

Fungus Detection using Convolutional Neural Networks

R. Priyadharshini¹, G. B. Nivetha¹, G. Kausalya¹, P. Anantha Prabha²

¹UG Scholar, Department of CSE, Sri Krishna College of Technology, Coimbatore, Tamil Nadu, India

²Assistant Professor, Department of CSE, Sri Krishna College of Technology, Coimbatore, Tamil Nadu, India

ABSTRACT

The fungus is enormously important for food, human health, and the surrounding. Fungus sign and symptoms in the food, medical science and any non-specific field which is an extremely large area which will result in us the challenging task for the fungus detection. Various traditional, as well as modern computer vision techniques, were applied to meet the challenge in the early days of fungus detection. Another main challenge that has been raised is that obtaining the enormous amount of dataset which is been related to the fungus detection and the processing of it. Despite this challenge, another phase that includes the classification of dataset separately and identifying the fungus presence, owing to all these difficulties, Transfer learning has been used in the approach to get multiplying our dataset. In pursuing this idea, we present a novel fungus dataset of its kind, with the goal of an advancing the State-of-the-art in fungus classification by placing the question of fungus detection.

Keywords : Convolutional Neural Networks, Transfer Learning, Activation Function ReLU.

I. INTRODUCTION

A Fungus is a eukaryote that digest food externally absorbs nutrients directly through its cell walls. It is enormously notorious for food, animals, and plants. The fungus is one of the most significant organisms in the environment they are hidden from the naked eyes but their effects and impact are very evident and plenty[1]. Fungi are heterotrophs and, like animals, obtain their carbon and energy from other organisms some fungi obtain their nutrients from a living host (plant or animal) and are called biotrophs; others obtain their nutrients from dead plants or animals and recalled saprotrophs (saprophytes,saprone). Some fungi will penetrate a living host, but kills the host cells in order to obtain and suck their nutrients; these are called necrotrophs. Fungus plays an important role not just in decomposition process of organic matter with its 100,000 unique recognized

and many more and recognized species but also very notorious for human health, food, and there by-products which makes them prove for the thread. The fungus can affect human health in a various way which includes systematic infection to human tissues, intestine, respiratory system, the decay of stored food in containers with a production of miotoxins and biodeterioration of study materials like books and documents[9].

HOW FARMERS HANDLE FUNGUS IN FIELDS:

When humans began farming before 12,000 years ago, they altered the future of our species and extinct our dangerous forever. Our ancestors were ecological pioneers, discovering and cultivating the most valuable crops, scaling them up to feed entire communities and transforming wild crops so fundamentally that became dependent on humans for their survival. Ants had already been farming fungi in

South American forests and rainforests for 60 million years. By creating an evolutionary free of fungus-farming ants, they report that the revolution in the ant agriculture may have been spurred by a dramatic shift in climate some 30 million years ago. Moreover, the farming system that emerged from that revolution may yet hold a few lessons for humans today.

II. LITERATURE REVIEW

In [1], The fungus is the big hazard and farmers lost nearly a million dollars per year due to different varieties of species in fungus. An automated system for the detection of fungus in the air spores. Air samples that are collected will be placed under the microscopic camera and the images will be obtained. Pre-processing techniques that are used in the images have many noise regions and the boundaries in the spores are not clear. After that support vector machine is used for extractions of features and classification.

In [2], The successful establishment of deep technique which plays a major role in image classification, object recognition and much other recognition from the traditional method to deep learning techniques. Here the human actions are been recognition based on the trained deep CNN model for the feature extraction and a hybrid combination Support Vector Machine and K-Nearest Neighbor (KNN) for human action recognition. But they are used in the limited amount of dataset. To overcome, here transfer learning technique is used to train the data and large-scale dataset has been used for human recognition.

In [3], The webcam is one of the promising sensors which has a development in the computer vision. The accuracy of eyes tracking and eye moment analysis will be based on the quality of webcam

videos CNN can be used to train the images obtained and extract the feature from it and analyze it.

III. PROPOSED ARCHITECTURE

A. System Architecture:

The goal of our proposed system is fungus detection using convolutional neural networks in order to identify whether the given classes of fungus is normal or abnormal. In figure 1, depicts the overall process of our proposed system: The dataset for the fungi are been obtained from various websites. Using this dataset, we are applying transfer learning technique to train the data and with the help of convolutional neural networks (CNN)[6], we are identifying the whether the given input image is normal or abnormal. In deep learning stream, a convolutional neural network(CNN or ConvNet) is a class of deep neural networks, which is commonly been used to analyze the visual imagery[10]. These networks are inspired by a biological process which resembles like neurons, the connectivity pattern in the animal visual cortex.

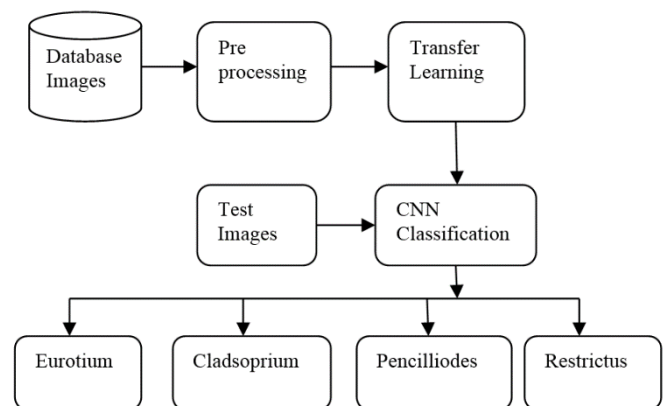


Fig 1: Block Diagram

B. Architecture of Convolutional neural networks:

The classic network architecture was comprised of a simple stacked convolutional layer. But in the modern architectures which explore new and

innovative ways for constructing convolutional layers in a way which allows us for more efficient learning and training[7].

LeNet-5: It was developed in 1998 to identify handwritten digits and zip code in the postal services. Convolutional network layers lies under this will reduce the computation and symmetry of the network.

Alex Net: It was developed in 2012 to compute the Image Net. This is quite similar to LeNet-5 but this is large. It will convince a lot of the computer vision and take a wide look at tasks.

Inception (Google Net):For each cell, a set of 1*1,3*3 and 5*5 filters which can be extracting the features at a different scale from the input images and other sources.

ResNet: This is a deep residual network which enabled the development of the network much deeper. This deeper model should produce no higher training error than its shallow mapping.

Transfer learning: Transfer learning is a popular method in computation which helps us to build accurate models which will pre-train our dataset and a timesaving method. With TL, the learning process will be started from patterns that have been learned with different problems instead of learning from scratch[5]. This will lead us for pre-trained learning from a huge amount of dataset and avoids from the beginning. In the computer, Transfer learning is usually expressed through pre-trained models. A pre- trained model which we help to solve a large dataset and different problem method.

C.Dataset: The dataset that we collected consist of nearly 9000 images from 4 different classes namely, *Saccharomyces cerevisiae* (Bakers yeast), *Penicillium* (TB and leprosy), *Sepiato brunneoin cannata*, *Amanita* species. Each species is identified

as definitely edible, definitely poisonous or some of the classes is left unknown to us like edible or not. From this, we are classifying the dataset using convolutional neural networks (CNN). In Figure 2 and 3 depicts the images of fungus,



Fig 2: Yeast



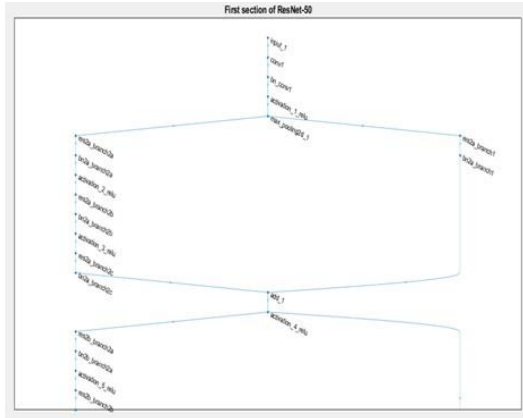
Fig 3: Mushroom

E..Activation function and ReLU:

Like human brain has millions of neurons in a hierarchy and networks of neurons which is been interconnected with each other like that our images that are been weighted and will be interconnected to ReLU layer in the convolutional neural networks layers which helps us to identify the features that are extracted from the images which has maximum – normal images and minimum- abnormal images[4]. The function returns 0 if it receives negative input(abnormal image) it gives us minimum points, but for any positive value that X return to us then we will be obtaining the

maximum points. In Fig 4, the graph shows that how it is been interlinked,

Fig 4: First ResNet



IV. PERFORMANCE ANALYSIS

Transfer Learning - The dataset that are obtained from the websites with several classes will be trained by using the transfer learning and this algorithm will help us to train the dataset that we obtained and the activation function and ReLU layer will help us to interlinked the weighted labels from the images. Here the images that we used in the training phase will provide us a better accuracy as well as a better performance in the selection, extraction, and classification[2]. In FIG 5: The graph of Transfer Learning.

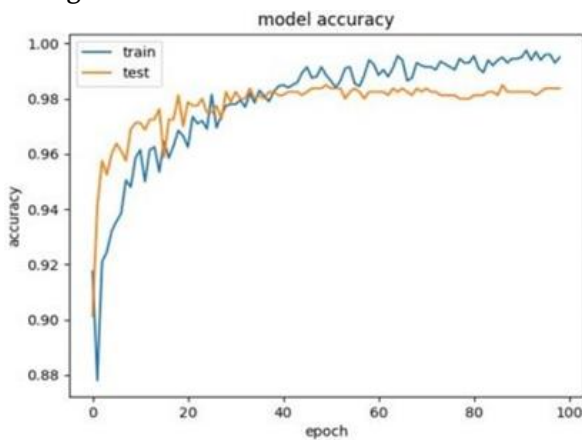


Fig 5: Transfer Learning

Convolutional neural network - Convolutional Neural network in this project will allow us to

identify the class name, Saccharomyces cerevisiae (Bakers yeast), Penicillin(TB and leprosy), Sepiato brunneoin cannata, Amanita species. The convolutional neural network allows us to identify the classes and help us to find whether it is abnormal or not. The accuracy of the images is

V. EXPERIMENTAL RESULT

The proposed Fungus detection using convolutional neural network is implemented using MATLAB 8.1.604 (R2018a) platform.

The database of 9000 images is acquired from different sources. All the images in the database are in the different classes Saccharomyces cerevisiae (Bakers yeast), Penicillin(TB and leprosy), Sepiato brunneoin cannata, Amanita species. The resolution of these images is 200 x 200 pixels and all these images were acquired in outdoor environment. The database holds red, blue, green color images of various format as bmp, jpg, tif, png. The input image is resized into 256*256 matrix. The selected image is deployed for feature extraction and using transfer learning is one of the iterative method which provides weights for the images. Here each images will be weighed separately with labels. Then we are using matrix form to extract the features from the images to the convolutional neural.

Label	Count
Eurotium	360
cladosporium	360
penicilliodes	360
restrictus	360

Fig 6: Classes of Images with Its Count

After training is completed test the images. Test data is used only to assess performance of model.

Test data is used to validate our model and a smaller portion of the data is used for testing.

Fig 7. Accuracy of Classification.

VI. CONCLUSION

In this paper, we proposed a convolutional neural network that help us to classify the fungus into categories abnormal image and normal image. The images that we obtain from the websites is been proposed and pre-trained using transfer learning and identification is done using the convolutional neural network were the image are weighed the image and send to activation function and ReLU layer. But here one of the disadvantage is that the training lasts for nearly 3-4 hours which predicts and result as slow processing.

The future research work of this project, is the image usage of python and extract the necessary package from the internet which makes the process furthermore faster. Also it can be developed as an application where the farmers can help to take the images from the field and directly upload the image in the application and find the case is normal or abnormal.

VII. REFERENCES

- [1]. Muhammad Waseem Tahir ; N. A. Zaidi ; R. Blank ; P. P. Vinayaka ; W. Lang "Fungus Detection System"- 2016 IEEE International Conference on autonomic computing(ICAC)
- [2]. Allah Bux Sargano ; Xiaofeng Wang ; Plamen Angelov ; Zulfiqar Habib "Human action recognition using transfer learning with deep representations" 2017 International Joint Conference on Neural Networks (IJCNN)
- [3]. Chunning Meng; Xuepeng Zhao "Webcam-Based eye moment Analysis using CNN" 2017 IEEE Access (Volume: 5)
- [4]. <https://towardsdatascience.com/activation-functions-and-its-types-which-is-better-a9a5310cc8f>
- [5]. <https://towardsdatascience.com/transfer-learning-from-pre-trained-models-f2393f124751>
- [6]. https://en.wikipedia.org/wiki/Convolutional_neural_network
- [7]. <https://www.jeremyjordan.me/convnet-architectures/>
- [8]. Muhammad Waseem Tahir; Nayyer Abbas Zaidi ; Roland Blank ; Poornachandra Papireddy Vinayaka "Fungus Detection through optical sensor system using two different kinds of features vectors for the classification" IEEE Sensor Journal (Volume 17; Issue: 16, Aug 15, 15 2017)
- [9]. Thomas Truong ; Anh Dinh ; Khan Wahid "An IOT environmental data collection system for fungal detection in crop fields" 2017 IEEE 30th Canadian Conference on Electrical and Computer Engineering (CCECE)
- [10]. Nima Tajbakhsh, Jae Y. Shin, Suryakanth R. Gurudu, R. Todd Hurst, Christopher B. Kendall, Michael B. Gotway, Jianming Liang "Convolutional Neural Networks for Medical Image Analysis: Full Training or Fine Tuning?" IEEE Transactions on Medical Imaging (Volume: 35 , Issue: 5 , May 2016)

Cite this article as :

R. Priyadharshini, G. B. Nivetha, G. Kausalya, P. Anantha Prabha , "Fungus Detection using Convolutional Neural Networks", International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), ISSN : 2456-3307, Volume 5 Issue 2, pp. 205-209, March-April 2019. Available at doi : <https://doi.org/10.32628/CSEIT195218>
Journal URL : <http://ijsrcseit.com/CSEIT195218>