First layer models and accuracy analysis

	Micro Average			
Model	Precision	Recall	F1-Score	Accuracy
Logistic Regression	0.96	0.96	0.96	0.96
KNN	0.98	0.98	0.98	0.98
SVM	0.98	0.98	0.98	0.98
Random Forest	0.99	0.99	0.99	0.99
Gaussian NB	0.99	0.99	0.99	0.99
Stacking Classifier	1.00	1.00	1.00	1.00

Table 1 : Performance evaluation of Crop recommendation system

	Micro Average			
Model	Precision	Recall	F1-Score	Accuracy
Logistic Regression	0.53	0.58	0.51	0.67
KNN	0.12	0.16	0.13	0.18
SVM	0.03	0.14	0.04	0.18
Random Forest	0.98	0.99	0.98	0.98
Gaussian NB	0.98	0.99	0.98	0.98
Stacking Classifier	0.98	0.99	0.98	0.98

Table 2 : Performance evaluation of Fertilizer recommendation system

Model	R2 Score
Logistic Regression	0.027
KNN	-0.085
SVM	-0.146
Random Forest	0.882
Bayesian Ridge	0.002
Stacking Regression	0.887

Table 1 : Performance evaluation of Crop yield prediction system

CONCLUSION

- The Agro-alliance system that we have proposed for smart farming can improve the life of farmers.
- Stacking model gives high variations in accuracy compared to individual models such as KNN , SVM, Logistic Regression, Linear Regression, RF, Gaussian NB, Bayesian Ridge which is much better.
- According to experimental results, Stacking Ensemble achieved greater accuracy.
- When predictions from the base models are used, meta-learners generalize better.
- This approach therefore provides a perception of implementing a more generalized yield prediction model.

FUTURE WORKS

- By examining more prediction parameters for crop, fertilizer, and yield, this can further be enhanced by increasing the number of first layer models.
- Another intriguing option is to improve the computing efficiency of the training process.
- Future models will be more robust as a result.

REFERENCES

[1] Sushitha, S.; Harsha, Hegde: Smart Farming-a key to Sustainable Agriculture Development in India -A Study. In: 2022 4th International Conference on Smart Systems and Inventive Technology (ICSSIT). 63-71 (2022)

[2] Ray, S.: A Quick Review of Machine Learning Algorithms. In: 2019 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (COMITCon). 35-39 (2019)

[3] Nigam, A.; Garg, S.; Agrawal, A.; Agrawal, P.: Crop Yield Prediction Using Machine Learning Algorithms. In: 2019 Fifth International Conference on Image Information Processing (ICIIP). 125-130 (2019)

[4] Mart´ın, J.; Jos´e, A.S.; Corchado, E.: On the suitability of stacking-based ensembles in smart agriculture for evapotranspiration prediction. Applied Soft Computing. 108, 107509 (2021)