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Design and Development of Crop Stress Diagnosis System Using Machine Learning

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Abstract : Many people in India depend on agriculture for daily livelihood. But farmers suffer a lot of problems during cultivation of crops. One of the main problems is crop stress. Crop stress destroys the crop productivity and yield. Early detection of crop stress will be very helpful for the farmers. Machine learning and deep learning can contribute a lot in this arena. This project attempts to create a system to diagnose the crop stress. The system collects data as images. These are images of stressed grape crops and collected in an image dataset. Different machine learning's deep learning techniques are used for classification. Classification models like LSTM, CNN and SIFT with LSTM are used here for crop stress diagnosis. In this system users can select any classification model to predict the crop stress. After processing respective models diagnosis is communicated by the system which is very essential for the farmers to improve farming which increases crop yield. The system identifies the type of crop stress affected and also identifies the name of crop stress. After identifying stress, the system gives the proper solution to the crop stress affected.

I. INTRODUCTION

Agriculture has an important role in the Indian economy. The agricultural sector provides not only food but also job opportunities. Rise in population increases the demand for food. As a result of this production of food must be increased. This will only become possible by cultivating more food items. Agriculture also supplies raw materials to various industries. It also contributes to our national income. Thus agriculture is one of the most important factors that help in the development of our country. But nowadays farmers suffer heavy losses due to crop stress. Lack of knowledge about new techniques, lack of proper supply of fertilizers and pesticides, etc. are some reasons for this. Crop stress is the main problem. It decreases the total yield and thus causes a huge decline in total production. Crop stress is something that affects the yield of plants. Environmental stresses that affect these plants reduce the productivity of agriculture. The two types of stress occurring in plants are abiotic and biotic stress. Examples of abiotic stress are flood, salinity, drought, etc. Biotic stress includes attack by some pathogens like fungi, bacteria, etc. The stresses that this project deals with are bacterial blight, Boron deficiency, Chemical injury, drought, Fungal blast, Iron deficiency, Nitrogen deficiency, Normal, Phosphorus deficiency, Potassium deficiency, Submergence and Zinc deficiency.

Proper diagnosis of these stresses will be very beneficial to the farmers. They can take proper measures according to the diagnosis and give better treatment methods. Therefore a crop stress diagnosis system is essential for the farmers. It can detect the type of stress and can give solutions to overcome those stresses. In this project a crop stress diagnosis system is developed which can take input as crop stress dataset. Classification models like LSTM, CNN and SIFT with LSTM are used here for crop stress diagnosis. Users can select any classification model to predict the crop stress. After processing respective models the system identifies the type of crop stress affected and also identifies the name of crop stress. After identifying stress, the system gives the proper solution to the crop stress affected. Thus the problems which involve crop stress can be rectified. With the help of deep learning it takes only less time and also an easier method.

II. LITERATURE SURVEY

Many sectors are applying machine learning models to address a variety of use cases. Below are just a few of the many applications of machine learning in the real world.

S. Rajanarayanan, Lea Sorilla Nisperos and J.R. Ephraim Basal [1] proposed a technique on recurrent neural networks with an aim to recognize pathogens with different deep learning stages. This paper detects whether small images contain a pathogen called vibrio cholera. The method used to classify the images with pathogens is RNN for better and easier classification which can increase the quality in pathogen determination. In this paper they have shown a methodology for the recognition of images which depends on the Deep Recurrent Neural system. The RNN proposed engineering provides the best results for characteristic accuracy of 94%, with Vibrio 200 cholera image and 200 for dataset and 80 images for test information. The proposed system has intelligent instruments to incorporate this arrangement into future magnifying instruments.

Muhammad Hammad Saleem, Johan Potgieter, Khalid Mahmood Arif [2] proposed different deep learning approaches for the detection pf plant diseases. Plant diseases can badly affect agricultural growth. Therefore their early detection is very important. Many machine learning models have been employed for the detection and classification of plant diseases. Also using deep learning techniques plant disease symptoms are identified. Moreover, several performance metrics are also used. This review provides an explanation of deep learning models used to visualize various plant diseases. Also in this paper some research gaps are identified.

Joanna M. Gambetta, Bruno P. Holzapfel , Manfred Stoll and Matthias Friedel [3] proposed a review for more research to be done regarding sunburn in grapes. This paper gave an idea about how sunburns occur in grape plants. It also tells us the symptoms of sunburn in grapes. This paper reviewed the impact of sunburn in crop production and yield. It consists of environmental factors affecting sunburn development. Also it has some methods which help to overcome stress. There are strategies for sunburn protection.

Gregory A. Gambetta, Jose Carlos Herrera, Silvina Dayer, Quishuo Feng, UriHochberg and Simone D. Castellarin[4] proposed a paper regarding drought stress in grapevines. In this paper they have suggested that grape is a fruit with greater economic importance. This review has the results on grapevine drought responses.

A.Kavitha [5] proposed a paper in which how deep learning is implemented in smart agriculture. This paper also tells us the applications of deep learning, machine learning, ioT, etc. They are very helpful in agriculture to minimize manpower. These technologies are used by farmers to attain high crop yield, production, etc

Prabavathi S, Kanmani P[6] presented a system for automatic prediction and classification of plant leaf diseases. Various surveys regarding different techniques are discussed. Image processing and feature extraction algorithms are used in the proposed system. Deep convolutional neural network is used to identify the disease. Accuracy obtained by this methodology is noted.

Different machine learning and deep learning methods are used in the literature for prediction and classification. Various papers use deep neural networks for classification purposes. In most of the literature convolutional neural networks are used for crop disease classification. While reviewing different literature it is found that no work is carried out to perform SIFT with LSTM.

III. PROPOSED SYSTEM

The three types of classifications used for crop stress diagnosis are classification using LSTM, CNN and SIFT with LSTM. All these three models are given with three radio buttons. After choosing any model, the user can select the input image. After that preprocessing takes place and then by the choice of user developed appropriate model is used. In this phase the crop stress will be identified, its type of crop stress will be identified and possible solution to treat crop stress will be displayed.

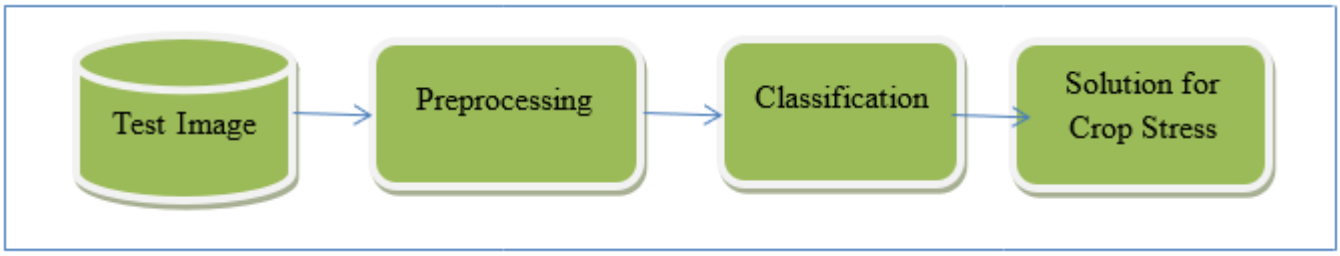

Fig 3.1 Architecture of proposed system

Preprocessing

Pre-processing is the first and important step before training a deep learning model with raw data. It is a process of converting the raw data to fit into the network. The pre-processing models are operated on the captured images that modify into a proper model. The chosen crop images can be reshaped and limited as it can be sampled in an effective manner. The pre-processing stage has massive processes like image advancement, color space conversion, image reshaping, and image filtering. It is utilized to improvise the visibility of an affected region in an image when compared with the actual image. The image which was opened by the user has been preprocessed in this step.

Classification

Developed classification model is used in this phase where the user can select a choice of classification model to classify the input image.

Solution for crop stress

In this part the classification model processes the input image and predicts the crop stress and gives a response to the user in the form of a solution.

IV. RESULT ANALYSIS

The proposed solution is implemented in Python. To provide good human computer interaction, a graphical user interface is designed. The project is dedicated to create crop stress diagnosis system in which the system take any image with user choice from the dataset and it perform preprocessing, training by selecting any model and after that it will give the classification result in the terms of stressed crop or normal, biotic or abiotic and as well as it gives suggestion for that respective stress in the form of message box which is shown in figure 4.1, figure 4.2, figure 4.3, figure 4.4, figure 4.5 and figure 4.6.

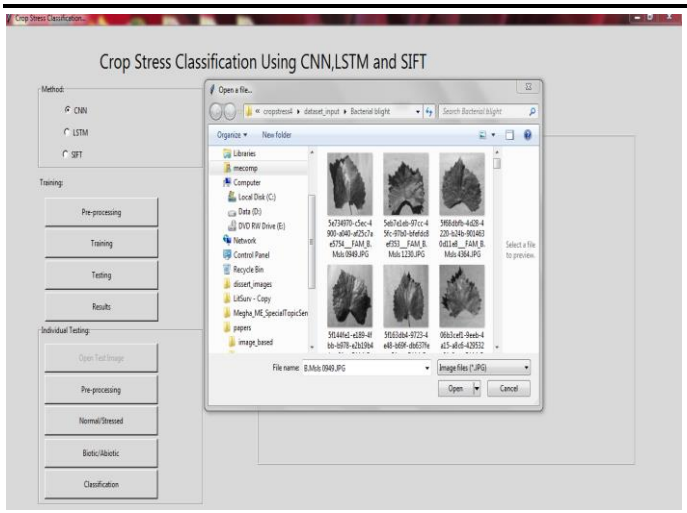

Fig 4.1. Open test image

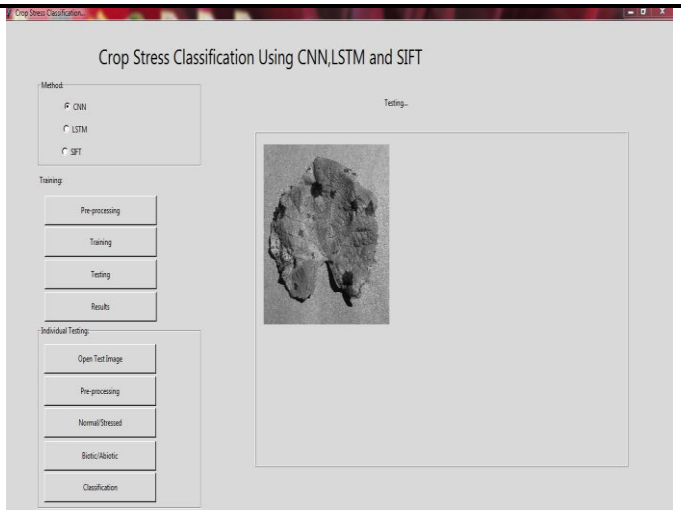

Fig 4.2 Test image is opened

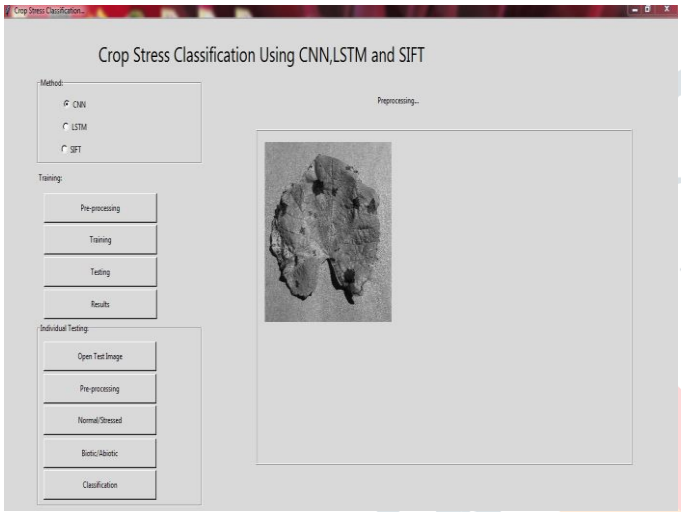

Fig 4.3. Preprocessing of opened image

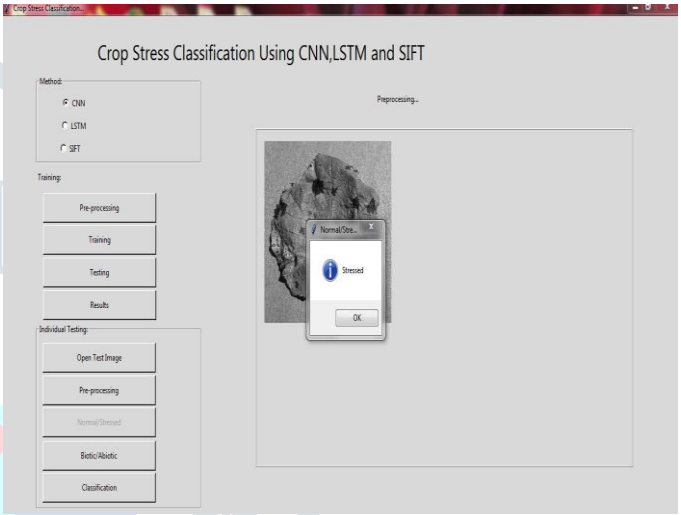

Fig 4.4. Identification of stressed image

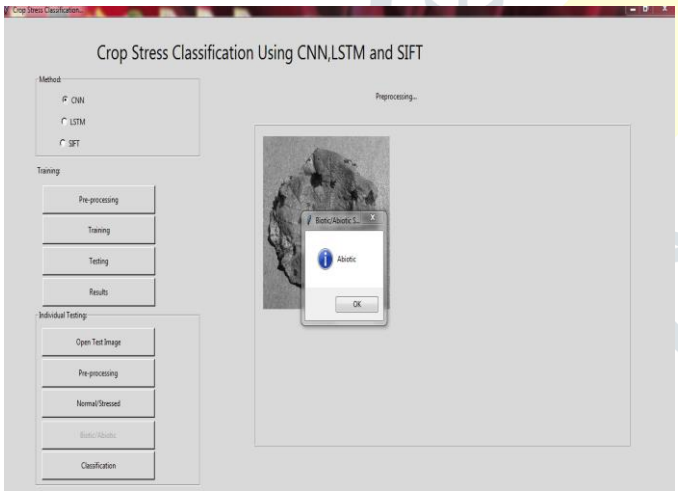

Fig 4.5. Identification of type of stress

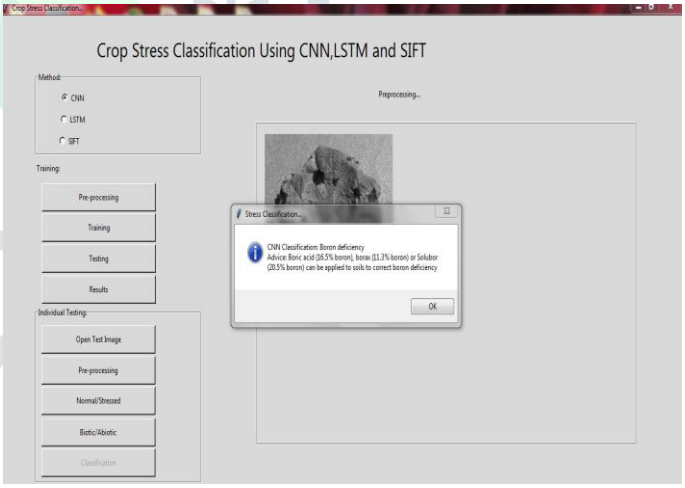

Fig 4.6. Identification of name of stress and solution

After identifying the type of stress, the system shows the name of the stress affected and also a solution to treat the identified stress.

V. CONCLUSION

Plant disease is a main challenge which affects the productivity and quality of the agricultural sector. Diagnosis of stress is very important for better crop production. This project focused on developing an efficient diagnosing system to detect the crop stress efficiently from crop images. The recognition and classification of various crop stress is a crucial process which improves the quality of the fruits and increases productivity. This project work has developed a set of intelligent Machine Learning and Deep Learning based models to identify the presence of stresses in grape plants. This work presented a crop image stress detection and classification model by incorporating several processes. After detecting the stress the system identifies the type of stress affected and also the proper solution to treat the identified stress.

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