PAPER DETAILS

Paper Title : Implementation of Deep Learning Methods to Identify Rotten Fruits.
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Authors :
1) FM Javed Mehedi Shamrat
2) Sovon Chakroborty,
3) Md.Al Jubair,
4) Rumesh Ranjan,
5)Md. Masum Billah,
6) Md. Alauddin

WHY THEY HAVE CONDUCTED THIS RESEARCH?

In this paper they classify fresh and rotting fruits. Because the agriculture sector very huge all over the world. Classification of rotten fruits and fresh fruits is usually carried out by humans. Where it is very critical to identifying rotten fruits. It is time consuming and also increase production cost. They conducted to this research for reduce production costs, reducing human effort, and shorten production time.

PROPOSED SYSTEM

In this research, they proposed a system using Convolutional Neural Networks (CNNs) for detection face musk. The process involves data collection, data preprocessing and augmentation, training a CNN using different architectures such as Convolutional layer with Max pooling, Convolutional layer with Average pooling, and MobileNetV2, detection output, and performance evaluation.

Firstly, in the data collection stage, they gather a large dataset with total 13599 images. The images can be obtained from various sources. The dataset divided into 6 classes, which is- Fresh Bananas, Rotten Bananas, Fresh Apples, Rotten Apples, Fresh Oranges, Rotten Oranges.

Next, in the data preprocessing and augmentation stage, they clean and preprocess the data to be used for training the model. This may involve tasks such as resizing images, removing irrelevant information, and normalizing the data. They normalized images 256 x 256 pixels. Then resized images 128 x128 to pass the second layer of Convolutional2D and again 64 x 64 to pass the third Convolutional2D layer.

After preprocessing the data, they train a CNN model using different architectures such as Convolutional layer with Max Pooling, Convolutional layer with Average Pooling, and MobileNetV2. These architectures are designed to handle different types of images and tasks.

After the classification stage, the CNN model outputs the result for each image as the given image is rotten or fresh.

Finally, evaluate the performance of the mask detection system using various metrics such as precision, recall, F1- score, and accuracy. The evaluation can be done on a separate validation dataset or through cross-validation on the original dataset.

ARCHITECTURE

In this research they used to architecture one is Convolutional Neural Network (CNN) architecture and second is MobileNetV2 architecture. In convolutional layer architecture they used Max pooling operation with three convolution layers, as well as the average pooling operation with three convolution layers.

Firstly, Max Pooling Operation. In the proposed system, the input image is first passed through three convolutional layers with max pooling, followed by a flatten operation, a fully connected layer, and an output layer with softmax activation function.

In the first convolutional layer, the input image with a size of 256 x 256 is convolved with a set of learnable filters, and applied the RELU function to the resulting feature maps. Then, the max pooling process is performed to downsample the feature map.

In the second convolutional layer, input images resized to 128 x128, the first convolutional layer are convolved again with a different set of filters. At the same way they applied third convolutional layer. Resized images 64 x64 to pass the third Convolutional2D layer.

After the three convolutional layers with max pooling, the flatten operation is applied to transform the 3D feature maps into a 1D vector, which is then taken care of into the fully-connected layer. Based on the extracted features, the fully connected layer is used to classify the data, and the output layer with the softmax function is used to generate the final classification results.

For function mapping again they used same architecture with the process of average pooling.

Also they used MobileNetV2 architecture for face musk detection. MobileNetV2 is a popular convolutional neural network architecture for image classification tasks. The architecture is based on depth wise separable convolutions, which allows for high accuracy with lower computational cost.

EXPERIMENTED RESULT

For identifying rotten and fresh fruits they used a dataset of 13599 images. Using MobileNetV2 architecture the model achieved training accuracy 99.46% and validation accuracy 99.1% that is the highest accuracy. Also proposed model achieved training accuracy 94.49% and validation accuracy 94.97% using Max pooling operation. The proposed model achieved training accuracy 93.06% and validation accuracy 93.72% using Average pooling operation.

After applying MobileNetV2 in 1st Epoch **Loss of Training -** 4.53%, **Accuracy of Training-** 98.02%, **Loss of Validation -** 4.21%, **Accuracy of Validation -** 98.75%, in 13th Epoch **Loss of Training -** 3.15%, **Accuracy of Validation Training -** 99.46%, **Loss of Validation -** 3.18%, **Accuracy of Validation -** 99.61%. After applying MobileNetV2 they achieved the highest accuracy.

After applying Max pooling in 1st Epoch **Loss of Training -** 47.13%, **Accuracy of Training -** 87.36%, **Loss of Validation -** 15.37%, **Accuracy of Validation -** 89.99%, in 13th Epoch **Loss of Training -** 5.84%, **Accuracy of Training -** 94.49%, **Loss of Validation -** 4.12%, **Accuracy of Validation -** 94.97%. From 1st epoch to 13th epoch there is a lot of change in results which is very excellent.
After applying Average pooling in 1st Epoch **Loss of Training -** 44.12%, **Accuracy of Training -** 86.89%, **Loss of Validation -** 11.12%, **Accuracy of Validation -** 88.23%, in 13th Epoch **Loss of Training -** 6.96%, **Accuracy of Training -** 93.06%, **Loss of Validation -** 5.28%, **Accuracy of Validation -** 93.72%.
In this proposed model, for training dataset best precision 99.46% and for validation dataset best precision 99.61%