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A Brief Overview of Deep Learning Methodologies for Analyzing Fruit Image

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Abstract

Deep learning is a groundbreaking advancement in image processing, fruit recognition and categorization, and other fields. This document, in my opinion, is the first of its kind in the food industry. In the past, many machine learning algorithms for fruit classification were presented. With its detection and classification abilities, deep learning can be a powerful engine for providing actionable results in today's reality. Deep Learning is commonly used to classify items from any image and its properties. The system or application feeds the image of the fruit into the trained model, which extracts and considers features via image processing. The system determines if the fruit is fresh or not based on the input and extracted features. The dataset used for this system is downloaded from Kaggle website. In this model, MobileNet is used as an architecture. The model was developed using TensorFlow and keras.

Keywords-CNN,MobileNet,Deep Learning.

1.Introduction

Many researches have found that those who eat fruit on a daily basis have a lower risk of disease. Fruits, in particular, are commonly gathered by each family and are high in supplements; hence, sustainable supply and manufacturing are required to meet the expanding demand of the global population. As a result, the agro-food chain's entire experience is improving. To boost productivity, challenges necessitate the introduction of new innovative technology. However, not all fruits consumed internally are beneficial to one's health There is parcel of advancements that are utilized for fruit recognition. Current computer vision (CV) developments have shown outstanding results in many areas of life.. Regardless, the standard Computer vision approach requires a raised level of

Deep learning is a class of machine learning algorithms that use multiple layers that capacity, a huge load of planning time, and contains numerous boundaries that that need to be manually determined, while the portability to other tasks is pretty limited.

Here comes machine learning. The most popular machine learning method is deep learning, where multiple hidden layers are used in a model. ML permits scientists and designers to tackle issues computationally Related to real-world knowledge. Deep learning is a piece of Machine Learning.

We have seen a new leap in algorithm performance. In 2017, the Mask RCNN was popular among all the algorithms. On the Contrary, the YOLOR algorithm that was delivered in 2021 accomplishes better accuracy ,outperforming the famous YOLOv4 and YOLOv3deep learning algorithm.

contain linear and nonlinear processing units. Each layer uses the output from the previous layer as input to get the desired output. Deep learning algorithms use more layers than shallow learning algorithms which is why preferred the most. Identification of different fruit species is a repeated activity in supermarkets, where the shopkeeper can send the fresh fruits The right solution to this problem is to provide a system of fruit identification that differentiate the fresh and rotten fruit. Here we are going to discuss different types of deep learning models that can be used on fruit analysis.

Deep Alex Networks

R. Brunda et al. [2] proposed a approach for detecting fruits in photographs and displaying their nutritional worth. AlexNet is a CNN image recognition network, as we all know. The goal is to locate the given input image entry within one of the classes. Alex's network contains eight layers. The first five layers are convolutional layers, and the last three layers are fully connected layers.

YOLO5

This model was proposed by Jia Yao[3]. This study uses a kiwifruit imperfection as the examination object, collects four types of normal blemish images to create a kiwi defect dataset, and applies the YOLOv5 calculation's high identification speed and precision to image detection.

Modified GoogleNet

GoogleNet was found in model by Song Jian et al. [4]. The framework proposes to use GoogleNet to achieve the classification of apples, lemons, oranges, pomegranates, tomatoes, and to upgrade Google Net to acquire an improved convolutional network for handling the issue of low preparation speed

YOLO-V5

In this paper [5],to understand the recognition of graspable and ungraspable fruits for the picking robot in an apple tree picture, a system was proposed using YOLOv5 for real time detection method for apple picking by robots.

Fruit identification and classification is a difficult task these days. In this industry, CNN is commonly employed. M. Horea and M. Oltean introduced a deep learning model for fruit recognition in [6].To group the fruit images, this study proposes a novel deep learning approach based on Convolution Neural Network (CNN), LSTM, and Recurrent Neural Network application. Accuracy and performance rely upon the separated and chose features

In this review[7], the author F.M. Javed Mehedi Shamrat used two deep CNN layers and one CNN-based MobilenetV2 design. In [8] ,the author Forhad Ali, had used MobileNet architecture along with Inception3 model to classify the fruits. In this study[9], the author Jia, designed a 13-layer convolutional neural network and had distinguished max pooling with average pooling .

Related work

Rahmoonfer and Shepard [1] used this model for fruit counting. The goal was to create a yield estimation simulating deep CNN. The model was used to handle a variety of challenges that CV algorithms face for fruit counting and production, including fruit with varied degrees of overlap, light and foliar occlusion, shadow fruit, and size variation, among many others. In[10], the author Md Sohel , proposed a framework, in which they have dealt with five CNN models.With a precision of 97.34 percent, the InceptionV3 model is the most accurate. They photographed work in which deep learning-based applications are combined to create a classification for characterizing fruits. CNN, RNN, and LSTM operate together in this coordinated process. The

and testing performance of the model as much as possible during the fruit an vegetable analysis.5658 natural items in total for this study, divided into 10 categories. Dang Th Phuong Chung and Dinh Van Tai used deep learning to develop a fruit detection system in [11].

In [12], Horea MURESAN and Mihai Oltean worked on preparing a neural network to distinguish fruits.. In their paper, they used a convolutional neural network. The dataset was divided into two parts: one for preparation and one for testing. On each picture from the cluster they have applied some preprocessing in order to augment the data set. To improve the network's precision, they converted each photo from each cluster to grayscale and connected it to the picture. The author Tejaswini Ananthanarayana used CMOS Image Sensors and Edge Processors to manually detect fresh and rotten fruit in[13]. Using ON Semiconductor's 13 MP camera with AR1335 sensro, the model achieves a 97 percent accuracy. Sai Sudha Sonali, the author, recommended a model that aids in the representation of new and rotten fruits in [14]. They used three different fruits in this project: apple, banana, and oranges. The elements were extracted and various models and their accuracy were analyzed using a Convolutional Neural Network (CNN). On images downloaded from Kaggle, this model performs with an accuracy of 97.82 percent. The author Azizah contributes to the classification of rotten fruit items in [15]. It aids in determining the ripeness of the mango's outer layer. First and foremost, fruits are genuinely assembled, and researchers depict them as fine and deficient. Images are pre-processed and CNN is used for training. In [16], the author Jasman Parade proposed machine learning algorithms to create a model that can predict the fruit's development. The VGG16 without the top layer was used in this study to create a deep CNN with transfer learning. A Multi-layers Perceptron (MLP) block was used to replace the top layer of VGG16. [17] The collection contains 81,104 images of various food images, with 120 characterizations for each image of fruit and vegetable goods. Done in 5 epochs, each of which took roughly 20-25 minutes to complete. Harmandeep Singh, the author of [18], offered a proposed strategy's main goal is to encourage the use of fruit labels. In [19] paper, author Peng Zheng is intended to give an establishment on machine vision thoughts, a comprehension of object detection framework and a study of deep learning approaches for fruit image analysis on deep learning.

Literature Review

AUTHOR	MODEL	TECHNIQUE	LIMITATION	PERFORMANCE
Jasam pardede	VGG16	Using CNN and transfer learning together	Overfitting is not entirely eliminated.	The performance of dropout legalizers is 0.5.
James Nelson	Xception	The InceptionV3 model is connected at the bottom to two fully connected layers, but its dimensionality has been lowered from three to one.	The time spent obtaining accuracy is excessive	99 percent testing accuracy with a 1.8 percent lost value
Md.Sohel	NASANetmobile and other 4	For good accuracy, multiple CNN models are used.	Because of the low dataset accuracy is good	Accuracy (97.34%) from InceptionV3
Na Yao	L2MXception and seven other	Using L1 and L2 with models to increase accuracy	For all seven models, regularization with L2 and L2M was ineffective.	Xception with L2M, accuracy is 92.16%
Horea Mures	Deep belief network	Different network configurations are used to train the data set.	Some fruits are detected wrongly	Accuracy is more than 90%
Leonardo Josue	R-CNN and 3 others	Detecting apples using center-points labelling strategy	When apples are drawn down due to natural factors, the output is incorrect.	highest AP of 0.925.
Anand Koirala	ANN	Using image pre-processing and resolve detection	Increase in more train and test data resulted in difficulty in training	91.90 accuracy

Mohammed Faisal	VGG-19 and three others	Using four separate models to compare date detection	Less accuracy compared to other models	Maximum performance of 99.175% accuracy, 99.225% F1 score, 99.8%
Harmandeep	Cnn-Rnn-LSTM	Create a hierarchy of fruit image labels	Only one model used in this paper	0.98 using the proposed model.
Maryam Rahnemoonfar	Inception-ResNet	The network was trained using synthetic images and tested on real images	Not having real images for training.	For one hundred randomly picked genuine photos, we observed 91 percent accuracy.
R. Brunda-	Deep Alex Network	There are 11 processing layers and more than two crore trainable weights in this system.	Low classes are used and mobile application is not present	DAN is efficient with an accuracy of about 91%
Lin	MGNet	Accuracy is achieved by using a low-cost RGB-D sensor	The suggested approach was challenging to segment.	For the fruit class, the FCN model achieved a mean accuracy of 0.893 and an IOU of 0.806
Sai Sudha Sonali	MobileNet	To identify photos, the author used SoftMax.	Not Mentioned	97.82 percent accuracy
Liu Jian	R-FCN	Machine vision is linked with the deep learning algorithm.	This technique uses varied sizes of rectangular candidate boxes to calibrate the particular position of each different size fruit, which is not good for fruit edge recognition	The accuracy of the proposed technique for apple and orange in this study is increased by 0.71 percent and 0.33 percent dataset

Table 1.Different CNN models on fruit analysis

Author	Dataset	Ratio of training and testing /Images
M. Rahnemoonfar	To resemble a tomato plant, synthetic images with green and brown coloured circles were developed.	10
R.Bundra	The dataset is constructed synthetically by using white sheet paper as background.	5
M. Horea and M. Oltean	The visuals were created by recording the fruits as they revolved around a motor and then removing frames.	2
Sai Sudha	From Kaggle website	2
jasman parade	results of taking photographs with the camera	1120 images
james nelson	Using a Logitech C920 camera was utilized to video the fruits and vegetables.	2.9
Harmandeep Singh	Not mentioned in the paper	Not mentioned in the paper
Anand Koiralaa	Images includes selfie and pictures taken are from internet	5,300 pictures
Mohammed Faisal	Using cameras from two different angles	8079 images
Leonardo Josoé Biffi	Using Canon EOS—T6 camera	1.8
Nao yao	Prof. Luo's team collected data from peach orchards.	8

Table 2. Dataset Used by different authors

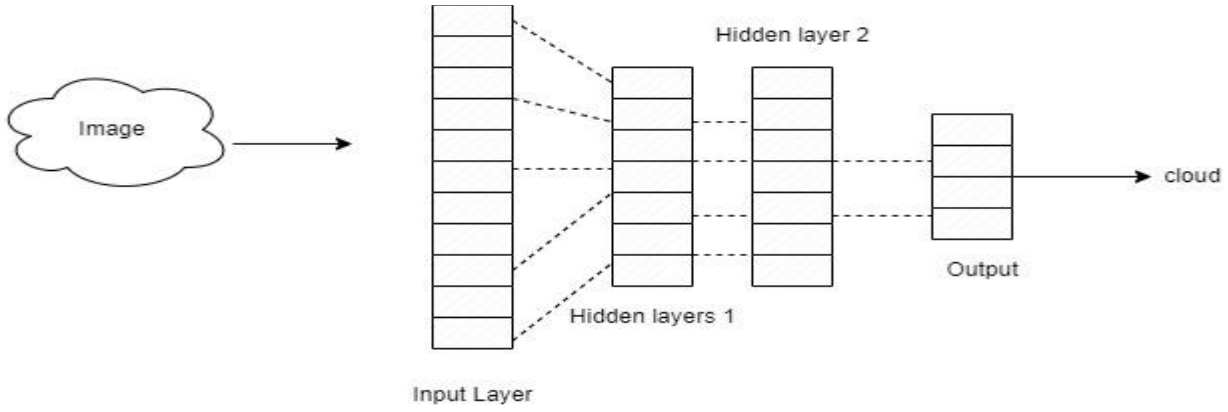

Figure 1 . Working of Deep Learning on fruit classification

Discussions

We present a complete study on the use of DL models in fruit identification . YOLO, Alex Net, MobileNet, and Xception were among the DL models used by the authors. When comparing all of the models, Xception has the most precision, followed by MobileNet.

Deep Learning models, with their multiple layer layouts, are very effective in separating convoluted data from input images. Convolutional neural networks are designed to cut estimation time by utilizing the GPU for processing, which is something that massive networks do not accomplish . In the vast majority of papers, at least two separate types of DL models are used and compared accuracy.

Limitations

1. A critical disadvantage that is observed from the above paper is that the algorithm requires immense datasets for preparation.
2. Deep learning models is a costly issue due to the complicated models. A portion of the
3. Can fail with an experiment on real images that are not present in the dataset. To elaborate, take a deep learning algorithm that is trained on the fact that school buses are yellow. But if in case the school buses are changed into blue then the model will not identify school buses.
4. If the CNN has many layers, then the training process takes a great deal of time.

Conclusion

This fruit system has numerous health benefits. People will be able to tell whether the fruit is bad or not. When comparing all of the different models for fruit recognition, CNN is the best model to utilize because it is accurate. On this fruit analysis system, different authors employed different methodologies. For testing and training purposes, we used photos from the Kaggle website and other websites. TensorFlow and Keras are the frameworks used in this paper.

time, they require more GPUs and many machines.

REFERENCES:

[1] M. Rahnemoonfar and C. Sheppard, "Deep count: fruit counting based on deep simulated learning," *Sensors*, vol. 17, no. 4, p. 905, 2017

[2] R.Bundra, Fruit Detection from Images and Displaying Its Nutrition Value Using Deep Alex Network

[3] Jia Yao ,Two-Stage Detection Algorithm for Kiwifruit Leaf Diseases Based on Deep Learning.

[4] Circular Fruit and Vegetable Classification Based on Optimized GoogLeNet.

[5] A Real-Time Apple Targets Detection Method for Picking Robot Based on Improved YOLOv5

[6] M. Horea and M. Oltean. "Fruit recognition from images using deep learning," Computer Vision and Pattern Recognition, vol. 17, no. 12, pp. 576–580, 2017.

[7]Sovon Chakraborty, F.M. Javed Mehedi Shamrat, Md. Masum Billah, Md. Al Jubair, Md. Alauddin, Rumesh Ranjan,"Implementation of Deep Learning Methods to Identify Rotten Fruits".

[8].Mehenag Khatun,Forhad Ali,Pritom Sarkar,Julker Nine," Fruits Classification using Convolutional neural network".

[9]Y. D. Zhang, Z. Dong, X. Chen, W. Jia, S. Du et al., "Image-based fruit category classification by 13-layer deep convolutional neural network and data augmentation," Multimedia Tools and Applications, vol. 78, no. 3, pp. 3613–3632, 2019.

[10] Md Sohel ,"An Advanced Method of Identification Fresh and Rotten Fruits using Different Convolutional Neural Networks."

[11] Dang Thi Phuong Chung and Dinh Van Tai ",A fruits recognition system based on a modern deep learning technique"

[12]Horea MURESAN and Mihai Oltean ,"Fruit recognition from images using deep learning"

[13]Tejaswini Ananthanarayana,Sean C. Kelly. "Deep Learning based Fruit Freshness Classification and Detection with CMOS Image sensors and Edge processors"

[14] Sai Sudha Sonali Palakodati | Venkata RamiReddy Chirra* | Yakobu Dasari | Suneetha Bulla ,"Fresh and Rotten Fruits Classification Using CNN and Transfer Learning"

[15] Azizah, L.M.R., Umayah, S.F., Riyadi, S., Damarjati, C., Utama, N.A. (2017).,"Deep learning implementation using convolutional neural network in mangosteen surface defect detection"

[16] Jasman parade ,"Implementation of Transfer Learning Using VGG16 on Fruit Ripeness Detectin"

[17] james nelson ,"Transfer Learning with Fruit Classification"

[18] Harmandeep Singh ",An integrated approach using CNN-RNN-LSTM for classification of fruit images "

[19] Zhong-Qiu Zhao, Member, IEEE, Peng Zheng, Shou-tao Xu, and Xindong Wu, Fellow,

[20]Ciocca, G., Napoletano, P., & Schettini, R. (2017). Food recognition: A new dataset, experiments, and results. IEEE Journal of Biomedical and Health Informatics

[21]I. Sa, Z. Ge, F. Dayoub, B. Upcroft, T. Perez & C. McCool, DeepFruits: A fruit detection system using deep neural networks, Sensors 16, 8 (2016)

[22] Lei Zhou, Chu Zhang, Fei Liu, Zhengjun Qiu , and Yong He ,Application of Deep Learning in Food: A Review

[23] Anand Koiralaa, Kerry B. Walsha, Zhenglin Wanga, Cheryl McCarthyb ,Deep learning – Method overview and review of use for fruit estimation

[24]Abadi, M., Agarwal, A., Barham, P., Brevdo, E., & Zheng, X. (2016).

[25]Ciocca, G., Napoletano, P., & Schettini, R. (2017). Food recognition: A new dataset, experiments, and results. IEEE Journal of Biomedical and Health Informatics

[26]Sa, I., Ge, Z., Dayoub, F., Upcroft, B., Perez, T., McCool, C., 2016. Deepfruits: a fruit based on deep neural network. In: ASABE 2018 Annual International Meeting

"Object Detection with Deep Learning: A Review."

[27]Zeiler, M.D., Fergus, R., 2014. Visualizing and Understanding Convolutional Networks, vol. 8689 LNCS

[28] Van Huy Pham & Byung Ryong Lee, An image segmentation approach for fruit defect detection using k-means clustering and graph-based algorithm

[29]LIN,Guava Detection and Pose Estimation Using a Low-Cost RGB-D Sensor in the Field

[30] Deep Learning and Computer Vision for Estimating Date Fruits Type, Maturity Level, and Weight MOHAMMED FAISAL

[31] Leonardo Josoé Biffi ,ATSS" Deep Learning-Based Approach to Detect Apple Fruits.