Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 5, No.4, May : 2024

PREDICTION OF YIELDING CAPABILITY OF CORN SEED USING CNN AND SVM

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Abstract—
Agriculture is one of the major sources for our country's Economy. Selecting good quality seeds is an important task to get a good yield. Observing the damaged and unhealthy seeds is crucial in the quality analysis of seeds. This project presents an innovative approach for seed quality monitoring leveraging Convolutional Neural Networks (CNN) and Support Vector Machines. The integration of these two powerful techniques aims to enhance the accuracy and efficiency of seed quality assessment. This approach overcomes the limitations of traditional assessment techniques. CNN is used to study seed images and recognize essential patterns related to seed quality that influence the overall quality of the seeds. SVM is employed for classification based on the extracted features from the CNN model. The model is trained to categorize seeds into three categories Excellent, Average, and Bad quality seeds. This project helps the farmers to identify good quality seeds accurately and efficiently.
Keywords: CNN, SVM, Image processing, Quality prediction, Deep Learning.

I. INTRODUCTION

This review examines the current state of corn seed quality prediction using deep learning and machine learning, aiming to identify challenges and provide a comprehensive understanding of the field progress in recent decades. Machine learning is an AI branch that improves prediction based on features. It uses historical data to determine model parameters during training, and in the testing phase, unused historical data is used for performance evaluation.

The existing system for classifying rice grain faces several challenges, including data availability and quality, feature representation, model complexity, and interoperability, generalization to unseen data, integration with agricultural practices, and model societal implications. Data availability and quality, feature representation, model complexity, generalization to unseen data, and integration with existing agricultural workflows are some of the challenges. The model's effectiveness in agricultural settings may require additional infrastructure, training, and support. Ethical considerations, such as data privacy and equitable access to technology, are also crucial. Collaboration between researchers, technologists, and stakeholders is necessary to overcome these obstacles and realize the full potential of this technology. The manual classification of rice grains is inefficient and time-consuming. An intelligent system is needed to automate this process, identifying rice grains based on their type. The primary process involves collecting data on parameters like major axis, minor axis, eccentricity, length, and breadth. The system will classify long grain basmati, and boiled rice, keeping the system organized and segregated. The proposed model for predicting corn seed-yielding capability uses a combination of CNN and SVM. CNNs extract features from input seed images, identifying patterns, textures, and shapes, SVMs classify these features into different yield categories. The model undergoes a training process to associate extracted features with their respective yielding capabilities. After training, the model can predict the yielding capability of new images by applying the learned feature extraction and classification processes. The performance of this model can be evaluated based on accuracy. This approach offers a powerful and effective approach for predicting corn seed yield based on visual characteristics. The remaining part of the paper consists of the Ease of use in section 2 followed by the Literature survey in section 3, The proposed methodology, architecture, and detailed description in section 4 the results of our proposed solution in section 5, The conclusion and future scope in section 6.

II. EASE OF USE

Integrating CNNs with SVMs for Corn Seed Classification

1) Improved Accuracy: Utilize CNN hierarchical features and SVM discriminative power for higher accuracy in corn seed classification. :
2) Automation and Efficiency: CNN automates feature extraction from seed images, reducing manual feature engineering and time and resources.
3) Robustness to Variability: CNN learns robust representation of data, enhancing their reliability in real-world applications.
4) Scalability and Adaptability: CNN and SVM are scalable and adaptable, accommodating large datasets and diverse classification tasks.
5) Contribution to Agriculture Technology: Advances seed classification technology, crucial for optimizing crop production, ensuring seed quality, and supporting sustainable agriculture practices.

III. LITERATURE SURVEY

Biren Arora et al. [1] proposed rice grain classification, a crucial task for the rice industry, which involves accurately Sorting and grading rice grains. The paper investigates various methods for rice images. It uses image processing algorithms like LiClipse, OpenCV, and Spider, and machine learning algorithms like Decision Tree Classifier, Logistic Regression, Linear Discriminant Analysis, K-Neighbors Classifier, and Random Forest Classifier. The main aim is to help vendors avoid fraudulent transportation due to sales.

Kamal Hammouche et al. [2] suggested automated seed identification. In addition to lowering the possibility of sowing weed seeds, the system claimed that this technology may speed up seed sorting and planting. This was investigated using 400 samples of several seed species, including barley, corn, lentils, and oats. Space reduction and k-means method clustering were two preprocessing features used to the photos. Based on the closest Euclidean distance criteria, decisions were made at this phase. In terms of shape and texture, the corresponding recognition rates for seeds were 85.75

Sandy C. Lauguico et al. [3] proposed lactuca sativa seeds into different varieties using a machine learning algorithm. The approach is based on single- Kernal RGB images and a support vector machine to learn the discriminating spectral features, overcoming the complexity of this complex task using image-processing techniques.

Mayada Mosa et al. [4] proposed detect pests and diseases on sesame seeds. The CNN was trained on a dataset of images labeled with pests and diseases, and evaluated on a dataset of images not labeled. The dataset consisted of around 1,700 images of sesame leaves, grouped into three classes: two of which were diseases affecting the seeds in the Sudan region, and the latter was healthy leaves. The model achieved the best results with a training accuracy of 90.77

Hashem Ibrahim et al. [5] suggested using cereal grain samples to determine the species of pot seeds. The findings indicated that certain weed seeds resembled wheat grains in size and form, which might lead to problems with weed control. Stages including scale-space extreme detection, key point localization, orientation assignment, key point descriptor, and matching were included in the initial SIFT algorithm, and they may have been essential for successful weed assignment.

Israa hassan Bashier[6], the method of dividing seeds by feel was covered by the writer. According to the method, one can identify the type of seed by touching it because each one has a unique form. In contrast to sunflower seeds, which are round or oval with multiple tiny indentations on the surface, pumpkin seeds are usually oblong or triangular with a few sharp points on one end. The most effective method for identifying the type of seed when it contains numerous concave points is multiple concave point detection.

Harshit Gupta et al. [7] Proposed Principles of seed Technology and propagation materials of highly suitable crop varieties, the first step towards seed certification is the identification of seed type. An exhaustive procedure of examining the morphology and visual qualities of a seed is required by a plant researcher in order to identify its kind. Progress in deep learning has led to the development of convolutional neural networks (CNNs), which offer classification using visuals. A significant bottleneck, despite their effectiveness in classification, is the need for a substantial quantity of labeled data to train the CNN before it can be applied to classification. To solve these challenges, the study makes use of the concepts of Contrastive Learning and Domain Randomization.

IV. PROPOSED METHODOLOGY

The Prediction of yielding capability of corn seeds can be done using CNN and SVM. The quality prediction uses advanced image processing, deep learning, and machine learning techniques. These techniques can be used to enhance the accuracy and efficiency of the seed quality. CNN can be trained to extract the features from the images of corn seeds. The extracted features can be used to predict the quality of the seeds. These trained models can help to predict the quality of the input image.

The system Architecture starts with the creation of a dataset of corn seed images. The corn seed images consist of clusters of seeds of varying sizes. The preprocessing of the dataset refers to the measures taken on the raw dataset to prepare that dataset for further analysis in the process. Preprocessing normally involves the resizing of the images so that all images can be in a similar size. Resizing is a crucial step because the images in the dataset can be in varying sizes. Normalization can also be done to adjust the pixel values of the images this process helps in the smooth processing of the dataset. The next step involves labeling the dataset into three classes that are Excellent, Bad, and Average. After that, the system uses a Convolutional Neural Network for image recognition and pattern Analysis from the corn seed images. The CNN model can be trained on the dataset containing corn seed images. The training of the model involves the CNN being able to identify the features from the images that is color, shape, size, and texture of the seeds. The extracted features from the CNN can be used to train the SVM model so that it performs the classification task more effectively and accurately. This trained SVM model is used to predict the quality of the image that the user uploaded. These integrated CNN and SVM model is used to predict the quality of the seed images and help the farmers to increase overall agriculture productivity.

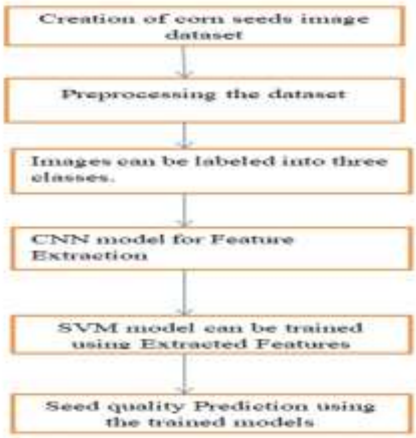


Fig1: System Architecture

V. ALGORITHMS

Convolutional Neural Network(CNN)

CNN is a deep learning model which is mainly used for image recognition and pattern analysis tasks. The CNN can be used in computer vision, object detection, segmentation, and medical image analysis. The CNN model contains several layers Convolutional layer, pooling layer, and Fully Connected Layers. These layers can be used to perform various tasks. The CNN algorithm is one of the most used algorithms for image recognition tasks because of its performance.

Support Vector Machine

SVM is the machine learning model which is used for both classification and Regression tasks. The SVM can be mainly used for Classification tasks. Each data point is plotted into n-dimensional space with n as the number of attributes. SVM comes under the Supervised Learning Algorithm because

SVM performs the classification tasks based on the labeled dataset. SVM can be divided into two types Linear SVM and Non-Linear SVM. Linear SVM is based on linearly separable data and Non-Linear SVM is based on nonlinearly separable data.

Supervised Learning Algorithm

Supervised Learning Algorithm is a type of Machine Learning technique. This algorithm is based on the labeled dataset. Label means names given to the data. This label is used to easily classify the data into their respective classes. Supervised Learning algorithm is mainly used in image classification and spam filtering.

VI. RESULTS AND ANALYSIS

This project predicts the quality of corn seeds that are Excellent quality, Average Quality, and Bad Quality from the image of seed. The input image is the clusters of seeds of corn seeds. The system starts with the creation of a dataset of labeled corn seed images over 2000 samples. After that, we trained the dataset using CNN (convolutional Neural Network). The CNN is used to extract the features from images that are size, shape, and texture. Then the extracted features can be given to the Support Vector Machine and then trained the model using SVM.SVM is used for classification purposes. SVM classifies the seeds into their respective classes. Predicting the quality of seeds manually becomes a difficult task and time-consuming process. So our proposed system automates this process by easily identifying the overall quality of corn seeds.

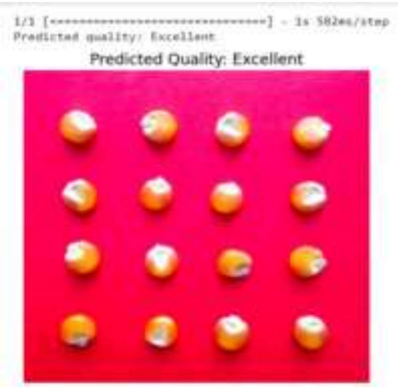


Fig 2: Predicted Quality: Excellent Fig 3: Predicted Quality: Average

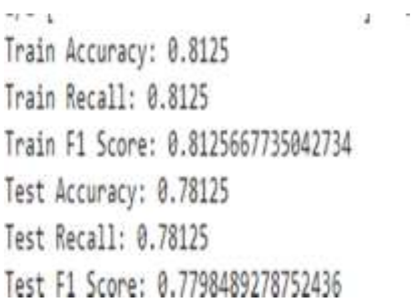

Train Accuracy: 0.8125
Train Recall: 0.8125
Train F1 Score: 0.8125667735042734
Test Accuracy: 0.78125
Test Recall: 0.78125
Test F1 Score: 0.7798489278752436

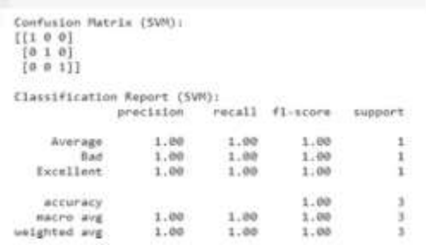
Fig 4: Predicted Quality: Bad Fig 5: Training and test dataset predictions

Fig 2 shows the predicted quality is Excellent quality. It represents that if the seed comes under Excellent quality defines that these types of seeds have high yielding capability and it results in high production of crops and produces profit to farmers.

Fig 3 shows the predicted quality is Average quality. It represents that if the seed comes under average quality defines that these types of seeds have minimum yielding capability and it results in medium production of crops.

Fig 4 shows the predicted quality is Bad quality. It represents that if the seed comes under Bad quality defined that these types of seeds have no yielding capability and it results in no production of crops and if the farmers use this type of crops results in loss.

Fig 5 shows the values of accuracy, recall, and F1 score between the test set and the training set. These features are used to evaluate the model's performance. The scores can be calculated by using the corn seed images present in the dataset.



```
Confusion Matrix (SVM):
[[1 0 0]
 [0 1 0]
 [0 0 1]]

Classification Report (SVM):
              precision    recall  f1-score   support

     Average       1.00      1.00      1.00         1
         Bad       1.00      1.00      1.00         1
   Excellent       1.00      1.00      1.00         1

    accuracy                           1.00         3
   macro avg       1.00      1.00      1.00         3
weighted avg       1.00      1.00      1.00         3
```

Fig.6. SVM classification prediction

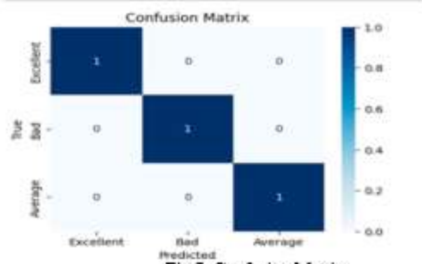


Fig 7: Confusion Matrix

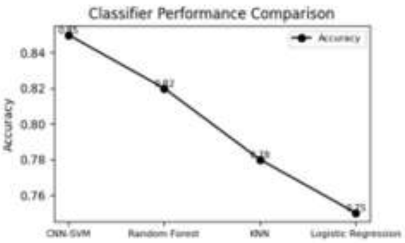


Fig.8: Comparison with other algorithms

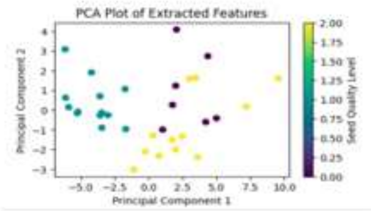


Fig 9. Feature Extraction of corn seed images

VII.CONCLUSION AND FUTURE SCOPE

The proposed system accurately predicts the quality of corn seeds by using CNN and SVM algorithms. The integration of these two techniques provides an efficient and accurate solution to assist farmers in selecting seeds having good yielding capacity. The proposed system is tested only on corn seeds. In future, the proposed system can be extended for testing different types of seeds. Overall this research provides a foundational framework for automated seed quality assessment, showcasing the transformative potential of technology in advancing agricultural practices.

VIII. REFERENCES

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