

MUSHROOM CLASSIFICATION USING CONVOLUTIONAL NEURAL NETWORK: A TRANSFER LEARNING APPROACH

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Bachelor of Science in Computer Science and Engineering

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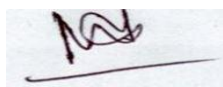
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APPROVAL

This Project/internship titled “MUSHROOM CLASSIFICATION USING CONVOLUTIONAL NEURAL NETWORK: A TRANSFER LEARNING APPROACH” submitted by Julfikar Habib, ID No: 181-15-11182, Shaswatee Sarker, ID No: 181-15-10991, Toma Rani Paul, ID No: 181-15-11179 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 2nd January 2022.

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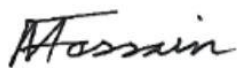
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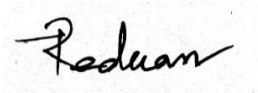
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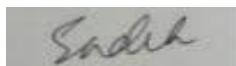
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DECLARATION

We hereby declare that; this project has been done by us under the supervision of **Md. Sadekur Rahman, Assistant Professor, Department of CSE** Daffodil International University. We 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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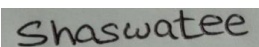


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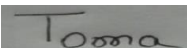
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ABSTRACT

Mushroom is a type of fungi. Nowadays it has become one of the world-wide nutrient's foods on the plant. We can cultivate mushroom for medicine, health food and for other purpose. Mushrooms are also used in medical center for killing cancer cell. The motive of this project to identify mushroom. Either it Poisonous or nonpoisonous. This project also shows how to utilize developmental calculation to do highlights determination on mushroom dataset, using Convolution Neural Network. For this paper we collect our image data from Kaggle and practically both. We are working on this paper so that we can focus to classify the wild mushroom surface element that is based on deep learning approach.

To find this we will implement here a different architecture of CNN. They are ResNet50 and VGG16. The project likewise discusses different utilizations of auto-affiliated organization and hereditary calculation. It could likewise assist mycologists with distinguishing wild mushrooms.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

These days, there are various difficulties to create framework that break down a colossal and complex information to improve choices. This review intends to observe a new methodology working to order the mushrooms pictures dependent on various elements utilizing the methods of Deep Learning. Mushrooms, the fruiting assortment of organisms, have been eaten by people for millennia. All mushrooms contain protein, fiber and the incredible cancer prevention agent selenium, yet at the same explicit types are pursued for explicit medical explicit medical advantages. At present, the mushroom alludes to the process that performed by robot in food industry. This review means to new methodology working to group the mushroom pictures dependent on various highlights utilizing the various strategies of Deep Learning. Deep depends under the umbrella of fake insight **Invalid source specified..** AI including the investigation of computational learning and example acknowledgement hypothesis in the man-made reasoning. Likewise, AI detects the light on the development of strategies that can learn and make forecasts on accessible information.

1.2 Motivation

Mushroom is a type of fungi. Nowadays it has become one of the worldwide nutritious foods on the plant. One of the problems of mushroom is to recognize which one is edible and which one is poisonous. We are consistently enormous keen on Deep Learning hence we needed to accomplish something dependent on Deep Learning. Then we plane to solve this problem using Deep Learning. This study aims to find new approach working to classify the mushrooms based on different features using the different techniques of Deep Learning.

1.3 Rationale of Study

A mushroom, or toadstool, is the plump, spore-bearing fruiting body of a parasite, ordinarily delivered over the ground, on soil, or on its food source. The greater part of us may have experienced mushrooms that are palatable to eat, which are developed for utilization these days,

yet years and years back the majority of them are wild mushrooms and individuals used to devour. Indeed, even in this day and age, we have a ton of spots, where individuals practice this culture of burning-through wild mushrooms yet there is a sufficient number of mushrooms that are noxious to eat and there are no such explicit elements that can portray edibility of mushrooms. This above issue can be addressed by utilizing Deep Learning strategies. They can discover what are the highlights that can depict the class(edible/noxious) of the mushroom.

1.4 Project Management and Finance

We don't need to go through any cash to do this venture. We don't need to purchase any product or then again equipment. Yet, for this venture we need to gather information and invest energy on information.

The measure of time spent on a movement is given in the accompanying table:

Table 1.1: Project Management Timeline

Task	Times
Data Collection	2 months
Literature Review	1 months
Experimental setup	2 months
Experiments and validations	1 months
Report and documentation	2 months
Total	8 months

1.5 Layout of the Report

In Chapter1 we have exhibited an Introduction to the Research with its Motivation, the normal of the review, research questions, outcome result.

In Chapter 2 we contain terminologies, related works, the scope of the problem, and challenges.

We are proposing methodology in Chapter 3 and also, we have data collection, statistical analysis, and implementation.

In Chapter 4 we have discussed experimental setup, experimental results & analysis and discussion.

In Chapter 5 we have discussed the impact of wild mushroom on society, the environment, Ethical Aspects and sustainability.

Finally in Chapter 6 the research summary, conclusion recommendation, and implication for future are included.

CHAPTER 2

BACKGROUND

2.1 Preliminaries/Terminologies

In the early wild mushroom was of extremely minor importance to the local area, but since of the absence of compelling advances and prior forecast, it has turned into a question of worry as it is developing progressively all over the world. But nowadays in this field we are using or applying a few methods to predict or classify wild mushroom. There are many methods like Deep Learning, Image Processing, Support Vector Machine (SVM) are utilized for the kind of wild mushroom. A few researchers are distributing their paper to carry out these methods. A significant change in large numbers of those techniques has effectively been made by numerous researchers. We use Linguistic Feature Extraction, Machine learning algorithm like Naive Bayes, Decision Tree (J48), Random Forest, LibSVM, SMO, Logistic Regression, Ad boost, Bagging, Stacking, and Multilayer Perceptron in this research.

2.2 Related Works

Many scientists use different techniques to manage wild mushroom for edible or poisonous classification or identification, but the methods are quite similar. Now I'm presenting some of them.

Nusrat Zahan, Md Zahid Hasan, Md Abdul Malek, Sanjida Sultana Reya have taken care of business for eatable, unappetizing and noxious mushroom arrangement. Consequently, significant learning approaches like InceptionV3, VGG16 and Resnet50 has been applied so they can recognize the mushrooms dependent on their classification on 8190 mushrooms pictures where the proportion of preparing and testing information was 8:2. Contrast restricted versatile histogram balance strategy has been utilized alongside InceptionV3 to acquire the most noteworthy test precision. An assessment has been evaluated between contrast-improved and without contrast-upgraded strategy.

At long last, InceptionV3 has accomplished 88.40% precision which is the most elevated among the rest executed calculations [1].

Jitdumrong Preechasuk , Fuangfar Pensiri , Orawan Chaowalit , Porawat Visutsak applied different AI calculation were utilized in this exploration .Collection and grouping were placed in this test. This work proposes one more model of requesting 45 sorts of mushrooms including consumable and harmful mushrooms by using a methodology of Convolution Neural Networks. The proposed model gives the delayed consequences of 0.78, 0.73 and 0.74 of precision, survey and F1 score, independently. It contemplated that the proposed model can organize sorts of mushroom picture with beneficially and sufficiently. In the investigation they used the dataset to describe 45 sorts of mushroom. The correct request of 45 sorts as organized ward on the name of mushroom by using the proposed model is 74.00%. The result showed high trustworthy that the proposed model can help for making a decision to pick the attractive mushroom to eat to diminish the disease and death rate due to the justification for eating the harmful mushroom [2].

Johaira U. Lidasan¹ and Martina P. Tagacay² have taken care of business for Mushroom Recognition using Neural Network is an application that joined the power of neural association with picture to take care of to see the mushroom picture reliant upon its solicitation and family and if it is consumable on the other hand it is palatable or noxious .Crafted by this multi-class portrayal program is to distinguish mushroom picture from 3 orders and 8 families described in this assessment. . The application used the Grab Cut computation for picture division and Probabilistic Neural Network (PNN) as like it is arranged that trains and groups the mushroom picture. This application used 133 mushroom pictures as its arrangement data and got an exactness pace of 92% [3].

S.K. Verma¹, M. Dutta² they involved request techniques for exploring mushroom dataset. Counterfeit Mushroom dataset is made from records of different kinds of mushrooms, which are consumable or toxic. Artificial Neural Network and Adaptive Nero Fuzzy derivation system are used for execution of the portrayal methodologies. Numerous strategies are used for portrayal like ANN, ANFIS and Naïve Bayes are utilized to arrange various mushrooms as palatable or noxious. The presentation of the different systems is surveyed using precision, MAE, kappa estimation. Many kinds of classifiers, for instance, Multilayer perceptron, Self-Organizing map, Support vector machine, decision trees, Bayes classifier, Genetic Algorithms, Neural Network, Nero fuzzy, Adaptive Nero Fuzzy Inference system, etc are used for portrayal of datasets. The Algorithm is

applied for picture plan .The proposed e-nose isolates nine fungicide type and giving unmistakable evidence rate from 84-98% [4].

Eyad Sameh Alkronz, Khaled A. Moghayer, Mohamad Meimeh, Mohannad Gazzaz they have chipped away at the utilization of Artificial Neural Network (ANN). It is a directed learning due to predefined info and yield attributes. Multi-layer ANN model is used for getting ready, endorsing, and testing of the data. In this paper, Multi-Layer ANN model was used to get ready and test the mushroom dataset to anticipate whether it is agreeable or poisonous. The Mushrooms dataset was prepared for getting ready, 8124 cases were used for the planning. Just NN writing computer programs was acclimated with planning and supporting the information. The fundamental credits of the educational assortment were recognized, and the precision of the predication of whether Mushroom is consumable or Toxic was 99.25% [5].

Shuhaida Ismail, Amy Rosshaida Zainal, Aida Mustapha they have dealt with this paper is set to research the particular highlights among mushroom and recognize their relationships in setting up the elements for grouping test. The assessment is performed to data change from straight out to numerical in setting up the dataset for K-Nearest, Neighbor computation while Naive Bayes stayed aware of the remarkable straight-out features.

K-NN was carried out comprehensively with K from 1 to 22 in light of the fact that the quantity of element distinction is 22. Around the completion of the two executions, four-way cross-endorsement technique was used to support the accuracy result. The course of action precision for Naive Bayes was 90% [6].

Eyad Sameh Alkronz, Khaled A. Moghayer, Mohamad Meimeh, Mohannad Gazzaz, Bassem S. Abu-Nasser, Samy S. Abu-Naser have showed that the predication is a utilization of Artificial Neural Network. It is a directed learning due to predefined data and result credits. Multi-layer ANN model is used for getting ready, endorsing, and testing of the data. In this paper, Multi-Layer ANN model was used to get ready and test the mushroom dataset to predict whether it is palatable or destructive. The Mushrooms dataset was prepared for planning, 8124 events were used for the arrangement. Just NN writing computer programs was acclimated with planning and supporting the data. The principle credits of the enlightening file were perceived, and the precision of the predication of whether Mushroom is edible or Poisonous was 99.25% [7].

Jitdumrong Preechasuk, Orawan Chaowalit, Porawat Visutsak have invented that Mushrooms are organisms. The consumable mushrooms incorporate dietary substance and medical advantages. Nonetheless, some mushroom species is harmful and contains noxious substances that could make sickness and lead passing. Mushroom harming represents around 70% of regular harming and frequently causes demise. Nonetheless, there are just 30-50 noxious species among a huge number of animal varieties found on the planet, and of these, something like 10 are lethally harmful. The primary explanation of eating noxious mushrooms is the absence of information and ability to characterize the eatable and toxic mushrooms. In addition, the actual attributes of mushrooms are comparative. This work plans to lessen the quantity of ailment people whom are hazard of openness to poisonous mushrooms.

The model gives the consequences of 0.78, 0.73 and 0.74 of accuracy, review and F1 score, individually.

Agung Wibowo, Yuri Rahayu, Andi Riyanto have exhibited that Order pattern of hurtful mushroom or not will be conveniently driven by learning machine using mining as one of the methods of isolating PC helped data. As of now, there are three assessments of the best gathering computations in data mining as like Decision Tree, Naïve Bayes and Support Vector Machine (SVM). The audit procedure used is attempt various things with helped gadget of WEKA that has been attempting in the connection of the three computations. To coordinate the testing, it is used the mushroom data of Agarics and Lapita family. The mushroom data were taken from The Audubon Society Field Guide to North American Mushrooms, in UCI AI document. Results of the testing exhibit that the C4.5 estimation has a comparable precision level to the SVM by 100% regardless, from the speed point, association of the C4.5 computation is speedier than the SVM [8].

Agung Wibowo, Yuri Rahayu, Andi Riyanto, Taufik Hidayatulloh they have worked in Indonesia 13 species kinds of mushroom on the planet anyway there is an incredibly confined focus on choosing palatable or poisonous mushroom. As of now, there are three connections of the best request computations in data mining, like Decision Tree, Naïve Bayes and Support Vector Machine. The survey technique is used to attempt various things with the help of instrument of WEKA

that has been attempting in the connection of the three estimations. To lead the testing, it is used the mushroom data of Agarics likewise Lapita family. In Indonesia, starting as of late considering the google web search device, it is found two investigation disseminations in the field of consumable and unsafe mushroom recognizing confirmation and course of action. The mushroom ID procedure that has been done used Naïve Bayes and Voting Feature Interval (VFI5) computations with the assumption precision of 99.52% and 84.53% [9].

2.3 Comparative Analysis and Summary

Subsequent to investigating these papers, I found some connected work that is pertinent to my work, just as a portion of the technique and precision they accomplished in their papers. The accompanying are the points of interest.

Table 2.1 Comparative analysis of the existing publications

Authors Name	Year	Applied Methods in their work	Accuracy/Evaluation Metric
Nusrat et al,	2021	InceptionV3 VGG16 and Resnet50	88.40%
Jitdumrong et al.	2019	Convolution Neural Networks	74.00%
Lidasan et al.	2018	Grabcut, Neural Network, Probabilistic Neural Network	92%

Verma and Dutta	2018	Artificial Neural Network and Adaptive Neuro Fuzzy, ANN, ANFIS and Naïve Bayes, , Multilayer perceptron, Self-Organizing map, Support vector machine, choice trees, Bayes classifier, Genetic Algorithms, Neural Network , Neuro fuzzy, Adaptive Neuro Fuzzy Inference framework.	84.98%
Eyad et al.	2019	Artificial Neural Network, Multi-Layer ANN	99.25%

Kanchi Tank	2021	Principal Component Analysis, Logistic Regression, Choice Tree, K-Nearest Neighbor (KNN), Support Vector Machine (SVM), Naïve Bayes and Random Forest	94.19%
Shuhaida et al.	2018	K-Nearest Neighbor, Naïve Bayes	90%
Wibowo et al.	2021	Decision Tree , Naïve Bayes and Support Vector Machine (SVM)	100%
Wibowo et al.	2018	Decision Tree , Naïve Bayes and Support Vector Machine (SVM)	99.52% and 84.53%
Sameh et al.	2019	Artificial Neural Network, Multi-Layer ANN	99.25%

2.4 Scope of the Problem

I have gathered loads of crude text information which was from many research paper, book, journal publication was taken bunches of time and dedicated and I attempt to search for likenesses and contrasts between the data information to figure out which data information has a place with which class. Also, to do Linguistic Feature Extraction was extremely difficult. And furthermore, ordered information to different Machine Learning calculation.

2.5 Challenges

Since the start of this review, I've been attempting to gather misery related data information. Notwithstanding, there is deficient information for a particular noxious mushroom. Therefore, gathering wild mushroom related data was very hard for me. I looked through a great deal of research paper, book, journal publication in any case, it was hard to track down wild mushroom classification related data I needed to actually look at them from different regions and read them to check whether they were identified with wild mushroom and if they were not identified, I didn't gather them. Accordingly, gathering them takes a long time. It was unquestionably hard for me to get wild mushroom-related information for this proposal.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Research Subject and Instrumentation

The subject of our research is “Mushroom Classification Using Convolutional Neural Network: A Transfer Learning Approach” and our aim is to build a unique model with a higher accuracy rate. Here we collect data from Kaggle and practically both. In this study we use two types CNN architectures to get more precise outcome it's can produce more exactness than a solitary CNN architecture.

3.2 Data Collection Procedure

The noxious mushrooms are normally known as toadstools. At times a species might be consumable when it is youthful and new, may become noxious or unpalatable when it is overmatured and has begun rotting. The normal palatable mushroom has a place with certain types of Agarics and Pleuritis. The normal toxic species are of Lapita and Amanita. Around 20 mushroom species fill wild in Bangladesh, of which 5-6 are harmful. A few mushrooms developed wild are eaten by the tribals of the Chittagong hill tracts. As of late some limited scale ranches are cultivating mushroom in the country.

In this study, we collected data from Kaggle and practically both. Above all else we visited that region where wild mushroom are developed. There we gathered information, pictures. However our measure of data are less, then, at that point, we gather data from Kaggle. From that point forward, I accumulated information from those regions and coordinated it sequentially in a excel sheet to make our work easy. For our study, we collect 6000 images 9 classes of mushrooms.

3.3 Proposed Methodology

The deep CNN model begins with data collection, which is followed by image preprocessing, augmentation, and the usage of VGG16 and ResNet50 pre-trained weights, as well as feature extraction. The tests were then carried out, followed by a detailed analysis of the data and step by step working procedure shown in Fig. 1.

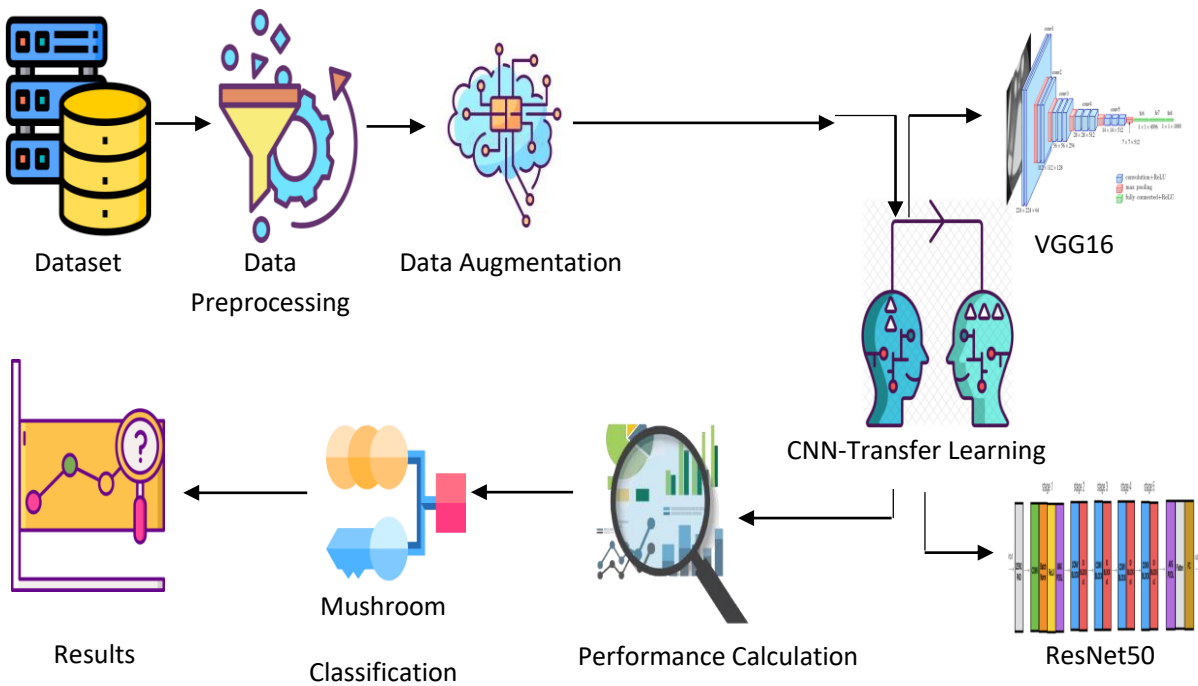


Fig. 3.1. Step by Step Working Procedure Diagram

3.3.1 Data Preprocessing

Preprocessing alludes to every one of the changes on the raw data before it is taken care of to the deep learning calculation. For example, preparing a convolutional neural network on raw pictures will presumably prompt terrible characterization exhibitions. The preprocessing is likewise vital to accelerate preparing (for example, centering and scaling methods). The viability of the image data important for image classification is improved by image processing. Preprocessing methods utilize geometric modification of images like image rotation, translation and scaling. During the preprocessing stages, we decrease the resolution, of all images considered to 224x224 pixels for VGG16 and 256x256 pixels ResNet50 separately. It should guarantee that each of the photos are of a similar quality. For quick picture searching, we should label or categorize pictures utilizing a keyword search. Now, all transcribed images were eliminated from the dataset.

3.3.2. Data Augmentation

This methodology is utilized to build the quantity of images in the preparation dataset. All through the preparation process, it assists with keeping away from the issue of overfitting. Overfitting happens when the network learns the information rather than the overall example of the dataset. Images augmentations were accomplished by applying specific image transformations such as rotation, shift, shear range and horizontal flip to the images. Deep networks need large amount of training data to achieve good performance. To build a powerful image classifier using very little training data, image augmentation is usually required to boost the performance of deep networks. **Image augmentation** artificially creates training images through different ways of processing or combination of multiple processing, such as random rotation, shifts, shear and flips, etc.

3.4 Implementation Requirements

3.4.1 Hardware Implementation

Laptop Configuration

Processor: COREi7 8th Gen, RAM: 8 GB, ROM: 1 TB, OS: Windows 10 64 Bit

3.4.2 Software Implementation

Here we use software Anaconda Python, Jupiter Notebook.

3.5 Model Implementation

In this study, we use two different version of CNN architecture of deep learning for feature extracting from those images we are using. They are: VGG16, Resnet50.

VGG16: VGG16 is a Convolutional Neural Network (CNN) model which is proposed by K. Simonyan and A. Zisserman from the Oxford Visual Geometry Group in the ILSVRC-2014 contest. This model won the first prize by accomplishing 92.7% top 5 test exactness on the ImageNet dataset which has around 138 million boundaries. This architecture has 16 layers and the input is of fixed size 224×224 RGB picture. It generally has the convolution layer that utilizes

3×3 filters with step 1 and the maximum pooling employments 2×2 filters with step 2 lastly, 3 completely connected layers are associated with the SoftMax activation function.

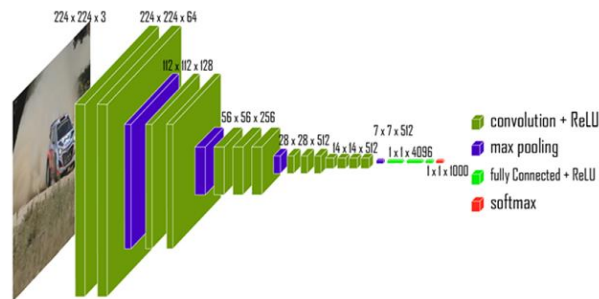


Fig. 3.2. Graphical Representation of VGG16 Architecture

Reset50: Another Convolutional Neural Network design ResNet50 is proposed by He who won the ILSVRC-2015 rivalry in 2015 to enlighten the issue of various non-straight layers not learning personality maps and corruption issues. Each 2-layer block is displaced in the 34-layer net with this 3-layer bottleneck block, achieving a 50-layer Resnet and the information picture is of fixed 224× 224 pixels. This design has north of 23 million boundaries.

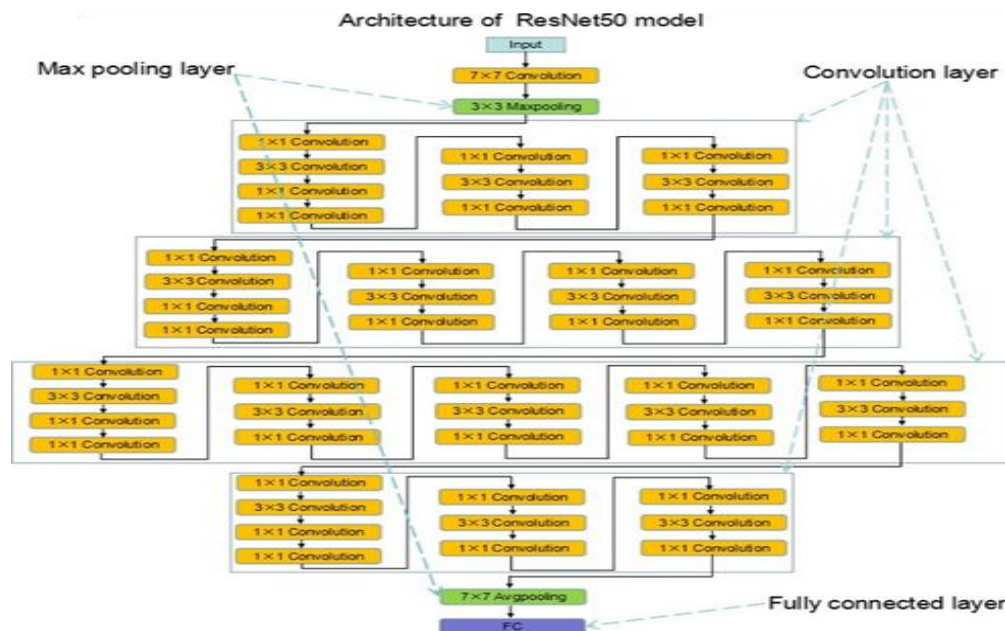


Fig. 3.3. Model Architecture of ResNet50

CHAPTER 4

EXPERIMENTAL RESULTS AND DISCUSSION

4.1 Experimental Results & Analysis

We divided the 1280 training pictures and 320 validation images of mushrooms and smooth roads into 80:20. The experiment platform has an Intel Core i3-7200 processor and 8 GB of memory. For the ResNet50 and VGG16 models, all input pictures were originally scaled to sizes of 256×256 and 224×224 , respectively. provide extensive information on the network topologies of the ResNet50 and VGG16 models.

validation curve, the remaining substantial part of the curve shows that VGG16 had a validation accuracy of 96.31% and ResNet50 had a validation accuracy of 98.47 percent.

4.1.1 VGG16

In our experiment, we used those applied models to scale images to 224×224 and 256×256 . After that, the augmentation was carried out. The pre-trained ResNet50 and VGG16 models' weights were used. With SoftMax activation and a batch size of 32, the stochastic gradient descent (SGD) optimizer was used. In this model, the default values for learning rate, decay, and momentum were utilized. With this approach, we were able to increase the number of captured photos whereas most previous efforts had less taken images.



Fig 4.1. Training and Validation Loss Graph for VGG16



Fig 4.2. Training and Validation accuracy Graph for VGG16

Training in 20 epochs

Training accuracy-96.91%

Validation accuracy- 96.31%

4.1.2 RsNet50

The classifier was then trained on the mushroom dataset using the ResNet50 and VGG16 architecture, and the model's performance was evaluated using test pictures. We experimented around with the weights of the pre-trained ResNet50 and VGG16 models. This was performed to compare our model to other well-known transfer learning pre-trained networks. We examined which pre-trained network would be the best fit for this dataset. We tested ResNet50 and VGG16, two different models. Table II shows the classification report of our proposed model. It demonstrates that the ResNet50 model has good accuracy and minimal loss.

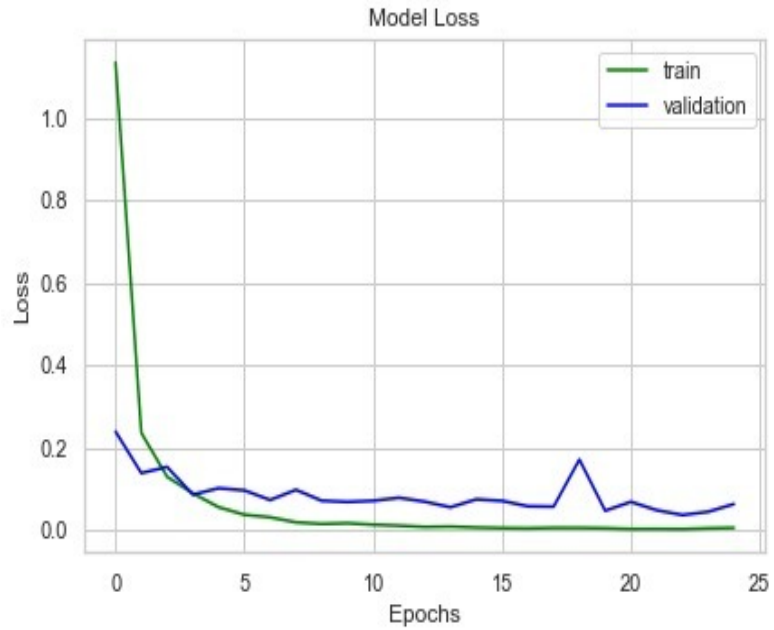


Fig 4.3. Training and Validation Loss Graph for RsNet50

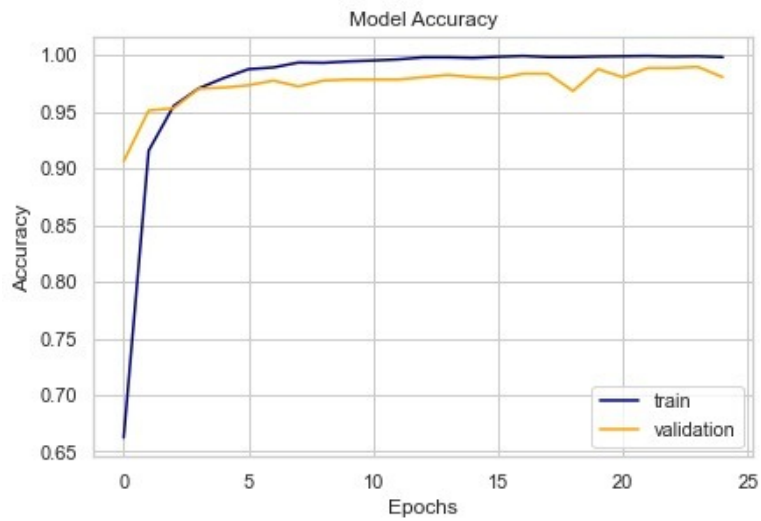


Fig 4.4. Training and Validation accuracy Graph for RsNet50

Training in 25 epochs

Training accuracy-99.25%

Validation accuracy- 98.66%

Then use the ResNet50 and VGG16 architecture to train the classifier on the pothole dataset, and use the test images to evaluate the performance of the model. We experimented with the weights of the pre-trained ResNet50 and VGG16 models. This is done to compare our model with other well-known transfer learning pre-trained networks. We checked which pre-trained network is best for this dataset. We tested ResNet50 and VGG16, these two different models. Table II shows the classification report of our proposed model. It shows that the ResNet50 model has good accuracy and minimal loss.

4.2 Confusion Matrices

Table 4.1 Confusion matrices as binary format

Model	TP	FN	FP	TN
VGG16	234	06	05	53
ResNet50	240	01	03	54

Our model was offered the opportunity of continuing to train using the training dataset, which comprised both the original and enhanced images. After that, the model was validated in order to make it more comprehensive. Fig. 8 and Fig. 9 and exhibits strong convergence during the training and validation stages. Despite a single low peak in the

4.3 Performance Calculation

For selecting the optimal model for our proposed system, we evaluate accuracy score, confusion matrix (TP, FP, FN, TN), Precision value, Sensitivity, Specificity, False Positive Rate (FPR), False Negative Rate (FNR), and F-1 score, as well as the criteria indicated in “(3-9)”.

$$\text{Accuracy} = \frac{\text{True Edible} + \text{True Nonedible}}{\text{Total No. of Sample}} \quad (3)$$

$$\text{Precision} = \frac{\text{True Positive}}{\text{True Positive} + \text{False Positive}} \quad (4)$$

$$\text{Sensitivity} = \frac{\text{True Positive}}{\text{True Positive} + \text{False Negative}} \quad (5)$$

$$\text{Specificity} = \frac{\text{True Negative}}{\text{False Positive} + \text{True Negative}} \quad (6)$$

$$FPR = \frac{\text{False Positive}}{\text{False Positive} + \text{True Negative}} \quad (7)$$

$$FNR = \frac{\text{False Negative}}{\text{False Negative} + \text{True Positive}} \quad (8)$$

$$F1 \text{ Score} = \frac{2 \times \text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}} \quad (9)$$

PERFORMANCE EVALUATION MATRICES

F1 score,

Accuracy,

Sensitivity,

Specificity,

Precision,

False Negative Rate (FNR) and

False Positive Rate (FPR)

Table 4.2. Performance evaluation matrices

Performance Scores								
	Class	Precision (%)	Sensitivity (%)	Specificity (%)	FPR (%)	FNR (%)	F1 Score (%)	Accuracy (%)
VGG16	Edible	97.91	97.50	91.38	8.62	2.50	97.70	96.31
	Nonedible	97.47	97.76	90.62	9.38	2.40	97.86	
ResNet50	Edible	98.77	99.59	94.74	5.26	0.41	99.17	98.66
	Nonedible	98.26	99.46	94.31	5.69	0.54	99.19	

Best given accuracy is 98.66% for ResNet50.

4.4 Discussion

We divide 1280 training images and 320 verification images of Mushroom and Edible into 80:20. The experiment platform uses Intel Core i3-7200 processor and 8 GB memory. For the ResNet50 and VGG16 models, all input images are initially scaled to 256×256 and 224×224 respectively. Provides extensive information about the network topology of the ResNet50 and VGG16 models. The activations of fc6 and fc7 are used to extract features. In our test, we utilized those applied models to scale pictures to 224×224 and 256×256. From that point onward, the increase was done. The pre-prepared ResNet50 and VGG16 models' loads were utilized. With SoftMax actuation and a group size of 32, the stochastic slope drop (SGD) streamlining agent was utilized. In this model, the default esteems for learning rate, rot, and force were used. With this methodology, we had the option to expand the quantity of caught photographs while most past endeavors had less taken pictures.

CHAPTER 5

IMPACT ON SOCIETY, ENVIRONMENT AND SUSTAINABILITY

5.1 Impact on Society

Mushrooms are the fruiting assemblages of a gathering of higher parasites that have developed contemporaneously with plants for a long period of time. They are generally circulated all through the world. There are great many types of mushrooms, yet around 100 types of mushrooms cause manifestations when eaten by people, and just 15-20 mushroom species are possibly deadly when ingested.

Mushroom poisonings can happen in view of forager misidentification of a noxious species categories as eatable, albeit many cases are purposeful ingestions. Ordinarily, very little of the mushroom is gulped, and the guardian for the most part looks for brief clinical consideration. Mushroom openings in grown-ups can be not kidding and might be lethal. Grown-ups are bound to search for and devour huge amounts of wild mushrooms, commonly more than one sort, and are more liable to stand by prior to looking for clinical consideration. Grown-ups may know nothing about the danger of eating wild mushrooms, need insight to appropriately recognize mushrooms, or be workers from regions where consumable mushrooms look like nearby harmful assortments (Kristina W. Kintziger, 2011). Mushroom poisonings might go from harmless indications of summed up gastrointestinal surprise to conceivably annihilating appearances which incorporate liver disappointment, kidney disappointment, and neurologic sequelae. A typical openness includes incidental mushroom ingestion by kids during open air play. There are up to 14 portrayed conditions, which show contingent upon the species, poisons, and sum ingested. Acute gastroenteritis is one of an assortments of "backyard mushrooms, for example, *Chlorophyllum molybdites*. Indications of sickness, regurgitating, stomach squeezing and perhaps loose bowels related with ingestion represent by far most of announced poisonings. It shows regularly inside 1-3 hours. Cholinergic poisonousness is caused by muscarine containing species in different genera like *Cnidocyte* and *Inouye*. Cholinergic impacts of stomach squeezing, diaphoresis, salivation, lacrimation, bronchospasm, bronchorrhea, and bradycardia normally happen inside 30 minutes. Length is portion subordinate however commonly brief when contrasted with different wellsprings of cholinergic harming like pesticides. Liver harmfulness is caused by amatoxin in types of

Gallerias, and Lapita and particularly Amanita. Harmfulness typically shows three particular stages. Gastrointestinal impacts start regularly 6-12 hours post-ingestion, trailed by a calm stretch 24-36 hours after ingestion with indicative improvement. During this stage, nonetheless, there might be lab indications of hepatotoxicity. Following 48 hours, hepatic harm increases, prompting liver disappointment and its sequelae. Passing might happen inside seven days in serious cases or require liver transplantation. In this way, for having poisonous or wild mushroom is exceptionally serious issue for society.

We disclose how to utilize Deep Learning to classify wild mushroom in this research. The question is, though, how it impacts society and how it performs. It will endeavor to adjust this review to society after it has been applied. In case it is a decent or better methodology, it affects society. People will be able to classify toxic mushroom, their side effects easily. This examination will assist cultivators with understanding which mushroom is poisonous. Mushroom hunting necessitates that the tracker has the option to distinguish the mushroom species, and have a mindfulness of which species are palatable. Trackers ought to try not to gather mushrooms that are hard to recognize, and ought to be comfortable with which toxic mushrooms look basically the same as consumable ones. It likewise helps the businessmen to comprehend which mushroom is poisonous. Some of the time fakes offer wild mushroom to the businessmen with high sum. Then, at that point, the businessmen offer this to clients, retail distributers. In the wake of taking that mushroom clients become wiped out. Hence their businesses drop down. Before ordering mushroom, retail food stores and restaurants will be able to know about the wild mushroom. So edible mushroom is served to customers.

In this way, it effects society.

5.2 Impact on Environment

In this study, we will be able to classify the wild mushrooms. For this reason, the cultivators will cultivate the eatable mushrooms only. Natural squanders from other essential businesses are utilized in the production of substrate in which mushrooms are grown. Raw materials utilized in mushroom substrate creation which are results of different enterprises incorporate wheat straw, poultry manure, stable waste. These materials, if not reused, could pose potential ecological threats. Once the yield has been collected, the substrate gives an organic and healthfully adjusted

item, great for expansion to high quality preparing blends or in agriculture. Mushroom developing is one of the quickest developing and most technologically modern green businesses on the planet. Wood waste could represent a genuine danger to timberland health and woodland fires, which seriously harm the biological system, it can be used to develop mushrooms. Simultaneously, the substrate resulted from mushroom development can be utilized to grow forest. Water hyacinth is a waterweed present in a large number of the rivers. Notwithstanding, it is high in nitrogen and can be utilized as separated of substrate for mushrooms cultivation. Mushrooms might actually be vital in future food supplies and in new components of sustainable agriculture and wild mushrooms creation and environment-proceeded

In this way, it impacts on environment.

5.3 Ethical Aspects

In each situation of our life, we want to contemplate the ethics. An examination can be extremely special or exceptional yet in case it has no ethical worth that makes the examination insufficient, we want to think concerning the ethical part of anything before we make or create something.

Information related moral angles:

- No close to home data of the clients are gathered.
- No dishonest encroachments were disbanded while gathering the information.
- The text-based information is just centered; no pictorial perspectives or news were gathered.

There are some computer ethics we followed for the research.

We didn't utilize a PC to hurt others.

We didn't meddle with others' PC work.

We didn't sneak about in others' PC records.

We didn't utilize a PC to steel.

We didn't duplicate or utilize respectability programming for which we haven't paid.

All out task won't hurt any moral provisions. The ethical angles of us after model are it tends to be especially helpful for humanity and it can forestall a great deal of providing harmful mushrooms sooner rather than later.

5.4 Sustainability Plan

In this examination in case, we can group wild mushroom then it will assist every one individual with understanding their incidental effects without any problem. Mushroom hunting requires that the tracker have the choice to recognize the mushroom species, and have a care of which animal groups are attractive and used to be alright with which poisonous mushrooms look fundamentally as old as ones. It will likewise help finance managers prior to serving mushroom to the clients. It can likewise help those burdensome individuals who has drops down from their business in light of their absence of data about mushroom. On the off chance that they can group wild mushroom appropriately then it tends to be exceptionally simple to get out from it.

CHAPTER 6

FUTURE WORK & CONCLUSION

6.1 Summary of the Study

As well as having the option to recognize the species, a few qualities of mushrooms are hints with respect to whether they might be toxic or consumable. Mushrooms that injury will generally be eatable, yet this isn't generally the situation. Mushrooms with no smell, or an almond or anise scent are quite often eatable. Mushrooms with a foul, creosote, sharp, hot, off-putting, or stale smelling smell are quite often harmful. A gill shade of buff or green are typically harmful, while red or orange are typically eatable. A luxurious tail surface is typically harmful, similar to a tail tone of buff, cinnamon, brown, or yellow (red, dim, or orange are typically protected to eat). A brown or on the other hand orange cover tone are normally protected to eat. An enormous or missing ring is probably going to be toxic, while an erupting ring is probably going to be eatable. At last, mushrooms with chocolate or green spore print tones ought to be kept away from, while the tones buff, orange, purple, and yellow are typically safe.

In this study, we use two architectures of CNN as we are working on Deep Learning. They are VGG16 and Resnet50. First of all, we collect both Kaggle and practically. Here we collect 6000 images of 9 types of wild mushrooms. Preprocessing insinuates all of the progressions on the crude information before it is dealt with to the profound learning estimation. For instance, setting up a convolutional neural organization on crude pictures will probably provoke horrible portrayal displays. The preprocessing is similarly crucial to speed up getting ready (for instance, focusing and scaling strategies). The practicality of the picture information significant for picture arrangement is improved by picture handling. Preprocessing techniques use mathematical change of pictures like picture pivot, interpretation and scaling. During the preprocessing stages, we decline the goal, of all pictures considered to 224x224 pixels for VGG16 and 256x256 pixels ResNet50 independently. It should ensure that each of the photographs are of a comparable quality. For fast picture looking, we should mark or sort pictures using a catchphrase search. Presently, all deciphered pictures were disposed of from the dataset. While we are doing this, we always maintain the computer ethics to find the accurate result. This paper will help to toxic mushroom. For this reason, people will be aware about wild mushrooms.

6.2 Conclusion

A Czech saying states that "each mushroom is consumable, yet some just a single time." There are about 100 types of mushrooms that are named noxious, with some causing as it were gastrointestinal misery, and others causing demise. Mushroom hunting necessitates that the tracker has the option to recognize the mushroom species, and have a mindfulness of which species are eatable.

The research expects to introduce the model of characterizing kinds of mushrooms dependent on 9 types of wild or toxic mushroom. Also, the image datasets of mushroom were utilized in the investigation by differing the image parts of scaling, interpretation, changing of light condition, and the viewpoint change. As indicated by the test, the proposed model can group each of the 9 types of toxic mushroom with high exactness and the proposed model can work by applying CNN and it is vigorous of scaling, interpretation, turn, light condition, and viewpoint change which are the challenge focuses for study.

6.3 Implication for Further Study

The region or field of the subject has an extremely wide space of suggestion. Presently a day, there are lots of new algorithms are coming out and those new algorithms can assist with acquiring the precision level farther more than us. More Deep Learning algorithm can be applied on similar information to assemble the execution investigation and contrast with the applied ones. The new cutting-edge algorithm can be bit complex to work with yet for some situation, they can acquire huge outcomes. For future investigations scientists can utilize some Machine Learning model that can help them to get extraordinary outcome.

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