ISSN (Online): 2583-7052

International Journal of Advanced Trends in Engineering and Management (IJATEM)
PP. 822-827

Article Title: **Enhancing Fruit Disease Recognition Using Deep Learning Model**

Enhancing Fruit Disease Recognition Using Deep Learning Model

Jasmin S[1], Benschwartz R[2]

[1]ME Applied Electronics, Mar Ephraem College of Engineering & Technology, Elavuvilai, India. E-mail: jasminstephen4@gmail.com

[2]Assistant Professor, Department of ECE, Mar Ephraem college of Engineering & Technology, Elavuvilai, India

ABSTRACT

Fruit and vegetable identification and classification system is always necessary and advantageous for the agriculture business, the food processing sector, as well as the convenience shops and hypermarkets where these products are sold. Therefore, it is necessary to build an effective automated tool to meet the needs of the market by boosting the outcome, in order to improve economic efficiency. In this paper, a two-stage model is proposed to recognize fruits using camera images. Fruit disease recognition plays a crucial role in ensuring the quality and yield of fruits in agriculture. The framework for fruit disease recognition using a combination of VGG16 feature extraction, APGWO and CNN classification.VGG16 is a deep convolutional neural network known for its excellent feature extraction capabilities. APGWO adaptively adjusts the parameters to enhance the search efficiency and accuracy of feature selection. In this study, Adaptive particle - Grey Wolf Optimization (APGWO) has been applied for choosing the most pertinent features.

1 Introduction

Fruit is very important to our body. It contains various vitamins and minerals and is recommended to be eaten after meals. Due to these reasons, the development in the food industry is escalating to increase. Technology, in Parallel, is also developing to meet the required demand so that automation increases and operating costs of factories are significantly reduced. With the development of CNN, it is easier and easier to classify types of pests, diagnose diseases, and determine the maturity of food. Especially during the Covid pandemic, human resources are decreasing, and the demand for food is high, leading to automation in the factory. With the advancement in the fields of Image Processing, Computer Vision, and Machine learning, Automation in the Food Industry is no longer a problem when a robot with cameras can replace human at certain processing steps. Deep learning method, to be more specific, deep convolutional neural network is one of the leading approaches in vision-based detection, recognition, and classification for the food industry.

There are several approaches which applied deep learning methods to classify fruits. To be more specific, the owner of a fruit360 dataset developed a Convolutional Neural Network (CNN) with four convolution layers interleaved with four max-pooling layers. The output of these layers is the input of two fully connected layers to generate 256 outputs with the ReLu activation function. The last layer is the softmax loss layer with 256 inputs. The output of this

ISSN (Online): 2583-7052

International Journal of Advanced Trends in Engineering and Management (IJATEM)
PP. 822-827

layer is equal to the number of classes. Develop a new algorithm that can solve these current issues by combining multiple methods.

2 Related Work

Dang Thi Phuong Chung and Dinh Van Tai 2019 This paper briefly discusses the use of deep learning (DL) for recognizing fruits and its other applications. The paper will also provide a concise explanation of convolution neural networks (CNNs) and the Efficient Net architecture to recognize fruit using the Fruit 360 data-set. The results show that the proposed model is 95% more accurate. [1]

Selvaraj Damodaran 2020 Magnetic resonance imaging (MRI) is an important diagnostic imaging technique for the early detection of brain cancer. Brain cancer is one of the most dangerous diseases occurring commonly among human beings. The chances of survival can be increased if the cancer is detected at its early stage. [2]

Tomar, Hanshu 2020 The need for an ancient fruit and vegetable identification and classification is always important and beneficial for not only the agricultural department or food processing industry, but also to the low level retail stores and supermarkets where fruits and vegetables are sold. Building ancient automated tool is very much required.[3]

Zerina Masetic, Abdulhamit Subasi 2016 Background and objectives: Automatic electrocardiogram (ECG) heartbeat classification is substantial for diagnosing heart failure. The aim of this paper is to evaluate the effect of machine learning methods in creating the model which classifies normal and congestive heart failure (CHF) on the long-term ECG time series. [4]

L.A. Belanche, F.F. González 2011 in this paper several fundamental algorithms are studied to assess their performance in a controlled experimental scenario. A measure to evaluate FSAs is devised that computes the degree of matching between the output given by a FSA and the known optimal solutions. [5]

3 Proposed Methodology

In this project, we have considered a fruit image database to classify fruits. The VGG16 pre-trained model is employed to extract discriminative features from fruit images. The extracted features are optimized using the adaptive particle-grey wolf optimization technique. The APGWO algorithm effectively selects the most relevant features from the extracted feature set, reducing dimensionality and enhancing the classification performance. A CNN classifier is trained on the optimized feature subset to classify the fruit diseases.

ISSN (Online): 2583-7052

International Journal of Advanced Trends in Engineering and Management (IJATEM)
PP. 822-827

Article Title: Enhancing Fruit Disease Recognition Using Deep Learning Model

3.1 Flow Chart

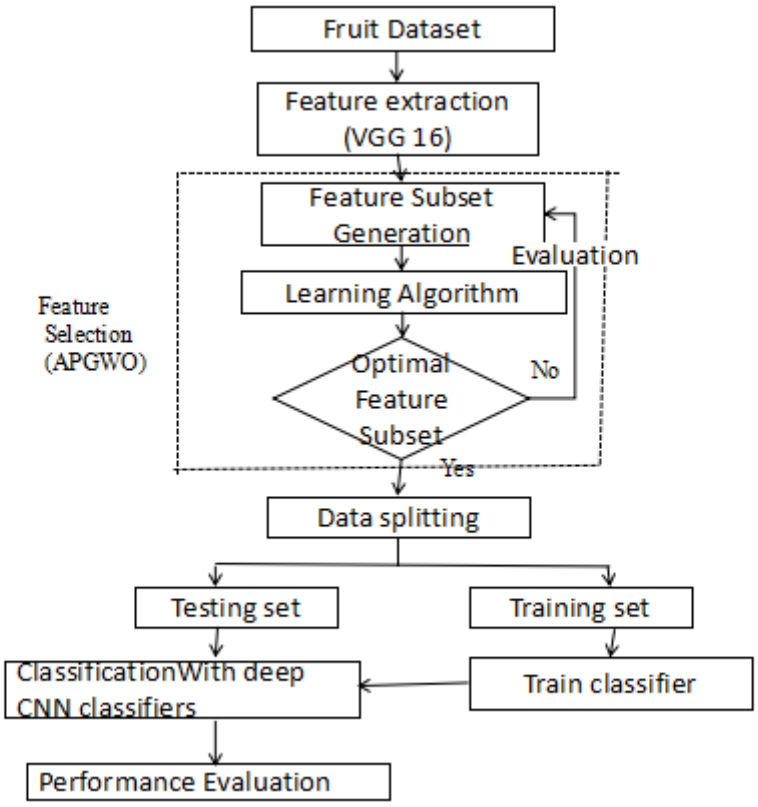


Figure 1: *System Architecture*

3.2 Visual Geometry Group (VGG 16)

A convolutional neural network is also known as a Convent, which is a kind of artificial neural network. A convolutional neural network has an input layer, an output layer, and various hidden layers. VGG16 is a type of CNN (Convolutional Neural Network) that is considered to be one of the best computer vision models to date. The creators of this model evaluated the networks and increased the depth using an architecture with very small (3 × 3) convolution filters, which showed a significant improvement on the prior-art configurations. They pushed the depth to 16–19 weight layers making it approx. — 138 trainable parameters.VGG16 is object detection and classification algorithm which is able to classify 1000 images of 1000 different categories with 92.7% accuracy. It is one of the popular algorithms for image classification and is easy to use with transfer learning.

3.3 Convolutional Neural Network

A Convolutional Neural Network (CNN) is a type of deep learning algorithm that is particularly well-suited for image recognition and processing tasks. It is made up of multiple layers, including convolutional layers, pooling layers, and fully connected layers.

ISSN (Online): 2583-7052

International Journal of Advanced Trends in Engineering and Management (IJATEM)
PP. 822-827

The convolutional layers are the key component of a CNN, where filters are applied to the input image to extract features such as edges, textures, and shapes. The output of the convolutional layers is then passed through pooling layers, which are used to down-sample the feature maps, reducing the spatial dimensions while retaining the most important information. The output of the pooling layers is then passed through one or more fully connected layers, which are used to make a prediction or classify the image.

3.4 Adaptive Particle Grey Wolf Optimization (APGWO)

In this section, GWO was used to reduce the size of the feature subset. To find the nearest way to food, each member of the herd has to follow their leaders who are closest to the prey. The authors present a PSO method that can be used to adapt to this circumstance and solve optimization problems. The two factors that characterize each component of the PSO are the element's current position - x - and velocity - v. At the time of departure, the position of each element is stated at random.

4 Experimental Results

4.1 Input Image Histogram

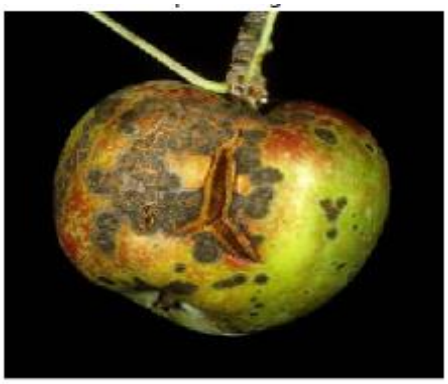


Figure 2: *Input Fruit Image*

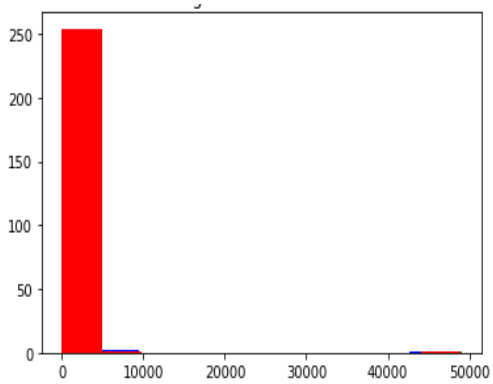


Figure 3: *Histogram Image*

ISSN (Online): 2583-7052

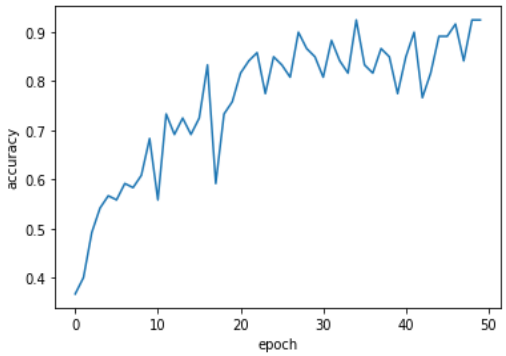
International Journal of Advanced Trends in Engineering and Management (IJATEM)
PP. 822-827

Article Title: Enhancing Fruit Disease Recognition Using Deep Learning Model

4.2 Fruit Disease Detection

Figure 4: *Output Image*

4.3 Model Accuracy Model Loss



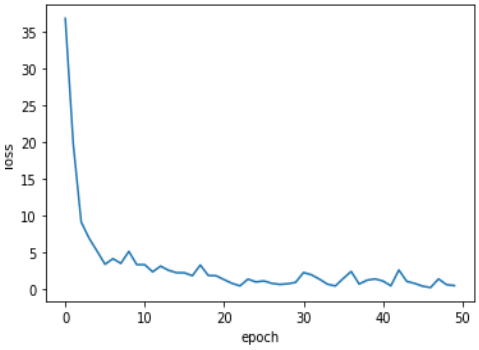


Figure 5: *Model Accuracy Image* **Figure 6:** *Model Loss Image*

5 Conclusion

This project has proposed a method for classifying various types of fruits in order to support in manufacturing. The scientific community has been working to effectively classify various fruits by leveraging the capabilities of ML or DL. In this study, we proposed a model using vgg16 as feature extractor and a feature selection serves as a mechanism to choose the most relevant features for the classification from the image of the fruits. Adaptive Particle Grey Wolf Optimization (APGWO) is used to enhance a feature subset selection method. With 508 selected features from the original data-set, we have applied various models for training such as K-Nearest Neighbor (KNN), Random Forest (RF), Multilayer Perceptron (MLP), Support Vector Machine (SVM), and Decision Tree (DT). The performance of the proposed methods has been achieved with high accuracy. The training and execution time are significantly reduced when irrelevant input attributes are removed.

ISSN (Online): 2583-7052

International Journal of Advanced Trends in Engineering and Management (IJATEM)
PP. 822-827

Article Title: **Enhancing Fruit Disease Recognition Using Deep Learning Model**

Reference

1. D. Pem; R. Jeewon, Year: 2015, "Fruit and vegetable intake: benefts and progress of nutrition education interventions- narrative review article," Iranian Journal of Public Health, Vol: 44, no: 10, pp. 1309–1321.

2. R. C. Fierascu; E. Sieniawska, A. Ortan; I. Fierascu; J. Xiao, Year: 2020, "Fruits by-products - a source of valuable active principles. A short review," Frontiers in Bioengineering and Biotechnology, Vol: 8, pp. 319–328.

3. S. R. Dubey; A. S. Jalal, Year: 2013, "Species and variety detection of fruits and vegetables from images," International Journal of Applied Pattern Recognition, Vol: 1, pp. 108–126.

4. R. A. A. Al-Fallujah, Year: 2016, "Color, shape, and texture based fruit recognition system," International Journal of Advanced Research in Computer Engineering & Technology, Vol: 5, pp. 2108–2112.

5. S. Arivazhagan; S. Newlin; N. Selva; G. Lakshmanan, Year: 2010, "Fruit recognition using color and texture features," Journal of Emerging Trends in Computing and Information Sciences, Vol: 1, no: 2, pp. 90–94.