SOIL TAXONOMY AND PREEMINENT CROP EXTRAPOLATION USING GENERATIVE ADVERSARIAL NETWORKS (GANs)

[1]Ramesh Sahoo, [2]A.Gopi, [3]Dr.C.Srinivasa Kumar

[1]Assistant Professor, Department of CSE, Vignan's Institute of Management and Technology for Women, Kondapur, Ghatkesar, Telangana

[2]Assistant Professor, Department of CSE, Vignan's Institute of Management and Technology for Women, Kondapur, Ghatkesar, Telangana

[3]Professor & Dean, Department of CSE, Vignan's Institute of Management and Technology for Women, Kondapur, Ghatkesar, Telangana

ABSTRACT:

Agriculture is the backbone of Indian economy and livelihood to many people. The use of computer science in the field of agriculture will potentially solve many problems faced by farmers. Farmers often choose crops for their field based on their own experience and instinct. This sometimes leads to loss and less yield. If the selection of crops is done with productivity data of the entire region, it may lead to better results. However all the crops cannot be cultivated in a particular soil. So the soil must be analyzed and crops must be suggested based on the type of soil. Many soil classification techniques involve testing in laboratories which might not be affordable and available to all the farmers. This work suggests an idea that is useful and easily accessible to all the farmers in India without any need of hardware. A list of crops with their success rate will be suggested to the farmer when the region of agriculture and soil image (used for agriculture) are given as inputs. This list of crops are both profitable and produce more yield in that region. The results obtained are promising. An accuracy of 94% is achieved in the soil classification module. The success rate for the crops obtained are realistic with the agricultural practices in the region. The web application developed is extremely user friendly and easy to use by the farmers.

Keywords: *Soil Prediction, Crop Prediction, Deep Learning, Generative Adversarial Networks(GAN's)*

INTRODUCTION:

Agriculture is the primary source of livelihood for about 58% of the population of India. Continuous efforts have been taken to develop this sector as the whole nation depends on it for food. For thousands of years, we have been practicing agriculture but still, it remained under developed for a long time. After the green revolution, we became self-sufficient and started exporting our surplus to other countries. Earlier we used to depend completely on monsoon for the cultivation of food grains but now we have constructed dams, canals, tube-wells, and pump-sets. Also, we now have a better variety of fertilizers, pesticides, and seeds, which help us to grow more food in comparison to what we produce during old times. With

the advancement of technology, advanced equipment, better irrigation facilities agriculture started improving. Furthermore, our agriculture sector has grown stronger than many countries and we are the largest exporter of many food grains.

In recent years, farmers are suffering financially and are facing many hard ships .This is due to various reasons such as urbanization, globalization, pollution, water scarcity, less rainfall, low fertility of soil, drastic climatic changes, political and economic reasons, poverty, lack of technological assistance etc. Addressing their needs through technology is the need of the hour. Though we haveverylesstocontributetoimprovisethenaturalfactorstohelpagriculture, we have a lot to contribute to this sector through computer science and technology. Internet of Things (IoT), Artificial Intelligence, smart agriculture, Agricultural Engineering, Irrigation Engineering are some of the fields that contributed to the development of agriculture in recent years. With large scale increase in the availability of data, machine learning, deep learning, big data analytics can help in solving various problems. Machine learning has emerged with big data technologies and high-performance computing to create new opportunities for data intensive science in the multi-disciplinary agro technologies domain. The works can be categorized as (a) crop management, including applications on yield prediction, disease detection, weed detection crop quality, and species recognition; (b) livestock management, including applications on animal welfare and livestock production; (c) water management; and (d) soil management. By applying machine learning to sensor data, farm management systems are evolving into real time artificial intelligence enabled programs that provide rich recommendations and insights for farmer decision support and action. There are many ways to suggest crops suitable for a farm land. It can be based on the climate or soil or the crop that produces high profit in that region. We want to suggest crops considering all these factors. We also want soil classification to be done easily with android camera images so that the laboratory tests can be avoided to identify the type. While analyzing the various problems faced by farmers, choosing crops for their land appears to be a concerning problem. Crops must be chosen not only based on the soil and climate but also on various other factors like usage of the crop in the particular area, cost, revenue, how much the crop is exported or imported.

LITERATURE SURVEY

Srunitha K, S.Padmavathi created a soil classification model that uses Support Vector Machine based classification .Almost all countries export their products, Countries which export agricultural products depend on soil characteristics. Hence classifying soil, based on their characteristics is very important to reduce the product quantity loss. The nature of soil is influenced by many factors. Some of them are power of hydrogen (PH), Exchangeable sodium percentage, moisture content etc. depending on their amount in soil they show different characteristics and that varies for different region. The manual segmentation and classification methods are time consuming, require efficient people and expensive also, SVM models are mainly used for analyzing the data for regression and classification. For a set of training examples it belongs to either one of the two categories, a support vector machine algorithm for training generates a model which tells the new thing falls into which category by a non-probabilistic binary classifier. The segmentation process splits the region of interest from that of non-interest regions. A two class classifier is required for classifying pixels in feature space considering segmentation as a two class problem. Method of segmentation includes The transformation phase includes color quantization, low pass filter and Gabor filter techniques. In color quantization they create a new image visually similar to that of the original image. Thus, it reduces the distinct colors used in the original image. Then a low-pass filter passes frequency below the cutoff frequency and attenuates the higher frequency. The attenuated frequency depends on the filter design. For the extraction of features from an image Gabor filter with different frequencies are useful. In image processing a 2-D Gabor filter is used for feature extraction especially while doing segmentation and analyzing texture. Sk Al Rahman, Kaushik Mitra, S.M. et al used dataset, collected from 500 soil series in Bangladesh which is identified by Soil Resources Development Institute (SRDI). Soil series means group of soils which is formed from the same kind of parent materials and remains under the similar conditions of drainage, vegetation time and climate. It also has the same patterns of soil horizons with differentiating properties. Each type of soil can have different kinds of features and different kinds of crops grow on different types of soils. We need to know the features and characteristics of various soil types to understand which crops grow better in

certain soil types. The main purpose of the proposed work is to create a suitable model for classifying various kinds of soil series data along with suitable crops suggestions for certain 5 areas of certain Upazila of Bangladesh.

METHODOLOGY

Algorithms such as weighted k-Nearest Neighbor (k-NN), Bagged Trees and Gaussian kernel based Support Vector Machines (SVM) are used for soil classification.The method involves two phases: training phase and testing phase. Two datasets are used: Soil dataset and crop dataset. Soil dataset contains class labeled chemical features of soil which includes a linity, pH values and iron, magnesium content etc. This system mainly uses three methods namely, Weighted K-NN, Gaussian Kernel based SVM, and Bagged Tree.

WEIGHTED K-NN

It is a refinement of the k-NN classification algorithm. It weighs the contribution of each of the k neighbors according to their distance to the query point, giving greater weight wi to closer neighbors. It makes use of all training examples not just k if weighting is used. The algorithm then becomes a global one. The only disadvantage is that the algorithm will run more slowly.

SVM

SVM is a supervised machine learning algorithm which works based on the concept of decision planes that defines decision boundaries. A decision boundary separates the objects of one class from the object of another class. Kernel function isused to separate non-linear data by transforming input to a higher dimensional space. The Gaussian radial basis function kernel is used in this method.

BAGGEDTREE

Here they have used a bagged decision tree ensemble classifier which consists of 30 trees. Bagging generates a set of models each trained on a random sampling of the data. The predictions from those models are aggregated to produce the final prediction using averaging. The soilclassificationaccuracyandalsotherecommendationofcropsforspecificsoil provided by this model is more appropriate than many existing methods. One of the drawbacks of the model is they have restricted it to soil types only to few districts.

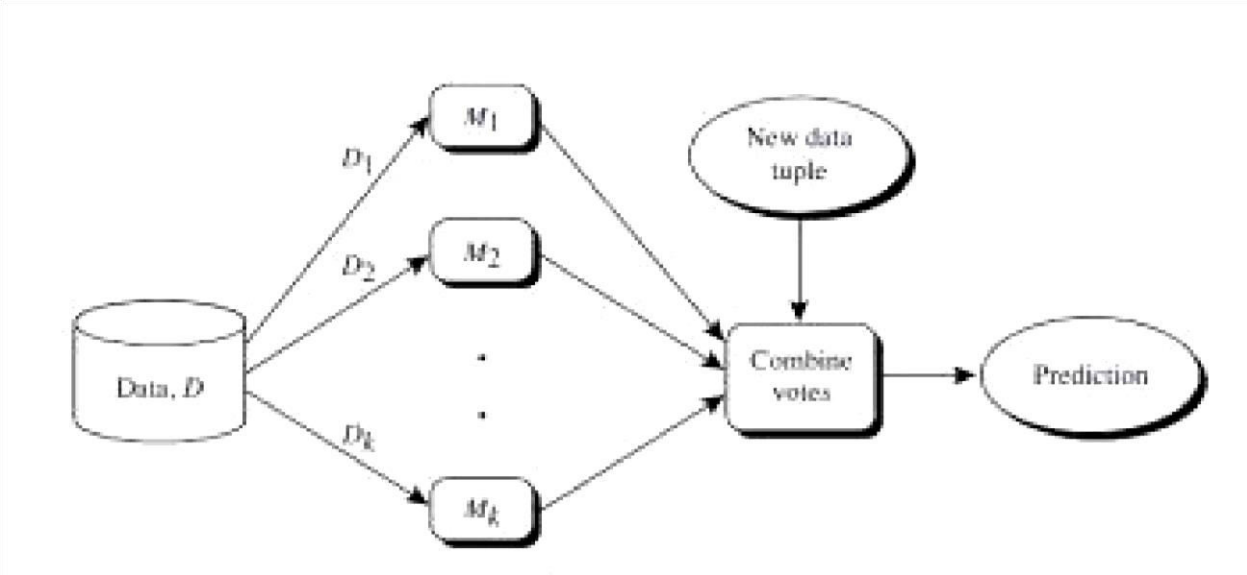

Figure1: Badge Tree

RESULTS AND DISCUSSION

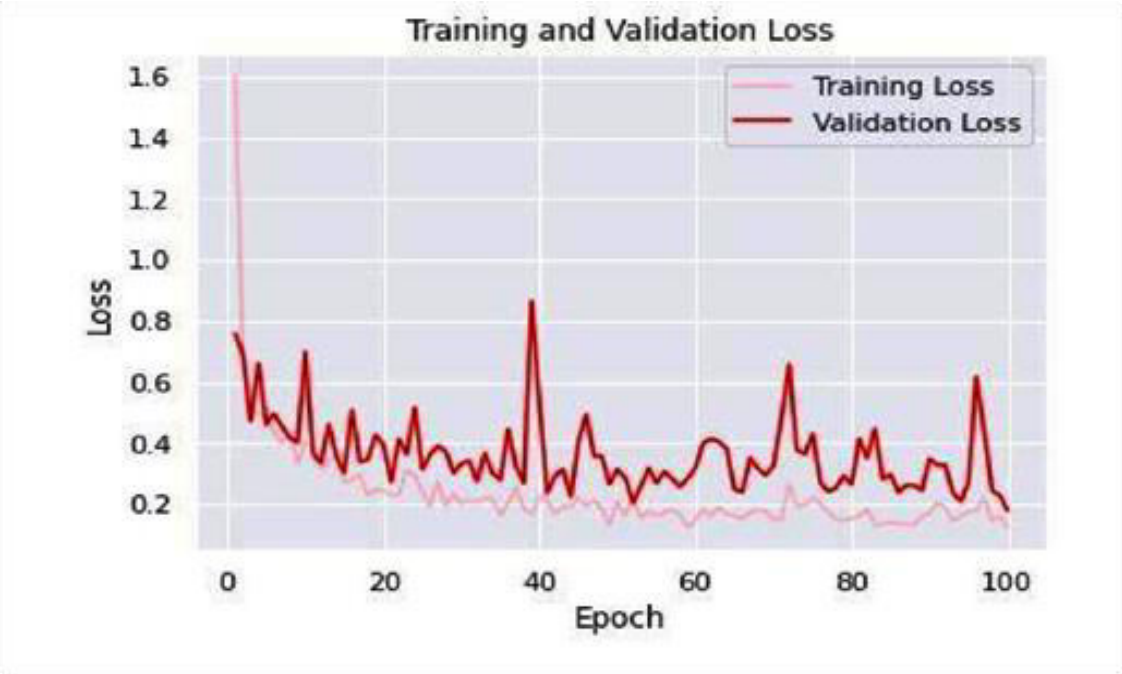

Figure2: Training and validation loss graph

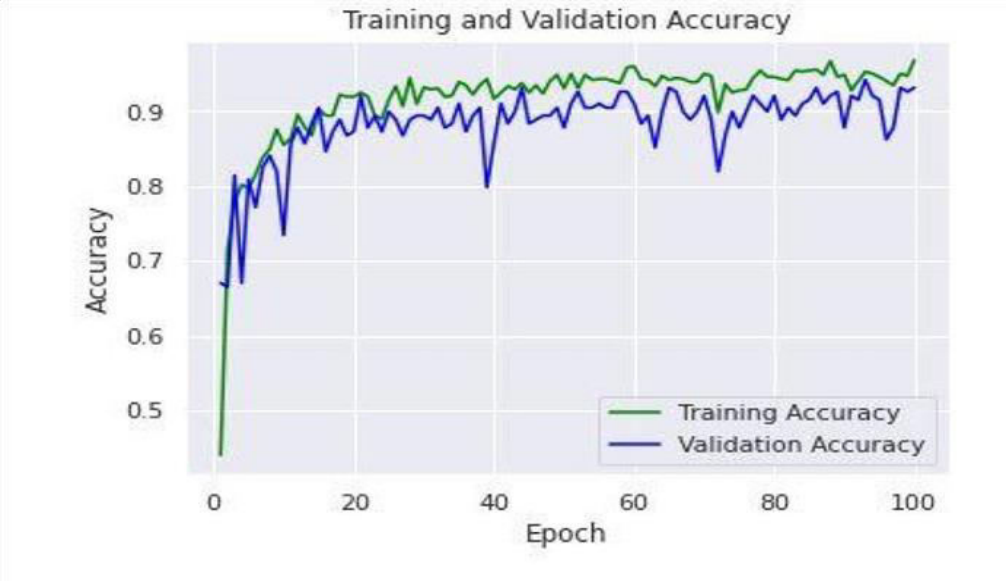

Figure3: Training and validation accuracy graph

CONCLUSION

Soilimagesareclassifiedaccurately.Soilimageclassificationworkswellforrealtime images. Crops with success rate are calculated taking all the mentioned parameters like export, import, production per unit area etc into account. The developed website is extremely user-friendly with simple and clear migrations. Most of the calculations are done before hand to reduce the latency to the users. We strongly believe that the developed system solves the problem of choosing suitable crops for their fields by farmers. While the developed system takes only soil type to determine the crops suitable, it might be more realistic if the weather and climatic conditions are also considered to make the decision. Instead of manual entry of a region, GPS technology can be used to determine the location. With the availability of the type of soil in a particular region, the usage of images to find the type of soil can be eliminated. The website can be extended as a complete guide to farmers including the fertilizers, pesticides to be used etc.

REFERENCES

[1] Abimala,T.,Sashya,S.F.andSripriya,K.,(2020),'SoilClassificationand Crop Suggestion using Image Processing', International Journal on Computing, pp. 3544.

[2] Barman, U. and Choudhury, R.D.,(2020),'Soil texture classification using multiclass support vector machines'. Information Processing in Agriculture, 7(2), pp.318-332.

[3] Bhattacharya, Biswanath ,and Dimitri P.Solomatine.,(2006),'Machine learning in soil classification',IEEE International Joint Conference on Neural Networks,pp.186-195.

[4] Devi,M.P.K.,Anthiyur,U.,andShenbagavadivu,M.S.,(2016).'EnhancedCrop Yield Prediction and Soil Data Analysis Using Data Mining'.
International Journal of Modern Computer Science, 4(6).

[5] Rahman,S.A.Z.,Mitra,K.C.and Islam,S.M.,(2018),'Soil classification using machine learning methods and crop suggestions based on soil series'. 21st IEEE International Conference of Computer and Information Technology,pp. 1-4.

[6] Ramesh, D., Vardhan, B. V., (2013), 'Data mining techniques and applications to agricultural yield data'. International journal of advanced research in computer and communication engineering, 2(9), pp.3477-3480.

[7] Saranya, N., Mythili, A., (2020), 'Classification of Soil and Crop Suggestion Using Machine Learning Techniques'.International Journal of Engineering Research & Technology, pp.671-673

[8] Srunitha.k,Dr.S.Padmavathi,(2016),'Performance of SVM Classifier For ImageBased Soil Classification'. International conference on Signal Processing, Communication, Power and Embedded System, pp.411-414.

[9] Suresh,G.,(2021),'Efficient Crop Yield Recommendation System Using Machine Learning For Digital Farming'.International Journal of Modern Agriculture, 10(1), pp. 906-914.

[10] Zhang, X., Younan, N.H., and O'Hara, C.G., (2005), 'Wavelet domain statistical hyperspectral soil texture classification'. IEEE Transactions on geoscience and remote sensing, 43(3), pp.615-618.