SUGARCANE STEM AND LEAF DISEASE PREDICTION USING DEEP NEURAL NETWORK

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Master of Science in Computer Science and Engineering

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APPROVAL

This Project/internship titled **"Sugarcane stem and leaf Disease Prediction using Deep Neural Network"**, submitted by Md. Shahin Sharif, ID No: 192-25-790 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 9th July 2020.

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I hereby declare that, this project has been done by me under the supervision of **Mr. Ahmed Al Marouf, Lecturer, Department of CSE** Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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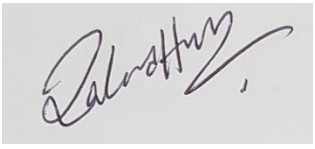

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ABSTRACT

Deep convolutional neural network is a diverting area where researches and achievement are taking excellent progress in agriculture field. The most recent enhancements in computer vision formulated thorough deep learning have covered the method for how to identify and analyze diseases in plants by utilizing a camera to capture images an basis for recognizing several types of plant diseases. This research elaborates disease detection and classification with help of deep learning convolutional neural network. Sugarcane is a vital crop in the world. For detecting sugarcane diseases the researchers used the convolutional neural networks (CNNs) as the basic deep learning method. This study trained and test deep learning model consisting of 2200 sugarcane images dataset. After applying CNNs it achieves an accuracy of 92% and also get error rate 8%. The trained model acquired it motive by detecting and classifying sugarcane images into healthy and infected of sugarcane plants. Therefore, this research provides a step of helping farmers with the process of deep learning algorithm in detecting and classifying sugarcane diseases.

CHAPTER 1

INTRODUCTION

1.1 Introduction

The Sugarcane industry within the Bangladeshis contributes high profits to the economy. It is one of the biggest crops cultivated in several provinces round the country. This crop provides 3 major products: sugar, bio-ethanol, and power. At present, sugarcane is cultivated in regarding a hundred countries. The principal sugarcane growing countries square measure India, Argentina, Australia, Brazil, Barbados, China, Cuba, Mexico, Egypt, Jamaica, Peru, South Africa, and Hawaii, Florida, and Pelican State of the United States of America. In Bangladesh sugarcane is grown in about 0.38 million acres of land [1]. The annual manufacturing of cane is about 5.5 million tons. It is one of the most vital money plants of the country. A sugarcane plant has prominently jointed stalks, each bearing two ranks of sword-shaped but gracefully arching leaves. Some sorts might also have stalks that are 5-7 meter long [1]. Sugarcane grows to the best advantage on a rich, moist soil under sunny skies in a tropical climate. Clay-loam soil with some share of sand and silt, combined with humus is amongst the quality soils for sugarcane cultivation. The modern manufacturing of sugar in Bangladesh is solely about 5% of whole demand. About 20% demand is fulfilled by jiggery production mainly from sugarcane and remaining 75% of total requirement is fulfilled by importation. The foremost reasons of decrease sugar manufacturing of the enterprise encompass much less furnish of sugarcane in the factories due to the fact most of the sugar are affected by means of one-of-a-kind diseases.

Various Sugarcane diseases are:

- Red Rot.
- Sugarcane Borer
- Rust
- Smut
- Wilt

Diseases Sugarcane suffers from several diseases at all stages of its growth. All are the most common diseases in Bangladesh which are reducing to cultivate more Sugarcane crop. About 30% to 40% sugarcane crops are destroying for this reason. So to alleviate sugarcane diseases we can apply some techniques which can be give a better result. Machine learning is a trendy technology used to classify and detect plant diseases in some studies. This method involves more calculations that are compound and hard on online applications. As a result, the performance of these methods may only achieve a satisfactory result. Deep learning uses artificial neural network architecture and usually contains many layers to process compared to the traditional neural network architectures. Deep learning has transformed the areas of image detection, image classification, acoustics, etc. that requires huge data to process. The integration of deep learning in plant disease diagnosis has paved the way on how the experts analyze and make decision. In this study, we used the Convolutional Neural Networks (CNNs) as the basic deep learning method CNN is one of the most prevailing methods in demonstrating complex methods and uses a large amount of data to perform pattern recognition applications. We place some image for training and testing and show the accuracy of the image result once detected. In our study, we tend to escapade the deep learning methodology for disease recognition, driven by evolvement of deep learning techniques and their application in follow.

1.2 Motivation

Bangladesh is an agriculture country and also depends on agriculture. In Bangladesh sugarcane needs very hardly for daily life. Sugarcane is a vital crop worldwide and the main source of sugar and ethanol one problem in the sugar industry is sugarcane diseases that leads in eradicating growing crops are infested with the diseases resulting in the financial loss of small-scale farmers [2].fo diseases reason lots of sugarcane crops are destroy daily and farmers are faced lot of problem. During this situation sugarcane demand for people are increased day by day and government import lot of sugar for their demand and lost many currencies. All those reason it motivates me and try to be a good solution by deep learning for how to cultivate more sugarcane crops and reduce the infected diseases which helps to our farmer and also may be benefited from this approach.

1.3 Rationale of the Study

Sugarcane diseases recognition using deep learning for how to detect and diagnose diseases in plants and leaves by using a camera to capture images as basis for recognizing several types of diseases. Deep learning is an advanced method of machine learning that uses neural networks. The people around the world rely on agriculture sector as one of the most important sectors where crops are the basic need for food. Sugarcane also an important crop in daily life. So prevent those diseases is very necessary. All diseases can be recognized by using deep learning. From Deep learning it detects the diseases from capture images and gets the accuracy to how the diseases are detected. Deep learning also classifies diseases.

1.4 Research Question

A good research question is essential to guide your research paper, project on thesis. It pinpoints

Exactly what you want to find out and gives work clear focus and purpose.

- Can this research give accurate result to predict diseases?
- Can technology ameliorate the magnitude of sugarcane crops?
- How beneficial it would be if we recognition sugarcane crops diseases utilize this technology?

1.5 Expected Outcome

In this session what one is the expected outcome of this research that are described. Now a day's technology is enhancing hastily. This research accentuation on agriculture developing by utilizing technology. From using Deep learning, the research tries to give a good solution on how to recognition sugarcane diseases and how to prevent them. It had been try to give a good accuracy for that it will be accepted a good solution. In future the researches also develop a cellular software in which farmer can directly perceive the affected area and way to reminds of the disorder. This mobile application is very easier and understandable to every person.

1.6 Project Management and Finance

For mange the project the researcher was going to the out cultivation sugarcane land field and collect sugarcane data. For this work farmer also be helped to find the affected area. Those data were taking by phone camera. For managing or collecting data some financial coast is handled.

1.7 Report Layout

Chapter-2 consists of the background where it has terminologies, related works, Scope of the problem, challenges. Chapter-3 gives the proposed methodology where include data collection procedure, Statistical Analysis and also Implementation. Chapter-4 describes the Experimental results and Discussion. Chapter-5 contains the Impact on Society environment and Sustainability of the sugarcane diseases and finally the last Chaper-6 bears the research summary, conclusion Recommendation and Implication for future.

CHAPTER 2

BACKGROUND

2.1 Preliminaries/Terminologies

Earlier those diseases were of minor importance but it has become matter of concern as it is sporadic rapidly in sugarcane growing area heavily monoculture of single variety and due to lack of effective technologies. But now a day's many techniques are applied this sector to predict or detect crops diseases. Some of the technique are Image Processing, Machine Learning, Deep convolutional Neural Network(DCNN), Support Vector Machine(SVM), Public Neural Network(PNN). Many researchers are publishing their paper to follow those techniques. Many scientists have already achieved a significant improvement in all those techniques. In this research I apply Deep Convolutional Neural Network(CNN) which is the advanced method of machine learning.

2.2 Related Works

Diseases detection or recognition related works are also done many researchers by different techniques but all techniques process is nearly to same. Many researchers have worked on each regular and smooth computing process for the segment of contaminated vicinity of plant from diseases but do few longer time of taking sugarcane crops and give a better solution. I study many paper and find some related work which are worked on different crops such as rice, Tomato, Jute, fruit etc. All are additionally used to in test; we exhibit some quantity of tender computing techniques that have been used to perceive the illness of the plant. After summarizing some papers some related works are found and they are given below in next section.

2.3 Comparative Analysis and Summary:

From the table 2.3.1 we see many associated work to identification many plant disorder in quite a number methodology. After learn about all these paper we can supply a description about all their work. Generally, it has been considered from the literature that image processing strategies have been utilized for the identification of plant diseases. Where the studying capacity of Neural Network (NN) additionally contributes for the same purpose. As it considered from the survey authors have majorly targeted on the identification of an illnesses from the precise plant due to the reality it is a challenging venture to find out and categorize the disorder amongst one of a type category. Some related works are given below to the table and those are described in this para. An application based on image processing have been presented like Ratih Kartika Dewi et al. use it for Feature Extraction for Identification of Sugarcane Rust Disease which accuracy is 95%. An application using Support Vector Machine to Identification grape leaf Disease which accuracy is 76% and author is Pranjali B. Pado et.al. Another application was using Genetic algorithm and rough theory for Recognition rice leaf disease which accuracy is 78% and it done by Santanu Phadikar et al. An application using Fuzzy c means and Vector machine to Identification of plant leaf disease which accuracy is 82%. Real time classification of plant Diseases using Image Processing Technique written by Tallah Akram et al. which accuracy is 80%. Another application has been presented Malvika Ranjah et al. using Anti-Facial Neural Network which accuracy is 81.3%. Also another application has been presented by Shanween Zhang et al. using K-means clustering to Detect cucumber leaf disease which accuracy is 75%. Last one have been presented by Jayamala Kumar patil et al. using Content vase image retrieval to Identification soya bean leaf disease which accuracy is 79%. So right here the brief precis of associated works which we are learn about before [3].

TABLE 2.3.1: REVIEW OF PLANT DISEASES USING SOFT COMPUTING METHODS

Authors	Methodology	Application Area	Accuracy
Ratih Kartika Dewi et al	Based on Image Processing technique	Feature Extraction for Identification of Sugarcane Rust Disease	95%
Tallah Akram et al.	Based on Image processing Technique	Real time classification of plant Diseases	80%
Faiza Nuzhat Joyee et.al	Image Processing Techniques	Jute Steam disease detection	80%
Pranjali B. Pado et.al	Support Vector Machine	Identification grape leaf Disease	74.6%
Malvika Ranjah et.al	Anti-Facial Neural Network	Identification cotton leaf disease	81.3%
Santanu Phadikar et.al	Genetic algorithm and rough theory	Recognition rice leaf disease	78%
Megha. S et.al	Fuzzy c means and Vector machine	Identification of plant leaf disease	82%
Shanween Zhang et.al	K-means clustering	Detect cucumber leaf disease	75%
Andre da Silva Abade et.al	Convolutional Neural Networks	Plant disease recognition	90%

2.4 Scope of the Problem

This research mainly works on four kinds of diseases which are described in this section. Fungus, bacteria and virus cause diseases to sugarcane crop [4]. These are transmitted from one plant to every other and one subject to some other discipline both by way of unique seed set or causal organism already in the soil or spores are carried via blowing wind. Some of the ailments of sugarcane crop and their counseled manipulate measures are mentioned here.

Red rot: This ailment is prompted via a fungus Colletotrichum falcatum.Red rod sickness seems in July. Leaves begin loosing color and withering. The stalk turns into dry, wrinkled, hole and alcoholic scent is emitted. To manipulate disease, if a very few florae are affected then uproot these florae and burn them in any other case discord the complete of the discipline and do now not develop this crop in the equal area for at least three years. Fresh sowing has to be accomplished with seed-sets from resistant variety, dipping these in 0.25% answer of Agallol or Aretan for 2-3 minutes.

Wilt: The ailment is prompted by way of a fungus Cephalosporium sacchari. The crown leaves emerge as yellow for the duration of late season and cane dries. To manipulate the disease, if the affected flora are very few, then uproot these and bum them in any other case discard or bum i the whilst field. Fresh sowings are performed with resistant variety.

Sugarcane rust is brought about by way of the fungus Puccinia melanocephela. An obligate parasite, the pathogen incites new infections solely on dwelling host tissue. Changes in varietal susceptibility to rust have been determined over the years, suggesting the existence of fungal variations.

Sugarcane Borer: It is additionally recognized as Chilo infescatellus. Attacks the crop all through the early section of cane growth, earlier than internode formation. It additionally assaults the cane stalks in the years of scanty rainfall. Larvae enter the cane laterally thru one or extra holes in the stalks (shoot) and bores downwards as properly as upwards killing the developing factor

2.5 Challenges

The trouble related with automated plant sickness identification the usage of seen vary pix has obtained full-size interest in the final two decades, then again the strategies proposed so some distance is normally restrained in their scope and based on perfect seize stipulations in order to work properly. This obvious lack of widespread developments may also be partly defined by way of some tough challenges posed through the subject: presence of complex backgrounds that can't be effortlessly separated from the vicinity of activity (usually leaf and stem), boundaries of the signs regularly are now not properly defined, uncontrolled seize prerequisites may additionally current traits that make the photo evaluation greater difficult, sure illnesses produce signs and symptoms with a large vary of characteristics, the signs and symptoms produced through unique ailments might also be very similar, and they might also be current simultaneously. This research affords an evaluation of every one of these challenges, emphasizing each the troubles that they may also purpose and how they may also have doubtlessly affected the methods proposed in the past. Some feasible options capable of overcoming at least some of these challenges are proposed.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Research Subject and Instrumentation

This research report based on Deep Convolutional Neural Network(DCNN) to recognition sugarcane crops disease. Deep Convolutional Neural Network is an advanced method of machine learning. As the basic deep learning CNN is one of the most prevailing methods in demonstrating complex method uses a large amount of data to perform diseases recognition. So the research subject is recognition sugarcane crops disease by using Deep Convolutional Neural Network in deep learning. For completing this research, we need some instruments which is very essential to solve the thesis. First we need vital part which is data set that means images. Then need the platform where code is being execute. I used to google colaboratory which is the most common platform to get accuracy, error rate and get also plot graph. In this section I used some library function which are Import Keras, Ipython.display import SVG, import matplotlib.pyplot, import Imagegenarator, Opencv, Convo2D, Dense, MaxPool2D etc. Here the research subject and Instrument.

3.2 Data Collection Procedure/Dataset Utilized

In collection of images disease images are selected 4 classes where various diseases are taking place in different class. Those all class images are also put on to class which are train data and another is testing data. All images are taken by mobile from sugarcane land. When image collect try to find good quality images. All images are not disorder image some images are also healthy. The diseases are Red rot, sugarcane Borer, Rust and wilt. Some demo is given below.

Red Rot

Here figure 3.2.1 we see the red rot diseases syndrome of sugarcane crops

Figure 3.2.1: Red Rot

Sugarcane Borer

Here figure 3.2.2 we see the Borer diseases syndrome of sugarcane crops

Figure 3.2.2: Sugarcane Borer

Rust

Here figure 3.2.1 we see the rust diseases syndrome of sugarcane crops

Figure 3.2.3: Rust

Wilt

Here figure 3.2.4 we see the Wilt diseases syndrome of sugarcane crops

Figure 3.2.4: Wilt

Here all the data set of sugarcane crops and their disorder images.

3.3 Statistical Analysis

In this research by deep convolutional neural network all data set are utilized correctly. A statistical overview of deep learning with a receptacle on testing belief highlighting statistical connection on the unseen synthesis of deep learning. Statistical modeling is more about finding the relationship between the train data and test data which is help for creating prediction. The data sets are classified two types train model and test model and they also have sub model which contain all diseases and healthy images. This all class is decorating statistical because when the method is applying then it finds correctly and gives an accurate result with any problem

3.4 Proposed Methodology

The whole procedure of creating the replica for plant disorder identification the usage of deep CNN is described right here in detail. The entire system is divided into few imperative steps, beginning with recruitment of pictures for classification system the usage of deep neural networks. An experimental design through a workflow diagram that shows whether the sugarcane plant is infected or not infected with the disease through images is shown in Fig. 3.4.1.

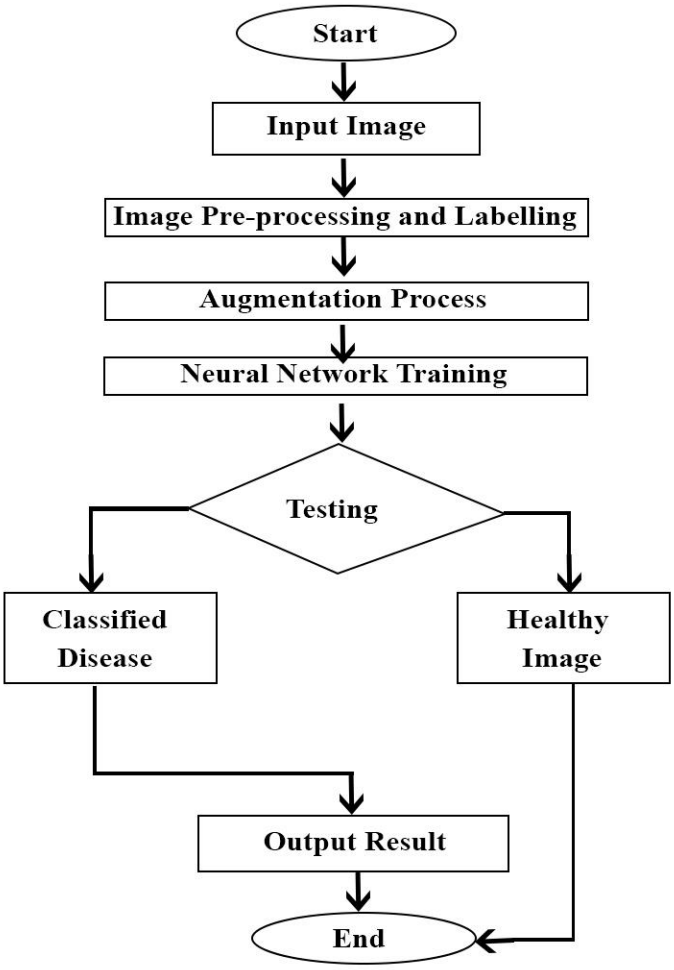

Figure 3.4.1: Workflow diagram for the prediction model

Image Preprocessing and labeling: In order to attain higher characteristic extraction, the remaining photos graph to be used as statistics set for deep neural community classifier had been preprocessed in order to attain fidelity. Then crop the photograph manually in order to mark the contaminated vicinity of the sugarcane crops. We ensured that the images content material all wished data for characteristic learning. We resize the picture to 256*256 to limit the training time. The coaching time we calculated through the written script in the Python, the use of the openCV framework [5]. Previously we have taken some training in the dataset. From the assist of Agricultural experts, we have labeled all the pictures with splendid disorder name. Also eliminated the duplicated and undesirable images from the dataset. This way we precisely categorized the images for the education and validate the dataset.

Augmentation:

We used augmentation to amplify dataset and overlook distortion which helps to limit over becoming whilst the training step. In computer gaining knowledge of and information over becoming happens when the statistical mannequin recounts random noise or error as a substitute than underlying relationship. Image augmentation consists of some transformation strategies containing affine transformation, standpoint transformation and rotations. Affine transformation used to divulge translation and rotation [6]. For this system we rotate the picture in more than a few degrees.

We have proven the transformation of augmentation process. In this stage we used to precise used the openCV library in order to automate the augmentation system for many pictures from the dataset with threat of moving the parameters of transformation in the execution time which enhances elasticity.

Neural Network Training

To discover the disorder leaves from the healthful leaves we have used Deep Convolutional Neural Network (DCNN) method. In Convolutional Neural Network training, images are needed to train for classification. In this section images are being trained where we used image in different disease class. In figure 3.4.2 we can see an image is taken for learn to train. After taking an image this image is going to convolutional process where image is marked by pixel and sent it pixel wise for convolution. The training is heavy faster using deep convolutional neural network

with ReLU. This method is used for the output of every convolutional and fully connected layer. Pooling layer is an important layer of CNN. It is a form of nonlinear down-sampling. Max pooling is a nonlinear feature that divides the enter picture into a set of non-overlapping rectangular and for all sub-region output is the maximum [7]. Pooling layer control the overfitting. Jointly ReLUs and dropout are more convenient [8]. After convolution process it needs to max pooling. Pooling layers provide an approach to down sampling features of this image and pooling is required for detect the image features.

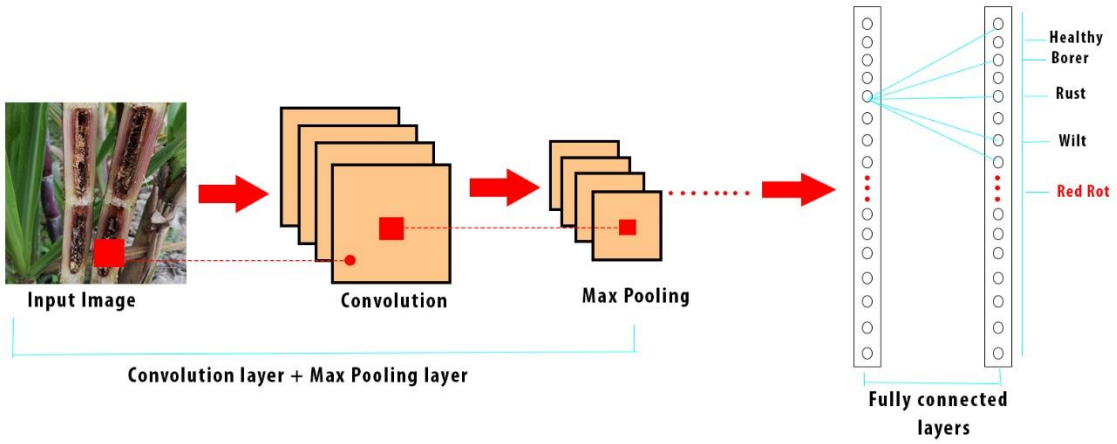

Figure 3.4.2: Convolution process

Then it sends to fully connected layer. Fully connected layer is very important feature of Convolutional Neural Network, which have been successful in recognition and classify images [9]. It is breaking down the image into features and analyzing them independently. This process gives final classification decision. This is the whole process of Neural Network training to trained model by convolution process.

Testing

Test is very vital part in this research for higher overall performance. We already trained the data set by convolutional network process for this purpose the information of the training is known. In figure 3.4.3 we see pick a train image as input where is the image is send to exhaustive search which help to images enumerate all possible task then it sends to CNN for gat an output image [10]. This output image is checked by softmax classifier. Softmax classifier is a loss function, in the context

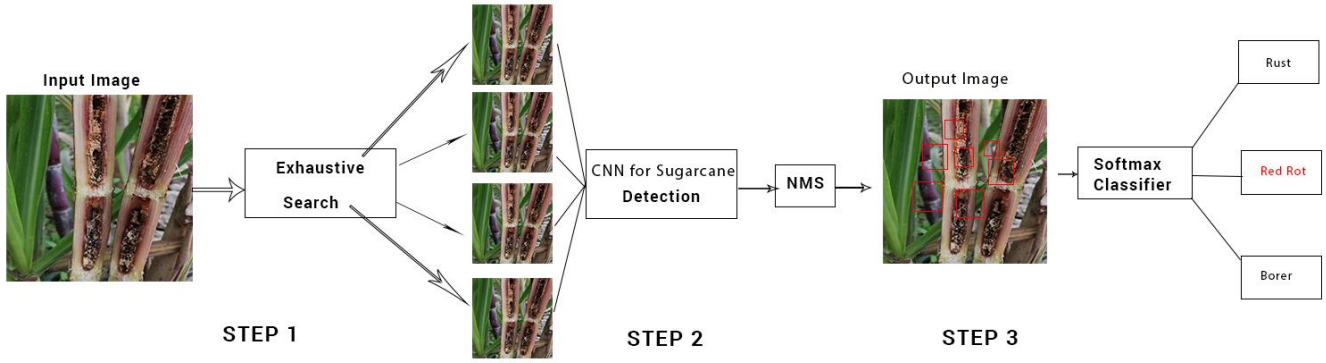

Figure 3.4.3: Overall Testing Process

of Machine learning and Deep learning tells us to quantify how good or bad a given classification terms is at exactly classify data points in our data set.

3.5 Implementation Requirements

For implementation we need to follow some instructions. First we need the platform where the code is done perfectly. The platform is google colaboratory. Then maintain all data set and library. For processing the data to train and test we need preprocessing and labeling, Augmentation, Neural Network training, testing. After that provide a minimal time for orientation and control, variable length subnet, low level protocol support, tasking support, creating a data model for accurate prediction which require deep knowledge on various algorithm.

CHAPTER 4

EXPERIMENTAL RESULTS AND DISCUSSION

4.1 EXPERIMENTAL SETUP

The dataset builds up about 2200 images involving 5 exclusive kinds of sugarcane stem and leaf diseases, a neural network application program interface (API) written in Python used to be utilized for the CNN model application. All the image dataset was used for training and testing images that was taken from the sugarcane land field. Data augmentation techniques were integrated into the application to enhance the image dataset by rotating the images to 25 degrees, flipping and shifting of images horizontally and vertically. Adam optimizer is incorporated using a categorical cross-entropy. The model trained 60 epochs using a batch size of 10. All the experimentations were performed on intel(R) Core(TM) i7-8700k processor and memory size of 16GB.

TABLE 4.1.1: DISTRIBUTION OF IMAGES INTO DIFFERENT CLASSES

S.No	Class	Count
1	Red Rot Diseases	924
2	Sugarcane Borer Diseases	365
3	Rust Diseases	153
4	Wilt Diseases	227
5	Healthy Images	85

4.2 Experimental Results & Analysis

We carried out the evaluation of this classification mannequin by using 9 comparison metrics. Samples of infected sugarcane plant and healthy sugarcane plant are designated as the Infected and the Healthy class respectively. Here,

- True Positive (TP): Accurately detected i.e. Infected sugarcane classified as Infected class.
- False Positive (FP): Inaccurately detected i.e. Healthy sugarcane is classified as Infected class.
- True Negative (TN): Accurately rejected i.e. Healthy sugarcane is classified as Healthy class.
- False Negative (FN): Inaccurately rejected i.e. Infected sugarcane is classified as Healthy class.

Evaluation metrics are given here:

- Accuracy = (TP + TN) / (TP + FN + FP+ TN)
- Sensitivity = TP / (TP + FN)
- Specificity = TN / (TN + FP)
- Precision = TP / (TP + FP)
- Negative Predictive Value = TN / (TN + FN)
- False Positive Rate = FP / (FP + TN)
- False Negative Rate = FN / (FN + TP)
- Error Rate = (FP + FN) / (TP + FN + FP+ TN)
- F1-Score = (2 * (Precision * Sensitivity)) / (Precision + Sensitivity)

The effects represented in this element are associated to training with the total database containing each authentic and augmented image. As it is acknowledged that convolutional networks are capable to analyze aspects when skilled on large datasets, outcomes carried out when skilled with solely authentic pictures will no longer be explored. We put into effect deep learning approach which is Convolutional Neural Network for attention sugarcane disorder. We have trained DCNN model for learning for that machine can easily detect all sugarcane disorder. The python kears library also executed to complete the classification data.

Table 4.2.1 shows the confusion matrix of DCNN, DCNN predicts the true positive (TP) 0f 1912, True negative (TN) of 112, False positive (FP) of 100 and False negative (FN) of 76.

TABLE 4.2.1 CONFUSION MATRIX OF CNN

Deep Convolutional Neural Network (DCNN)			
Sugarcane Diseases		**Predicted Class**	
		Healthy	**Infected**
Actual Class	**Healthy**	112 (True Negative)	100 (False Positive)
	Infected	76 (False Negative)	1912 (True Positive)

Accuracy = (True Positive + True Negative)/ Actual number of samples

So the Accuracy of this model (1912+112)/2200 = 0.92*100 = 92%

Error rate is = 100- Accuracy

=100 – 92 = 8%

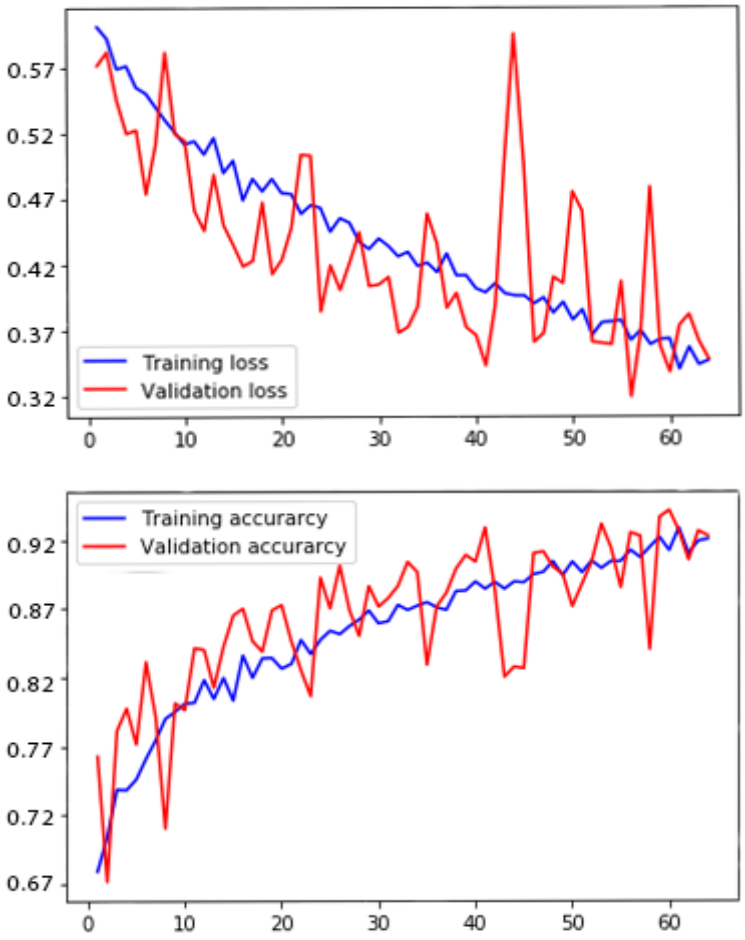

Figure 4.2.2: Overall Process Graph

From figure 4.2.2 we can see the Training Accuracy, Validation Accuracy and Training Loss, Valadon Loss.

4.3 Discussion

From the above figure 4.2.2 we see overall process graph. In this chapter we experimentally setup all the images with different class. Then rotating for enhancing the images to 25 degrees, flipping, shifting of image horizontally and vertically. The model train 60 epochs using a batch size of 10. All experiment is completed by Deep Convolutional Neural Network with confusion

matrix. In confusion matrix we calculate the accuracy and error rate. Confusion matrix table 4.2.1 given above. From figure 4.2.2 we can see the training accuracy is nearby validation accuracy. So we can say it is better training accuracy by apply this method. A 92% accuracy rate was accomplished using 60 epochs during the training model. We said that it is better result. If we get below than 60% accuracy that cannot be a proper solution. When testing random images of sugarcane plants diseases, the recognition of plots of train and test accuracy is described in figure 4.2.2. we can also see the graph training loss and validation loss graph where training loss is reducing slowly. Training loss and validation loss is given above it also get by 60 epochs. After over all process that easily calculate the error rate from accuracy where error rate is 8% that is a better outcome. Finally, over all process we can say we get a better result and better accuracy by Convolutional Neural Network.

CHAPTER 5

IMPACT ON SOCIETY, ENVIRONMENT AND SUSTAINABILITY

5.1 Impact on Society

In this research we implement how to recognition sugarcane crops diseases by Convolutional Neural Network. But question is how it impact on society or how does it work. After implementation this research it try to apply society. If it gives a good or better solution, then it impacts on society. If we reduce recognition sugarcane crops diseases with this method then farmer easily detect those diseases and takes a step for control this if they previously know about those diseases. Sugarcane is a vital crop in our country. Every year lot of sugarcane are import in our country from another country for our demand because our country sugarcane cannot full fill our demand. But if we cultivate more sugarcane crops without any disorder and lot of sugarcane are not destroy then we easily handle it. From this method we easily detect the disease and through a better solution then farmers can easily control the it. If farmers are easily understanding how to apply this, then they cultivate lot of sugarcane crops and earn lot of money. For this reason, government no need to import and also they save lot of currency. So all these are great impact on our society.

5.2 Impact on Environment

From this method to recognition sugarcane disease is also a good impact on Environment. This overview summarizes previous part that has evaluated the direct environmental influences using empirical dimension or modeling and the lifestyles cycle environmental influences of sugarcane growing practices the use of Deep learning [11]. If increase the sugarcane cultivation applies this method, it impacts on environment in two ways. One is good impact on environment and another is harm impact on environment. If sugarcane cultivation increase then farmer will be happy and export another country then our country will be proud, it will change the environment. After detect diseases if they want to remove those diseases, they use lot of chemicals and fertilizer. For

this reason, our environment was polluted. Many mills and factories start for collect lot of sugar which is harm on environment.

5.3 Ethical Aspects

Every year lot of sugarcane is import in our country from another country for our demand because our country sugarcane cannot full fill our demand. But if we cultivate more sugarcane crops without any disorder and lot of sugarcane are not destroy then we easily handle it. From this method we easily detect the disease and through a better solution then farmers can easily control it. If farmers easily understand how to apply this, then they cultivate lot of sugarcane crops and earn lot of money. For this reason, government no need to import and also they save lot of currency.

5.4 Sustainability Plan

Deep learning has been compact in many applications such as crop variety detection and classification plant identification and classification. By convolutional neural networks sugarcane images are trained and test and give an accuracy and error rate. The trained model acquired it motive by detecting and classifying sugarcane images into healthy and infected of sugarcane plants. Therefore, this research provides a step of helping farmers with the process of deep learning algorithm in detecting and classifying sugarcane diseases. After applying this algorithm any farmer can easily scope this problem and this algorithm gives a better solution. For this purpose sugarcane crops are cultivated more and more which is help for the farmer.

CHAPTER 6

SUMMARY, CONCLUSION, RECOMMENDATION AND IMPLICATION FOR FUTURE RESEARCH

6.1 Summary of the Study

This research paper carried out deep learning by Convolutional Neural Network(DCNN) to discover and classify whether or not the sugarcane leaf and steam are diseased or healthy. The structure used an easy convolutional neural community with six special instructions to classify the sugarcane leaf and the attained accuracy is 92% and error rate is 8%. The trained model has done its intention with the aid of efficiently detecting and classifying sugarcane photos into healthful and diseased class primarily based on the sample of leaves and steams. Therefore, this learn about presents a concept of supporting farmers the use of pc imaginative and prescient and desktop mastering in detecting and classifying sugarcane diseases. For future work, distinct fashions may additionally be carried out to decide the overall performance of the mannequin on the training set. Different mastering quotes and optimizers might also additionally make use of for experimenting with the proposed models.

6.2 Conclusions

Sugarcane is a very important crop for the economy of Bangladesh. It has played a vital role in our economy. The human beings round the world count on the agricultural region as one of the most essential sectors the place sugarcane plants are the primary want for food. Early focus and detection of these ailments are integral to the agricultural industry. This research has accomplished its intention to discover and recognize sugarcane plant sorts and plant ailments the usage of convolutional neural network. The training model can be used to check real-time photos to notice and apprehend plant diseases. For the future work, extra plant sorts and exceptional kinds of plant illnesses might also be blanketed in the current dataset to enlarge the skilled models. Other CNN architectures can also additionally use specific gaining knowledge of quotes

and optimizers for experimenting the overall performance and accuracy of the model. With the finished accuracy of 92% and the error rate is 8%, the proposed mannequin can help farmers to observe and apprehend Sugarcane crop diseases.

6.3 Implication for Further Study

In Future we have to implement a mobile application computerized device on the foundation of our lookup that become aware of disorder of the sugarcane leaves and stems and supply the records about this disease. Artificial neural community (ANN) that we can without difficulty applied on Android phones, successful of detecting plant lesion elements that has been presented The size results in the detecting of the quantity of spots and their vicinity on plant leaves effects accuracy greater than 92%.We have future diagram to put in force our machine for actual existence software in the rural areas so that the humans of our united states get benefitted from our lookup and it will assist them in Sugarcane crops cultivation numerously.

In future work the shade characteristic of the identified spots will moreover be taken into consideration for immune plant sickness evaluation and the added algorithm will be carried out on clever telephones and examined under outside conditions. In future we additionally improve each English Bangla language diagram and voice navigation utility system. We additionally would like to improve our gadget an excessive stage the place it can realize all the possible jute illnesses and others that our farmers face in the cultivation period.

REFERENCES

[1] Sugarcane in Bangladesh, available at << http://en.banglapedia.org/index.php?title=Sugarcane >> last accessed on June 20, 2020.

[2] Sammy V. Militante, Bobby D. Gerardo, Ruji M. Medina, "Sugarcane Disease Recognition using Deep Learning", Published 2019 Computer Science 2019 IEEE Eurasia Conference on IOT, Communication and Engineering (ECICE)

[3] Bacterial foraging optimization based Radial Basis Function Neural Network (BRBFNN) for identification and classification of plant leaf diseases: An automatic approach towards Plant Pathology published in 2018 by Siddharth Singh Chouhan et al from page 2

[4] Sugarcane diseases & their management, available at << http://agropedia.iitk.ac.in/content/sugarcane-diseases-their-management >> >> last accessed on June 21, 2020.

[5] J.Howse,OpenCV ComputerVision with Python, PacktPublishing, Birmingham, UK, 2013.

[6] D. M. Hawkins, "The problem of over-fitting," Journal of Chemical Information and Computer Sciences, vol. 44, no. 1, pp. 1–12, 2004.

[7] C. C. Stearns and K. Kannappan, "Method for 2-D affine transformation of images," US Patent No. 5,475,803, 1995.

[8] C. Ciresan Dan, U. Meier, J. Masci, L. M. Gambardella, and J. Schmidhuber, "Flexible, high performance convolutional neural networks for image classification," in Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI '11), vol. 22, no. 1, pp. 1237–1242, 2011.

[9] A. K. Reyes, J. C. Caicedo, and J. E. Camargo, "Fine-tuning deep convolutional networks for plant recognition," in Proceedings of the Working Notes of CLEF 2015 Conference, 2015, http://ceur-ws.org/Vol-1391/121-CR.pdf.

[10] A. Krizhevsky, I. Sutskever, and G. E. Hinton, ImageNet Classification with Deep Convolutional Neural Networks, Advances in Neural Information Processing Systems, 2012

[11] Alison Collier, Mark Poggio, Eamon Holligan, "The impact of sugarcane growing practices on farm profitability and the environment – a literature review" Submitted to Sugar Research Australia (SRA) as part of SRA Project 2014/15

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