ONION DISEASE PREDICTION USING DEEP LEARNING

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

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APPROVAL

This Project titled "**ONION DISEASE DETECTION & POSSIBLE TREATMENT**", submitted by Farjana Yesmin, ID No: 171-15-10050 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 02.05.2021

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ABSTRACT

Now a days in Bangladesh, onion disease is one of the most serious agricultural problems. As a result, most people in our country value onion care. While recent advances in computer vision have made object detection from images much easier, automatically classifying onions with computer vision remains a difficult task due to similarities between different types and factors such as their location (e.g., stacked) or lighting conditions. A framework for classifying onion diseases can be useful in a variety of fields, including autonomous agricultural robotics and the development of mobile applications for detecting specific onion diseases on the market. We tested two different models for fruit detection that used deep convolutional neural network (DCCN) techniques in this paper, and based on our training results, we proposed an efficient model. Dense-net-201 and AlexNet were used to train with endemic Bangladeshi fruits. Images of onion diseases from six different disease classes were included in our dataset. The dataset was split into two parts: 80% for training and 20% for research. For easier preparation, the training dataset was augmented and expanded. With our own dataset, we achieved a high accuracy rate of 93.83 % with the AlexNet model.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

Onions (Allium cepa) are harvested as dry bulbs that are ingested raw or medium. In certain countries, e.g., Bangladesh, they will be cut once young to be used in salads [1]. Typically the expansion of onion is cut by its illness, which hampers our daily market and consumption. The event of onion depends on temperature, tropical and sub-tropical regions of the planet. In our country, the assembly of onion decreases for several reasons. It's usually attacked by viruses and its treatment is incredibly required. A variety of diseases and disorders have an effect on onions and connected crops in onion. Most diseases are caused by fungi or microorganism, whereas infections are also caused by adverse weather, air pollutants, soil conditions, organic process imbalances, and blighter management merchandise. Typically many diseases and disorders will be a gift at a similar time.

"Gradual advancements in Convectional Networks over the years have resulted in significant contributions to the field of image recognition. Deep Neural Networks outperform all other techniques and algorithms for identifying, classifying, and fully differentiating between different types of fruits. However, onion classification is problematic for a variety of reasons, including a disease's form, color, and texture being identical to an analogous group." [21]. With our dataset, 2 deep learning model are evaluated that gave satisfactory results.

This project aims to predict onion disease so that people came to know which treatment may prevent onion disease. And to find these criteria, we take the help of deep learning to predict which is more dangerous and which one should we emphasize most to prevent onion disease.

1.2 Motivation

Onions are needed in our daily life as a vegetable consumption. The cost of onion in our market when are in low production by diseases. Onion diseases are very complex. Collecting data and work on it is very much enjoyable, we feel. We agreed and conducted research to see whether we could develop an expert system to assist specialists and farmers in diagnosing and treating various onion diseases. As the rate of disease is very high in Bangladesh, we want to work with it and find the reason and the outcome. So that, we can make conscious about the danger of disease which may affect their body in the long run. So, we started to research this topic called "Onion disease detection & possible treatment." There was also some work on this area before, but our context is different from then, and the result outcome percentage is very high. Hence, they need experts with deep knowledge of onion diseases. If we can control these diseases and give solutions to the farmers easily, then common production problems should be decreased.

1.3 Rationale of the Study

The objective is the detection of onion disease and gives possible solutions to the farmers. In Bangladesh, research on rapid preparation of compost using Trichoderma and value addition of compost with mixing Trichoderma and other agents before field application was not adequate. Considering the facts mentioned above, the aims of the current study for developing technology smartphones reach the rural area, and nowadays, farmers are also using a smartphone. Deep learning is used for cancer prediction [2], a systemic review of software fault prediction [3], dermatological disease detection [4], and so on. Many types of detection and risk prediction are now conducting by using machine learning. As machine learning has a vast field of work, we thought we should apply machine learning for our prediction work.

1.4 Research Questions

In this section, there are a few focuses given that focuses were our main expected result. The expected result of this inquiry about the research-based project is detecting the early stage and the reason for the diseases.

- Detecting diseases
- Providing possible treatment
- Providing direction how to control

We hope our research will help people to predict. By using this technique, Farmers can easily and quickly know the risk of Onion disease. They can also know more about prediction with Design mobile apps. Successful deployment of existing or new app algorithms for predicting onion disease.

1.5 Report Layout

This paper contains the subsequent contents as given below:

Chapter 1: explains the introduction of the analysis with its reference to study, motivation, and outcomes.

Chapter 2: discusses work, analysis outline, the scope of issues, and challenges.

Chapter 3: contains the progress of this analysis, the procedure of information assortment, feature implementation, and applied math analysis.

Chapter 4: covers experimental analysis and a few relevant discussions, the result of analysis via numerically and diagrammatically.

Chapter 5: covers this research's impact on society with the limitation and future work.

CHAPTER 2
BACKGROUND STUDY

2.1 Introduction

We will discuss in this section the research summary, related works, the scope of the problem, and challenges. We study more and more about Onion disease prediction before starting this research. We also study about solution of onion diseases, the necessity of onion disease prediction in Bangladesh. Try to analyze the existing system, many marketing values. To solve this problem, we analyze challenges. For the cultivated fresh onion, the disease prediction system is more important. In the related work, we summarize some underlying methods, related works, research papers, classifiers, and accuracy related to our work. In the research summary part, we prepare a summary of some related works and display them in a better and easier table. The scope of the problem part discusses how we can contribute to the problem with our work model. Finally, the Challenges part contains some words about the obstacles and dangers we encountered during this research work.

2.2 Related Works

This chapter will introduce some related work done by researchers in disease prediction. In this section, we will explore and elaborate on different processes and methods. Dhiraj Dahiwade and so on. [6] proposed a general disease prediction system based on machine learning algorithms. They proposed disease prediction based on the patient's syndrome. They used evidence of this disease in the data set. They collected a person's living habits and checked the data of the forecasting system. They remove commas, punctuation, and whitespace from the fascinating data and use it as a training data set. The patient disease data set downloaded from the ICU machine learning website. They used KNN and CNN algorithms. In KNN (Euclidean distance), Hamming distance is used as a general distance metric. In CNN, data integration is the carrier of its realization. The maximum grouping operation performed during the convolution stage of the CNN. KNN took longer than CNN. They compared two algorithms based on accuracy and time and found that the accuracy of CNN is 84.5%, which is higher than that of KNN. They use Java to implement the case, and the backend uses MySQL. Hiba Asri proposed machine learning as a model for predicting and diagnosing breast cancer risk in [7]. In his article, Support Vector Machine (SVM), Decision Tree (C4.5), Naive Bayes (NB) and k Neighbors (k-NN). The main purpose is to evaluate the accuracy of data classification based on the effectiveness and efficiency of each algorithm in terms of specificity, sensitivity, accuracy and accuracy. Tarek Habib et al. [8] Analyzed the recognition of papaya disease based on machine learning classification technology. They used color images of defective papaya. They convert all images to 300 x 300 pixels. Bicubic interpolation and histogram equalization are used for image processing. They used a total of 129 defective and non-defective images on the model. They divided the data set into two parts, two thirds as the training data set, and one third as the test data set. They used various machine learning classifiers. These techniques include SVM, Random Forest, BPN, CPN, RIPPER, C4.5, Logistic Regression, Naive Bayes and KNN. Among these techniques, SVM works best. Among all classifiers, SVM yielded 95.2% accuracy. Lee Jae-Hong Leea, Do-Hyung Kima, Seong-Nyum Jeonga, Chong-Ho Choib [9] proposed a deep learning-based convolutional neural network algorithm to identify and evaluate the model of onions. Their goal is to use deep CNN, which is very useful in medical research. In the fields of radiology and pathology, they found impressive diagnostic and predictive results. They analyzed 3000 root apex radiographs and divided them into training and validation data sets (n = 2400 [80%]) and test data sets (n = 600 [20%]). The diagnostic accuracy, sensitivity, specificity, positive predictive value, negative predictive value, receptor operating characteristic curve (ROC) and area under the curve (AUC) of the deep CNN algorithm are determined to evaluate its detection and diagnosis performance. Yang lutecium et al. [10] investigated rice disease and the diagnostic accuracy of premolars and molars were 89.0% (80.4 to 93.3), 88.0% (79.2 to 93.1) and 82.0% (75.5 to 87.1), respectively. The identification was based on CNN, and they proposed a unique identification technology for rice diseases. Using 500 images of healthy and diseased rice leaves and stems captured in experimental rice fields, CNN was used to identify the top ten rice diseases. Liu Bin et al. [11] proposed a model for detecting apple leaf disease. This work proposes a method to correctly isolate apple leaf disease supported by a deep convolutional neural network. The expected deep convolutional neural network model is trained on a dataset of 13,689 pathological apple leaf images to detect four common apple leaf diseases. The experimental results show that the overall accuracy of the predictive disease recognition method assisted by the convolutional neural network is 97.62%. Compared with the standard AlexNet model, the model parameters are reduced by 51,206,928, so the accuracy of the prediction model is increased. Konstantinos P. Ferentinos [12] proposed a model based on deep learning to detect and identify diseases. Through deep learning methods, a convolutional neural network model is established in this article to perform disease detection and recognition in simple leaf images of healthy and pathological plants. The model was trained using open data collection containing 87,848 images, which contained 25 completely different plants and healthy plants in 58 different combinations (plants, diseases). Mohammed Brahimi, Kamel Boukhalfa and Abdelouahab Moussaoui [13] proposed a deep learning model for tomato disease. Compared with existing technologies, they need to use massive data sets. The data set includes 14,828 tomato leaf images contaminated with 9 diseases. One of the most important advantages of CNN is to automatically extract options by directly processing the original image. The results obtained are encouraging, reaching 99.18%, which shows that our model is significantly better than the shallow model, and it will be used as a useful tool for farmers to protect tomatoes from diseases. Wan-Soo Kim [14] conducted a study on automatic onion pseudomold symptom recognition based on machine vision. This article introduces an image-based field observation system for mechanical observation of crops. The system includes the construction of a field observation system to detect disease symptoms and evaluate the results of the developed system. The image work module includes a departmental observation system. The deep learning model only recognizes and locates objects based on image-level annotations. It is successful to identify the symptoms of crop diseases with unknown boundaries. The observed disease symptoms are distinguished from the background by the threshold of the group activation map. Calculate the hour with the highest value in the school activation table as the optimal threshold for the location of the disease symptom. Through promissory notes, the output of disease symptom recognition was evaluated using the victimization metric mAP. The results show that in the 0.5 promissory note standard, there should be more than 500 overlapping mAPs, which is the best overall model from 74.1 to 87.2.

2.3 Comparative Analysis and Summary

Some work has already done about prediction and detection with the machine learning algorithm and data mining process. Nowadays, the use of machine learning technology has increased with the use of various disease detection. Using the system the work and the process can be fully optimize and the output data function provides a clear result that result can justify the disease very quickly and also the main reason is working capacity. The full function period of using this technology was so promising and comparable. The prediction and detection subject are clearly mentioned so In this section, related works comparison is shown. Here for comparison, subject, methodology, and the outcome of works (refer Table 2.1 *page-8*)

TABLE 2.1: RELATED RESEARCH WORK SUMMARY

SL	Author name	Description	Methodology	Outcome
1	Dhiraj Dahiwade, Prof. Ektaa Meshram Prof. Gajanan Patle,	Machine learning-based general disease prediction system.	K-nearest neighbours (KNN), CNN.	84.5% accuracy in CNN.
2	Hiba Asria, Hajar Mousannif, Thomas Noeld, Hassan Al Moatassime,	Using Machine Learning Algorithms for Breast Cancer Risk Prediction and Diagnosis	Support Vector Machine(SVM), Decision Tree (C4.5), Naive Bayes(NB) and k Nearest Neighbors(k-NN)	SVM gives the highest accuracy (97.13%).
3	Md. Tarek Habib, Mohammad Shorif Uddin, Farruk Ahmed, Anup Majumder and Rabindra Nath Nandi.	Papaya disease recognition based on a machine learning classification technique	SVM, C4.5, naïve bayes, logistic regression, KNN, random forest, BPN, CPN and RIPPER.	SVM got 95.2% accuracy.

4	Jae-Hong Leea, Do-Hyung Kima, Seong-Ho Choib, Seong-Nyum Jeonga.	Detection and diagnosis of ONION caries using a deep learning-based neural network algorithm	Deep CNN Algorithm	premolar model provided the best AUC with 91.7%
5	Wan-Soo Kim, Yong-Joo Kim, Dae-Hyun Lee,	Machine vision-based automatic disease symptom detection of onion downy mildew	Machine Vision.	mAP at an IoU criteria of 0.5 in the range of 74.1 to 87.2.
6	Mohammed Brahimi, Kamel Boukhalfa & Abdelouahab Moussaoui	Deep Learning for Tomato Diseases: Classification and Symptoms Visualization	Convolutional Neural Network (CNN).	99.18% of accuracy.
7	Konstantinos P. Ferentinos	Deep learning models for plant disease detection and diagnosis	VGG, AlexNet	99.53% success rate.

8	Yang Lua,b, Shujuan Yi a, Nianyin Zengc, Yurong Liud,e, Yong Zhang	Identification of rice diseases using deep convolutional neural networks	deep convolutional neural networks (CNNs)	95.48%.
9	Bin Liu, Yuxiang Li, and Yun Zhang Dong Jian He	Identification of Apple Leaf Diseases Based on Deep Convolutional Neural Networks	convolutional neural network (CNN)	accuracy of 97.62%

Currently, a combination of deep learning, machine learning and artificial intelligence is being explored with new technologies that are used in any kind of prediction and detection model. Diagnosis and detection of material are being made recently using various machine learning algorithms. AlexNet, Dense-net, VGG-16, Inception v3, and many algorithms are popular for any detection model. We can see that the CNN algorithm's popularity and effectiveness for prediction or detection models are high from previous research. In our research, we have tried to implement AlexNet and other algorithms to predict the onion disease in Bangladesh's perspective and we have 93.83% accuracy in AlexNet.

2.4 Scope of the project

This project is helping to create a model that can predict onion disease by analyzing data and using deep learning algorithms. This model will help us to predict the causes of onion and thus, it will be helpful for society to that issues. In our society, even people have some knowledge about the causes of onion disease, but they are not aware of the fact that which action is more responsible for this. So, this model is solely working on finding the causes that can lead to agricultural problems. Using artificial intelligence and machine learning, we are creating a model that will tell us which habitant is harming most. And that is the reason we thought about creating a model that can predict onion diseases.

2.5 Challenges

While doing our research, we are facing some problems. Data collection was very challenging for us. Due to this Covid-19 pandemic, we hardly manage our data set. We read a lot of newspapers and talked to different people, talking to people in the neighbourhood, but nobody was going to give any information about their onion disease people. It was very difficult to collect information about the disease from our village, markets and unknown places. We were also not familiar with Anaconda, Jupiter notebook, and some new machine learning algorithms. It took us a while to know and learn about it at first, but with the help of our supervisor and doing more practice we can grab them easily. Then we continue to do our job very well and with enthusiasm.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

The research methodology is the primary component of an investigation project's work. As a result of the methodology, an investigation project is able to progress step by step and achieve perfection. Additionally, it is possible to discover new ideas with the right technique and creativity. Additionally, we worked on the onion disease data-set using a variety of procedures. It involves information assortment, knowledge prepossessing, knowledge Augmentation, Train Model (AlexNet and Dense-net is that the name of a CNN architecture), Model analysis.

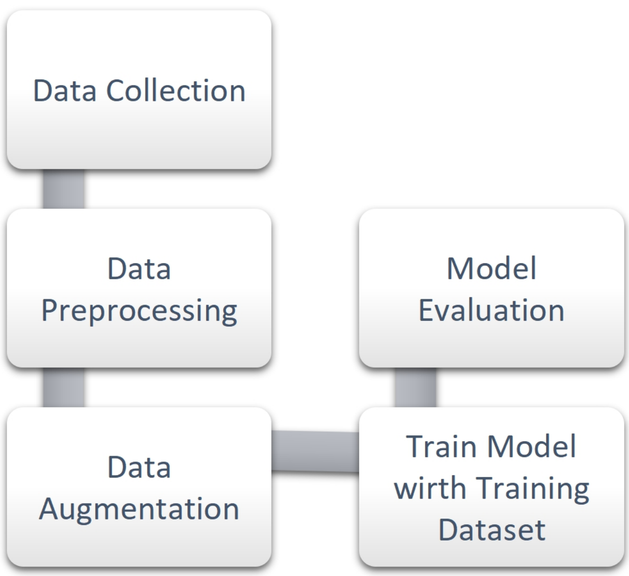

Figure 3.1.1: Work Flow Diagram of Onion disease recognition System

3.1.1 Data Collection:

In this research, we recognized onion disease from images. Due to the covid-19 pandemic, we couldn't take pictures of onion disease so we have to collect the images from a different site in google and collected 6 categories of onion disease image (bacterial soft rot[15], downy mildew[16], purple blotch[17], botrytis leaf bligh[22], neck rot[18] and onion smut[19]) from different sites.

TABLE 3.1.1: DATA SAMPLES

Disease Name	Picture	No. of images
Botrytis Leaf Blight		**30**
Purple Blotch		**50**
Downy Mildew		**43**
Neck Rot		**27**
Bacterial Soft Rot		**35**
Onion Smut		**36**

Because of the pandemic situation and the limited onion disease, images were unavailable on google.

3.1.2 Data Prepossessing:

Data in a dataset is dissipated, making it difficult to obtain precise results. For this purpose, data preprocessing is critical. This dataset has been balanced to get real precision and achieve better execution by balancing different boundaries.

3.1.3 Data Augmentation:

Data expansion is a system that employs specialists to simply fabricate the various assortment of information available for getting ready models without actually assembling new data. We used data enlargement techniques such as zoom, shear, flip, move, and splendour.

3.1.4 Training dataset Train Model:

We chose five different CNN models and train them on our 3000-image training dataet. AlexNet is the model we used.

3.1.5 Model evaluation:

Evaluation of a model is a critical component of developing an efficient convolutional neural network model. We used the F1-score, Confusion matrix, Recall Accuracy, Precision, and plot diagram for evaluating our model.

3.2 AlexNet Model:

The architecture consists of eight layers: five conventional layers and three completely linked layers. This, however, is not what distinguishes AlexNet; rather, the following characteristics represent novel approaches to conventional neural networks:
ReLU Nonlinearity: AlexNet makes use of Rectified Linear Units (ReLU) rather than the common tanh function at the time. The advantage of ReLU is in terms of training time; a CNN trained with ReLU achieved a 25% error rate six times faster than a CNN trained with tanh on the CIFAR-10 dataset.

Multiple GPUs: GPUs with 3 gigabytes of memory were also in use back then (nowadays, those kinds of memory would be rookie numbers). This was particularly troubling, given that the training set contained 1.2 million images. AlexNet supports multi-GPU training by placing half of the model's neurons on one GPU and the other half on a different GPU. This not only allows for a larger model to be trained but also reduces training time.

Overlapping Pooling: CNN's usually "pool" the outputs of adjacent groups of neurons that do not overlap. However, when the authors added overlap, they saw a 0.5 % in error and discovered that models with overlapping pooling are typically more difficult to overfit.

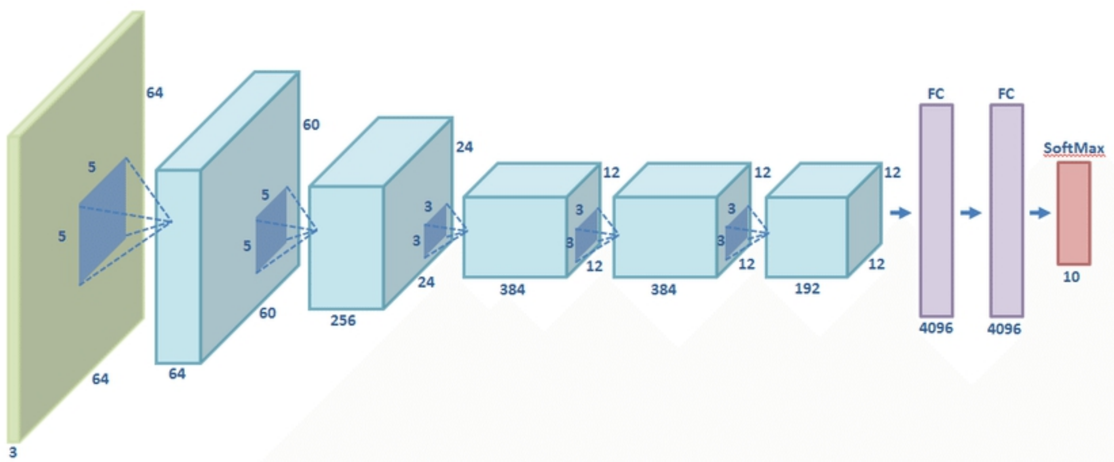

Figure 3.2.1: AlexNet architecture diagram [23]

AlexNet can also be credited with applying deep learning to adjacent fields such as natural language processing and medical image recognition, thus paving the way for the widespread availability of deep learning.

3.3 Dense Net Model:

A Dense-net is a convolutional neural network that utilizes dense connections between layers through Dense Blocks. Dense Blocks bind all layers (with corresponding feature-map sizes) directly. To retain the feed-forward structure of the algorithm, each layer receives additional inputs from preceding layers and passes its own feature maps to subsequent layers.

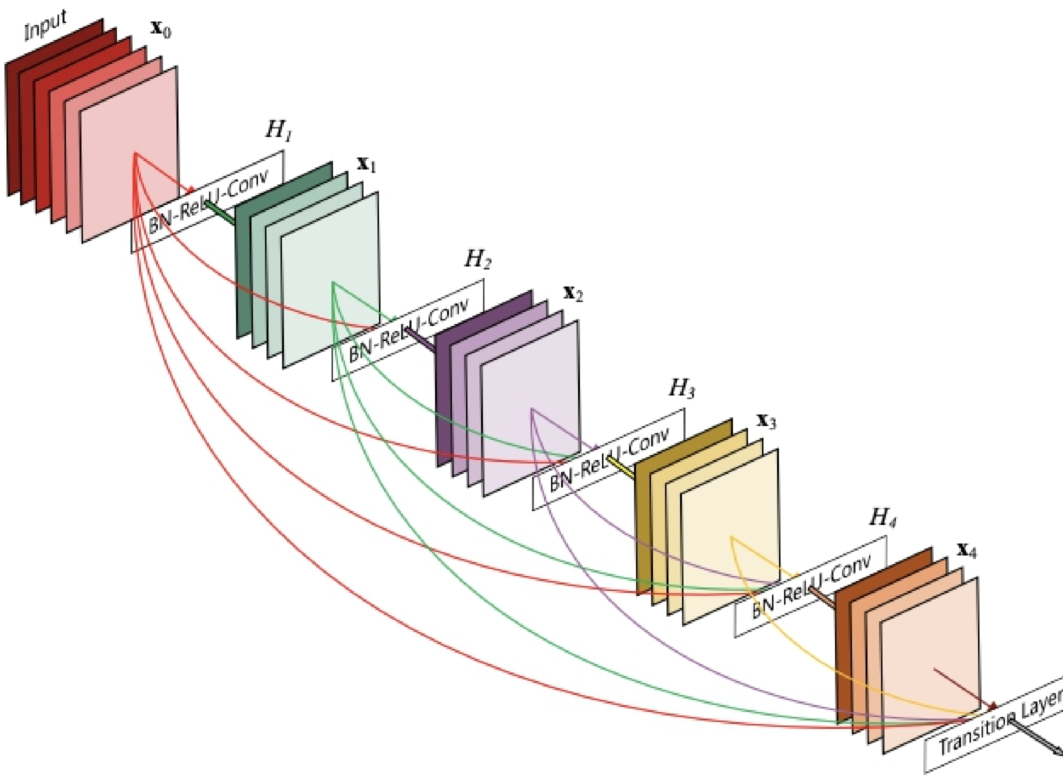

Figure 3.3.1: Dense-net architecture diagram. [24]

CHAPTER 4

RESULTS AND DISSCUSSION

4.1 Introduction

In this section summarizes the training and testing with the five DCNN models listed previously. For each model, we divided the tests into five distinct tests, which are described below. We used a total of 7271 onion files, with 5000 being used to train the models and 2271 being used for research. We supplemented our training and assessment data to improve results. Consider a study as a single row of data. The batch size is the number of samples, to begin with before changing the internal models' parameters. Epoch: An epoch is a hyper-parameter that determines how often the training model can run on the entire training dataset. Confusion Matrix: A confusion matrix is a metric used to determine the efficiency of machine learning classification models when applied to a test dataset.

4.2 Experimental Result and Analysis for AlexNet Model:

Total number of parameters: 87,671,558
Parameters those are trainable: 87,668,806
Parameters those are non-trainable: 2,752
Accuracy: 93.86%
For each number of epochs, the accuracy is specified. In this case, increasing the number of epochs reduces accuracy:

TABLE 4.2: ACCURACY RESULT FOR ALEXNET. [25]

Epoch No.	Loss	Variable loss
1/25	0.2773	0.9058
2/25	0.2416	0.9172
3/25	0.2685	0.9049

4/25	0.2106	0.9287
5/25	0.2800	0.9040
6/25	0.2482	0.9146
7/25	0.2334	0.9203
8/25	0.3136	0.8908
9/25	0.2829	0.9036
10/25	0.1969	0.9317
11/25	0.1778	0.9313
12/25	0.1918	0.9326
13/25	0.2686	0.9115
14/25	0.2262	0.9207
15/25	0.2415	0.9194
16/25	0.1696	0.9410
17/25	0.1374	0.9489
18/25	0.1997	0.9269
19/25	0.2498	0.9093
20/25	0.2215	0.9260
21/25	0.1948	0.9344
22/25	0.1966	0.9247
23/25	0.2001	0.9247
24/25	0.1835	0.9304
25/25	0.2431	0.9075

Validation Accuracy Vs Train Accuracy:

We note a smaller gap in the beginning and an increasingly larger difference as the progression continues.

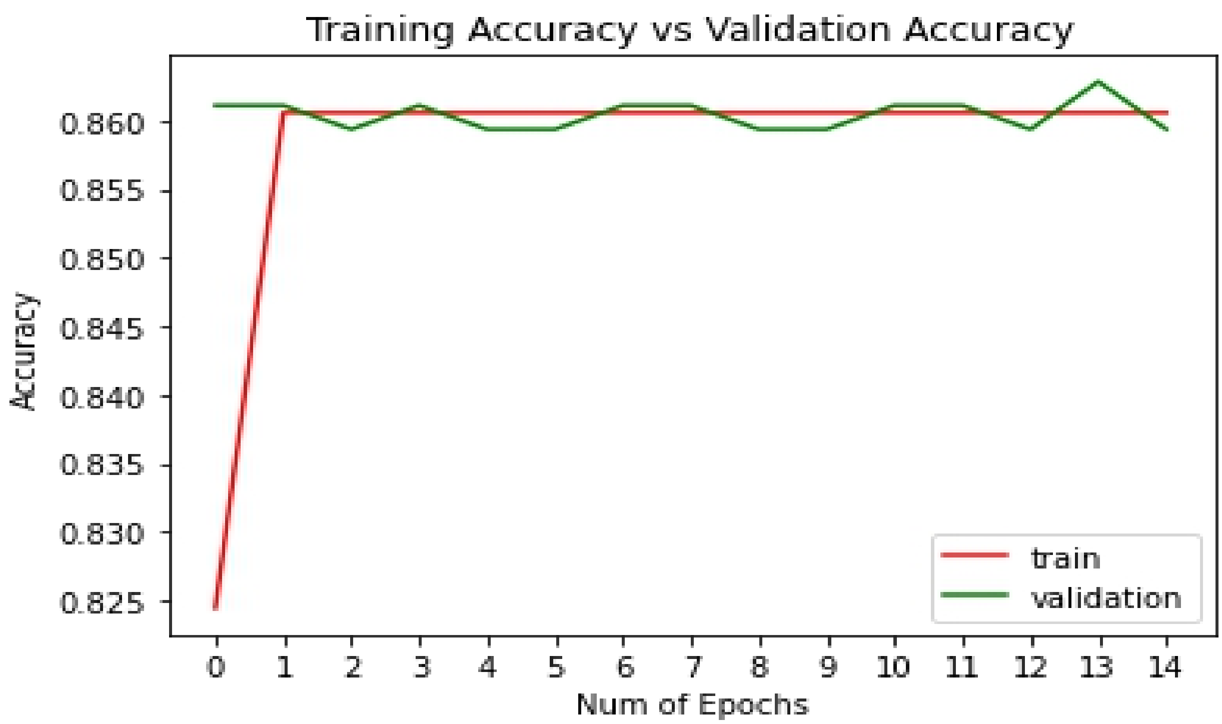

Figure 4.2.2: Validation Accuracy vs Train Accuracy for AlexNet

Validation Loss vs Train Loss for AlexNet

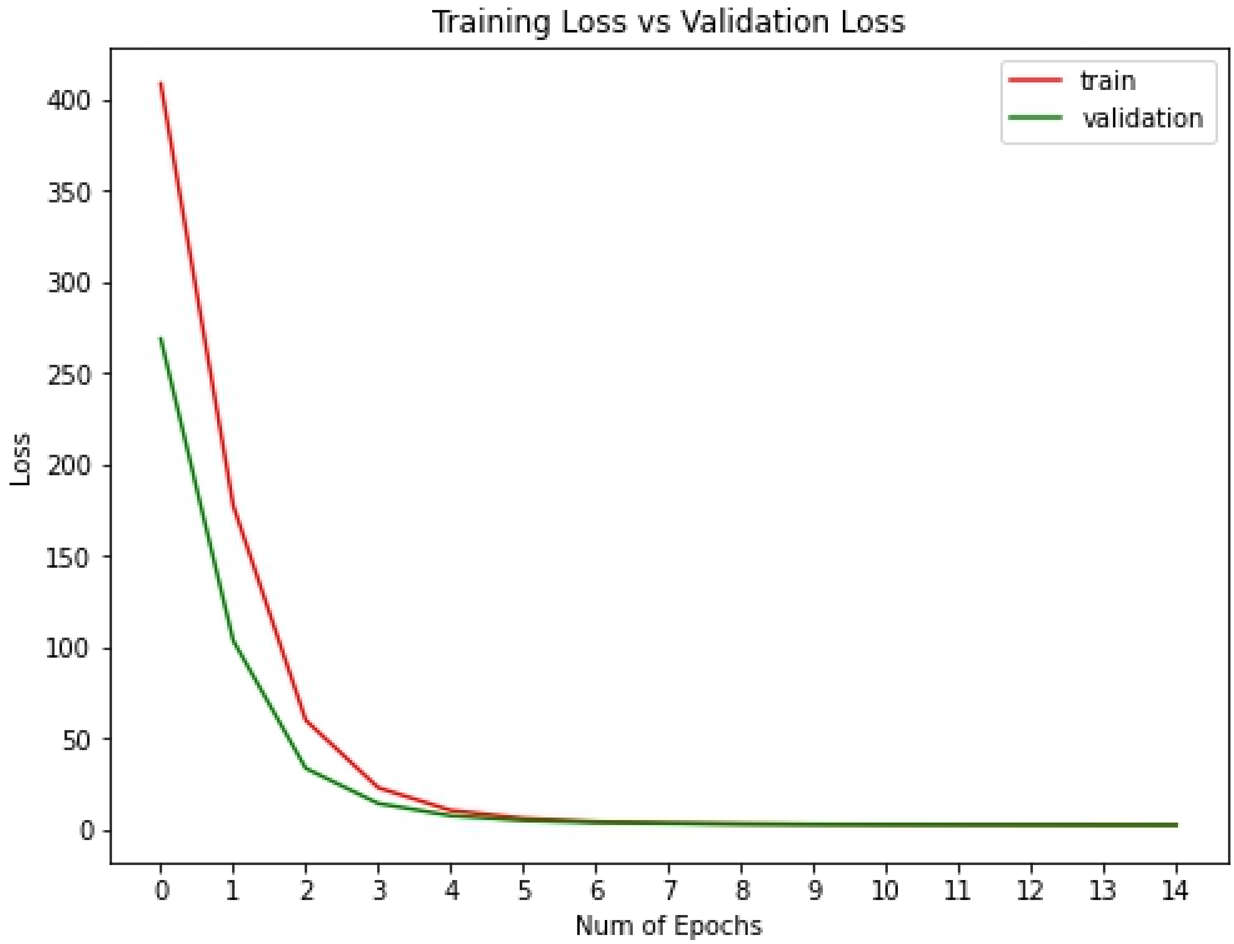

Figure 4.2.3: Validation Loss vs Train Loss for AlexNet

4.2.1 Experimental Result and Analysis for Dense NET Model:

Total number of parameters: 59,034,119.

Parameters those are trainable: 702,471.

Parameters those are non-trainable: 58,331,648

Accuracy: 86.05%

TABLE 4.2.1: Accuracy Result for Dense Net. [26]

Epoch No.	Loss	Variable loss
1/15	0.2773	0.8058
2/15	0.3416	0.8172
3/15	0.3685	0.7049
4/15	0.3106	0.8287
5/15	0.3800	0.8040
6/15	0.3482	0.7146
7/15	0.3334	0.7203
8/15	0.3136	0.7908
9/15	0.2829	0.8036
10/15	0.2969	0.8317
11/15	0.3778	0.8313
12/15	0.3918	0.8326
13/15	0.2686	0.8115
14/15	0.3262	0.8207
15/15	0.3415	0.8194

Val Accuracy Vs Train Accuracy:

A gradual reduction in the difference between the curves.

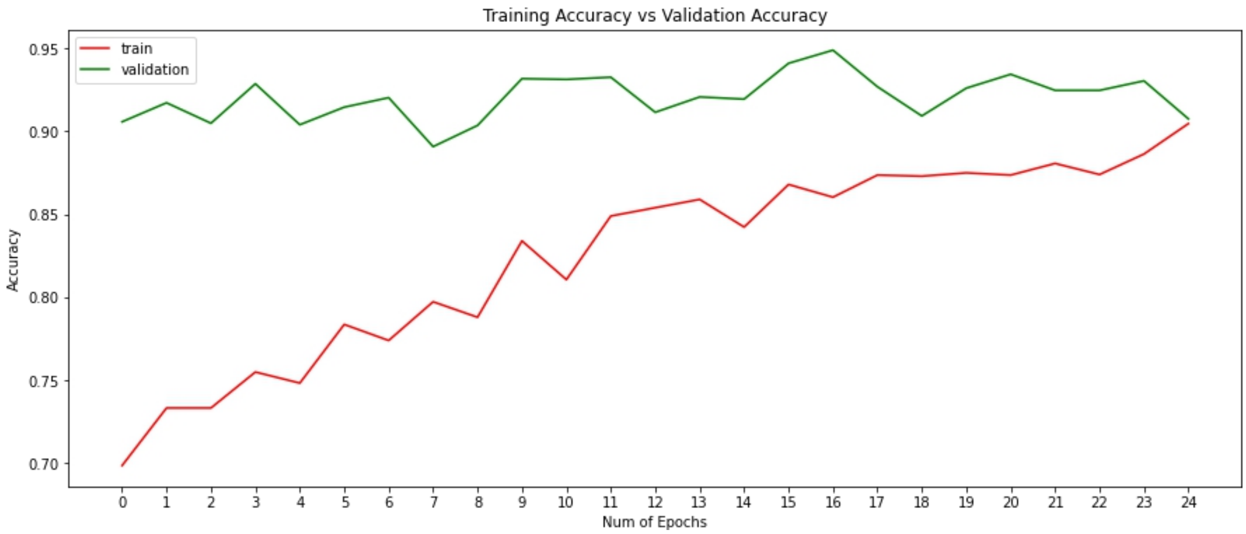

Figure 4.2.5: Validation Accuracy Vs Train Accuracy for Dense-net.

Val Loss Vs Train Loss:

Validation loss fluctuated initially but decreased as time progressed.

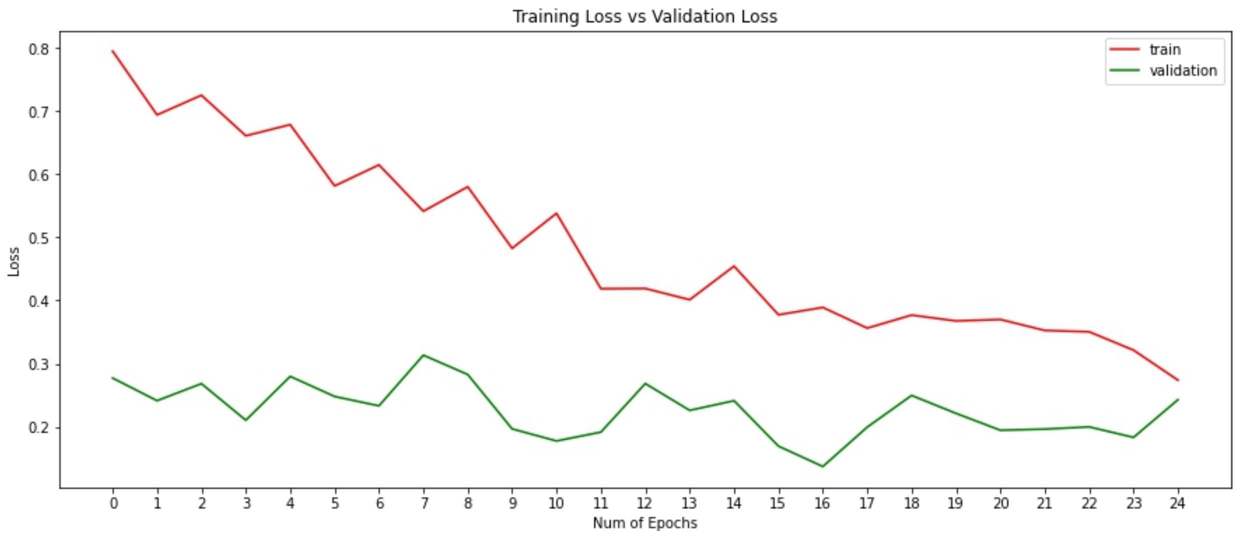

Figure 4.2.6: Validation Loss Vs Train Loss for Dense-net.

4.3 Discussion

This section reviews the performance of algorithms, accuracy, sensitivity, specificity, recall, precision, f1-score and ROC curve. Also discussed here are the equations of evolution models and their function. We can see that the AlexNet algorithm yields the highest accuracy with 93.83%. As well as this algorithm achieved 9.54% sensitivity, 99.17% specificity, 90.24% precision, 77.08% recall and 83.14% f1score. Finally, we find out that using the AlexNet algorithm, we can get the best performance on our onion disease model.

CHAPTER 5

SUMMERY, LIMITATIONS, CONCLUSION AND IMPLICATION FOR FUTURE STUDY

5.1 Summery

Our scientific research, we compared and evaluated 2 powerful deep learning models like AlexNet and Dense-net to recognize onion diseases that are unit native to our country Asian nation. We tend to conjointly mention their operating principles and applications. Among these 2 models, AlexNet deep learning model has shown its exquisite potential to recognize onion illness. We've established our own information from six totally different categories of onion illness for experimentation. Once preprocessing the information, we tend to train and tested all 2 models. Our goal was to check the potency and accuracy of all models concerning onion illness prediction**.**

5.2 Limitations and Conclusions

The main limitation of our project is we've worked solely on six different diseases. We capture of these images within the same lighting position; however, the angle was totally different. The orientation of onion disease is not fixed.

Many advanced methods could also be used for data processing, and the model could be presented beautifully using different variations in the application of algorithms.

With our proposed model, it is possible to determine the tendency of Onion disease. We hope that this model will use very quickly by ordinary people once it is fully formed andwill be able to realize the importance of this model in raising awareness. It is essential always to be vigilant to avoid the habits of Onion disease and not get affected by it.

5.3 Implication for Further Study

Nowadays, technology and modern science create our life quick and a lot of accessible. We would like to use our model within the future associate degree exceedingly|in a very} package or net application or a humanoid application to continue that data technology. The web is also employed in our country. We'll be ready to increase the accuracy of our model in the future, employing a lot of intensive info. Also, by making easy GUIs, the package created by the model will be reached to the individuals. Within the future, implementing new algorithms, adding completely different parameters, and adding a lot of options will be created simpler from the model. Within the future, strong info will be created by collecting knowledge from completely different classes of individuals consistent with the district. Besides, with the assistance of the Department of an international intelligence agency, the model will be created larger and brought forward**.**

5.4 Sustainability Plan

Our main goal for predicting onion disease is to ensure the future free from onion problems. So, the model will be of great help for the doctor working to take care of people's onion disease. This model will give them a great heads up for taking care of their patient. The survey question that we prepared to collect the data is the most common cause of people's onion disease. So, this model will always help the doctors find the causes for someone's onion problems. It will be helpful for the doctor, but for the common people, it will be the most useful way to know which food they should avoid and which way they should treat their teeth most. With the help of the model, even health care organizations will be able to aware people about the main causes for their onion disease. Also, nowadays, they tend to find solutions to their problems by using any online medium. So, they will also be able to get a proper result for their onion problems. And they will be able to avoid the food or the way of life to avoid further harming their teeth. Also, some people who feel embarrassed telling their people will also be able to find out the issues they are having and get a beneficial result from this model.

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APPENDIX

Abbreviation

SVM = Support Vector Machine.

KNN = k-nearest neighbors.

MLP = Multilayer Perception.

DNN = Deep Convolutional Neural Network

ANN = Artificial Neural Network.

Appendix: Research Reflections

We had little knowledge about machine learning and artificial intelligence detection and prediction at the beginning of this study. Our supervisor was really friendly and honest. He gave us precious advice and helped us a great deal. Throughout the research period, we have learned numerous new techniques, new knowledge, learning algorithms, and various methods. I have learned the Python programming language, Anaconda-navigator and Jupyter notebook. At first, problems with them were found, but eventually, we got to know Anaconda-navigator, Python and Jupyter notebooks. Finally, we have gained enough confidence through this research and become motivated to do more in the future.

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