Paper Review: 05

Title: CLASSIFICATION OF FRUITS USING CONVOLUTIONAL NEURAL NETWORK AND TRANSFER LEARNING MODELS.

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Basics about this paper

Automated categorization of freshness of fruits using deep learning based model is required for the industrial applications. A proposed Convolution Neural Network (CNN) model is implemented by using public dataset named as "fruit fresh and rotten for classification" derived from kaggle.

INTRODUCTION

India is one of the largest fruit producing countries, and machine vision can be used to classify fruits in "fresh" or "rotten" category. This method is more efficient, error-free, and allows for automated image-based inspection analysis.

LITERATURE REVIEW

ML approach is used to extract image feature-metrics for the classification. Support Vector Machines (SVM) display acceptable results on small data sets, while CNN based model improves image classification for large datasets.

A CNN model was used to detect the defect on mangosteen with accuracy of 97%. The model includes 3 convolution, 3 ReLU, 3 pooling and 2 fully connected layers and was trained using 4-fold cross validation process.

Crop insect classification is a big challenge. Deep CNN models were employed on NBAIR, Xie1 and Xie2 datasets, and the accuracy in insect categorization was 96.75 percent, 97.47 percent, and 95.97 percent, respectively.

CNN is frequently used in agriculture for picture categorization of a variety of issues. The current study shows that a CNN model based on deep learning is more effective in classifying fruits as "fresh" or "rotten".

Dataset

The current work uses dataset "Fruits fresh and rotten for classification" from Kaggle to perform fruit classification. The size of training, validation and test sets are 5451, 2180 and 3270 respectively.

Convolutional Neural Network

Convolution neural networks are today's most popular class of models for image recognition and classification. It requires much less preprocessing time as compared with other classification algorithms, and can work with large data sets without losing important features.

In convolution layer filters are applied to the original image. In pooling layers, the maximum pool technique is employed, and in the final layer, the image is classified into distinct labelled classes using the softmax activation function.

Proposed CNN based model

The fruit dataset is initiated with an input image size of 224 x 224, and a CNN-based model is employed. A categorical cross-entropy loss function and an Adam optimizer with a learning rate of 0.0001 are used in the present project.

Transfer Learning models

In deep learning, transfer learning reduces training time and may reduce generalization. The current work includes performance comparisons of CNN models.

Alexnet

AlexNet is a Convolutional Neural Network that uses data augmentation and dropout to reduce overfitting. It is made up of eight layers and uses a ReLU function after each convolution and fully linked layer to improve the model's non-linear features.

LeNet-5

Lenet-5 is a multi-layer Convolution neural network for image classification that consists of seven layers out of which five layers are with trainable parameters. It employs average pooling in the subsampling layer and has tiny filters in each convolution layer.

The VGG model was developed by Simonyan and Zisserman in 2014. It consists of many convolutional layers, five max pool layers, three fully connected layers and a softmax layer.

The present work includes testing of fresh and rotten category of fruits using deep CNN-based model. The model was trained and tested using Google colab with an HP Z2 MT.

CNN Model Parameters Proposed

The Adam optimizer is used to train the model, which has learning rates of 0.1, 0.01, 0.001, and 0.0001.

IMPACT OF HYPER-PARAMETERS OF THE MODEL

The accuracy of classification model is affected by the specification of batch size. The model performed best with a batch size of 16 people.

The proposed model is trained over a period of 25 epochs, and a classification accuracy of 98.23% is achieved.

3) Optimizers

Another important factor is to choose optimizer which optimizes model's performance. Four optimizers are used in presented work and best optimizer is found to be Adam optimizer which gives the accuracy of 98.23%.

4) Learning Rates

The learning rate of neural networks can range between 0.0 and 1.0. The training accuracy improves from 19.97% to 98.23% if the learning rate is reduced from 0.1 to 0.0001.

EVALUATION OF SUGGESTED MODEL'S CLASSIFICATION ACCURACY AND TRANSFER LEARNING MODELS

The suggested CNN model has the greatest accuracy (98.23%) and takes less time to compute and uses less memory than the current transfer learning model. It uses the RELU activation function between the convolution and max pool layers and the dropout value is 0.5.

CONCLUSION

A CNN-based model is proposed for the auto categorization of fruit in fresh and rotten category. The proposed model achieves a classification accuracy of 98.23 %, which is better than transfer learning approaches.