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Convolutional Neural Network for Leaf and citrus fruit disease identification using deep learning model

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Abstract *- Grouping of the different sorts of citrus organic products in light of their skin tone is an arduous errand and consumes a ton of time. An automated framework whenever prepared to arrange citrus organic products in light of their external skin tone, it would be of extraordinary assistance for the ventures that perform arranging and evaluating of the farming items.*

The target giving a viewpoint to the arrangement of seven various types of citrus leafy foods by a prepared computerized framework. The framework is prepared to such an extent that it would anticipate the biggest maker of the concerned citrus organic product on the planet and will likewise pass on a message containing the supplement worth or medical advantages of the particular citrus organic product.

The pre-prepared convolution brain network models like AlexNet and LeNet Architecture when retrained with a dataset of 2029 pictures gave us attainable outcomes. The exploratory outcomes as exactness and misfortune rate displayed in the charts approves the adequacy of the proposed methods.

Keywords : Citrus Fruits & Leaves Classification, Neural Network, Tensorflow

I. INTRODUCTION

Farming examination means to increment food creation and quality while bringing down costs and helping benefits. Natural product trees assume a significant part in any state's monetary turn of events. One of the most notable natural product plant species is the citrus plant, which is high in L-ascorbic acid.

Citrus organic products are known as agrumes, which generally signifies "harsh organic products". Most citrus natural products are from a little gathering of plants that are presumably gotten from around four species in Southeast Asia. The most widely recognized are oranges, grapefruits, tangerines, lemons, and limes. Citrus organic products contain many mixtures that can assist with keeping your heart sound. Their dissolvable fiber and flavonoids may assist with raising solid HDL cholesterol and lower unsafe LDL cholesterol and fatty substances. The natural products might bring down hypertension, another gamble factor for coronary illness.

Convolutional brain networks are profound learning calculations that are exceptionally strong for the picture handling is utilized to examination the leaf and natural product qualities. The rural area is a huge and new system for scientists in the field of PC vision today. Agribusiness' essential objective is to create a wide scope of important and significant harvests and plants. In cultivating, plant microorganisms lessen the sum and attributes of the item, so they should be controlled early.

As of late, rural analysts have zeroed in their endeavors on infections of different foods grown from the ground. The analysts concocted a few strategies for distinguishing and grouping infections in foods grown from the ground . Pre-handling and side effect division are finished utilizing an assortment of new strategies.

II. LITERATURE SURVEY

[1] The proposed CNN model extracts complementary discriminative features by integrating multiple layers. The CNN model was checked against many state-of-the-art deep learning models on the Citrus and Plant Village datasets. According to the experimental results, the CNN Model outperforms the competitors in a variety of measurement metrics. The CNN Model has a test accuracy of 94.55 percent, making it a valuable decision support tool for farmers looking to classify citrus fruit/leaf diseases.

[2] The use of deep-learning models (AlexNet, VggNet, ResNet) pre-trained on object categories (ImageNet) in applied texture classification problems such as plant disease detection tasks. The proposed method proves to be significantly more efficient in terms of processing times and discriminative power, being able to surpass traditional and end-to-end CNN-based methods and provide a solution also to the problem of the reduced datasets available for precision agriculture.

[3]A novel deep learning (DL) based citrus disease detection and classification model. A new DL based AlexNet architecture is employed for effective identification of diseases. The presented model involves four main processes namely pre-processing, segmentation, feature extraction, and classification.

[4]Agriculture has a major role in the economic development of our country. Productive growth and high yield production of fruits is essential and required for the agricultural industry. Application of image processing has helped agriculture to improve yield estimation, disease detection, fruit sorting, irrigation and maturity grading. Image processing techniques can be used to reduce the time consumption and has made it cost efficient. In this paper, we have provided a survey to address these challenges using image processing techniques.

[5] Machine learning based approach is presented for classifying and identifying 10 different fruit with a dataset that contains 6847 images use 4793 images for training, 1027 images for validation and 1027 images for testing. A deep learning technique that extensively applied to image recognition was used. We used 70% from image for training and 15% from image for validation 15% for testing. Our trained model achieved an accuracy of 100% on a held-out test set, demonstrating the feasibility of this approach.

[6] Deep convolutional-neural-network (CNN) models are implemented to identify and diagnose diseases in plants from their leaves, since CNNs have achieved impressive results in the field of machine vision. Standard CNN models require a large number of parameters and higher computation cost. In this paper, we replaced standard convolution with depth=separable convolution, which reduces the parameter number and computation cost. To evaluate the performance of the models, different parameters such as batch size, dropout, and different numbers of epochs were incorporated. In comparison with other deep-learning models, the implemented model achieved better performance in terms of accuracy and it required less training time

[7] The production of citrus fruits. Lemon, Oranges and Mosambi in India is around 13% in overall production of fruits. Wastage in post harvesting is around 20% of its production as they are not ripened. Non-climacteric fruits, once4 harvested, never ripen further.

[8] It is mainly focused on to increase yield wherein Agriculture the automatic methods for counting the number of fruits play a critical role in crop management. In this paper a review of previous studies and systems to count the number of fruits on trees and their yield estimation is performed. The various computer vision and optimization techniques are presented to automate the process of counting fruits. Further the main features and drawbacks of the previous systems in this area are summarized in this paper.

III. PROPOSED METHODOLOGIES

In the creation of organic products , they likewise get impacted by sickness which brings about diminished return and benefit. These days use of pesticides, composts and bug sprays , has raised .Even however utilizing them influences the tree involving them in perfect sum and when required is vital to note. For utilizing composts that have synthetic substances as well as for it are normally made to utilize excrement that. To make it understood, treating the patient without realizing the sickness will likewise bring about infection.

Subsequently, recognizable proof of illness of trees and plants are truly significant. So here mostly citrus natural products are made into center, as they are plentiful in Vitamin-C and furthermore has a few health advantages. One such essential to make reference to is that it keeps heart sound as they contain fiber and flavonoids might assist with raising solid HDL cholesterol and lower unsafe LDL cholesterol and fatty substances. And furthermore, they lower hypertension.

In the proposed framework, utilizing Convolutional Neural Network the infection of the Citrus natural product is recognized. In this organization model, the dataset is shipped off convolutional layers, pooling layers, and completely associated (FC) layers. For this undertaking we have utilized 2788 dataset from Kaggle to recognize 7 explicit infections of citrus organic product specifically, Canker, Greening, Healthy, Limon Corillo, Limon Mandarino, Mandarina Israeli, Mandarina Pieldesapo. To

group the citrus leafy foods. We wanted to configuration profound learning method so an individual with lesser aptitude in programming ought to likewise have the option to handily utilize it. The proposed framework to anticipating citrus foods grown from the ground. It makes sense of about the exploratory investigation of our procedure. Different number of pictures is gathered for every classification that was arranged into dataset pictures and info pictures. The essential credits of the picture are depended upon the shape and surface arranged highlights. The example screen captures show the citrus foods grown from the ground utilizing TensorFlow model. Exactness we got is 98%.

ADVANTAGES

In the proposed structure, utilizing Convolutional Neural This for the most part centers around expanding throughput and decreasing emotion emerging from human specialists in recognizing the citrus natural products and leaf. And furthermore carried out multiple Architectures for getting more exactness.

In this we are conveying in a page utilizing python's Django structure. Subsequently it would be more proficient to utilize.

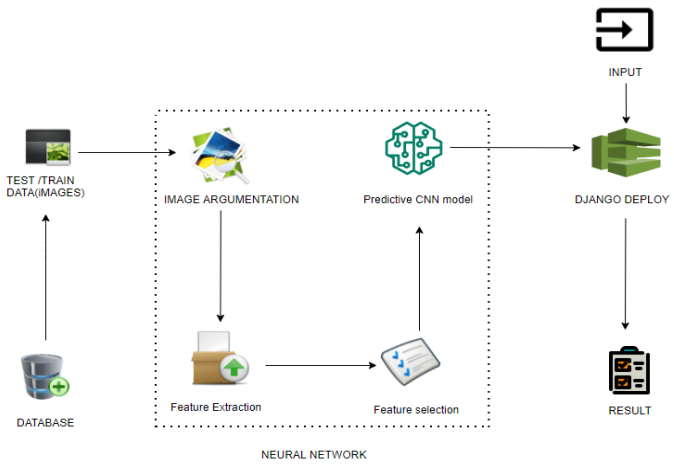
In this work, we have involved CNN calculation as contrasted and past fake organization technique profound learning is more exact in acknowledgment and picture arrangement.

PROBLEM IDENTIFICATION

The objective is to recognize the illness of the citrus plant with more accuracy.Earlier in the business related to this, they have executed it utilizing a solitary calculation and architecture.We utilized 2 engineering in particular AlexNet and LeNet structure to obtain results more exact.

To recognize the sickness we really want more number of dataset, yet we dint have enough dataset to prepare the model.Hence we wound up looking and catching pictures of them and uploading them.

IV. ARCHITECTURE DIAGRAM



In the above diagram, initially we collect data and store it. Then we test and train the data, next it is sent to image augmentation section where the images undergo process like flip , flop, rotate etc. in order to get accurate results. Once the image gets augmented, from that its feature gets extracted and the required feature are selected and used for evaluating.

Now comes the important part of the project, where the CNN algorithm gets implemented. By using CNN algorithm, the image gets passed through four layers [2]. From this we can classify the disease and identify. Now the model is completely ready to get deployed. Finally the input from the users are obtained and then processed and evaluated. From the processing and evaluating, output is obtained.

V. MODULES

MANUAL NET

✓ **Import the given image from dataset:**

Need to import our informational index utilizing keras preprocessing picture information generator work likewise we make size, rescale, range, zoom range, level flip. Then we import our picture dataset from organizer through the information generator work. Here we set train, test, and approval additionally we set target size, group size and class-mode from this capacity we need to prepare utilizing our own made organization by adding layers of CNN.

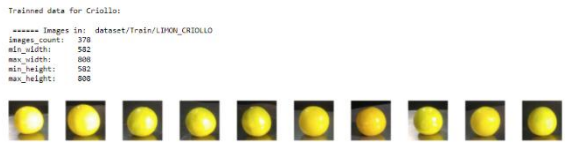
Diseases are:

CANKER

GREENING

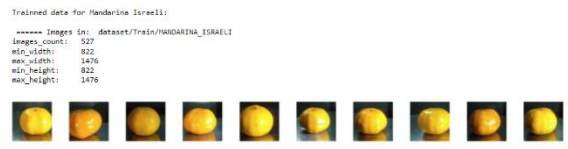
HEALTHY

LIMON CRIOLLO



LIMON MANDARINO

MANDARINA ISRAELI



MANDARINA PIELDESAPO

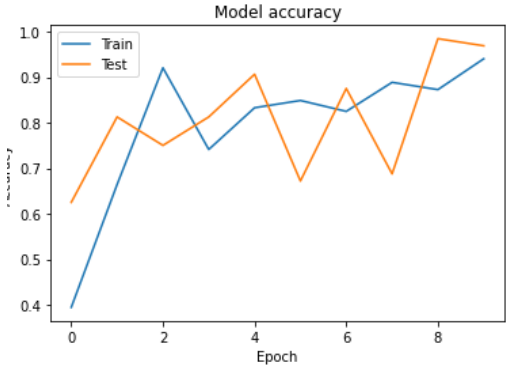
✓ **To train the module by given image dataset**

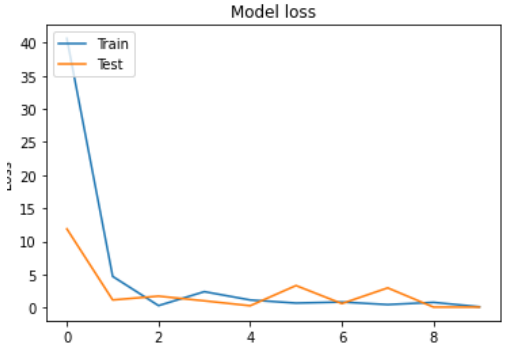
To prepare our dataset utilizing classifier and fit generator work additionally we make preparing steps per age's then absolute number of ages, approval information and approval steps utilizing this information we can prepare our dataset.

```
Epoch 1/10
8/8 [==============================] - 92s 11s/step - loss: 40.6297 - accuracy: 0.3944 - val_loss: 11.8876 - val_accuracy: 0.62
50
Epoch 2/10
8/8 [==============================] - 85s 11s/step - loss: 4.7086 - accuracy: 0.6641 - val_loss: 1.1567 - val_accuracy: 0.8125
Epoch 3/10
8/8 [==============================] - 82s 11s/step - loss: 0.2997 - accuracy: 0.9203 - val_loss: 1.7294 - val_accuracy: 0.7500
Epoch 4/10
8/8 [==============================] - 87s 11s/step - loss: 2.4066 - accuracy: 0.7410 - val_loss: 1.0218 - val_accuracy: 0.8125
Epoch 5/10
8/8 [==============================] - 81s 10s/step - loss: 1.1518 - accuracy: 0.8327 - val_loss: 0.2818 - val_accuracy: 0.9062
Epoch 6/10
8/8 [==============================] - 77s 10s/step - loss: 0.6843 - accuracy: 0.8486 - val_loss: 3.3290 - val_accuracy: 0.6719
Epoch 7/10
8/8 [==============================] - 78s 10s/step - loss: 0.8407 - accuracy: 0.8247 - val_loss: 0.6063 - val_accuracy: 0.8750
Epoch 8/10
8/8 [==============================] - 77s 10s/step - loss: 0.4545 - accuracy: 0.8884 - val_loss: 2.9757 - val_accuracy: 0.6875
Epoch 9/10
8/8 [==============================] - 79s 10s/step - loss: 0.7911 - accuracy: 0.8725 - val_loss: 0.0752 - val_accuracy: 0.9844
Epoch 10/10
8/8 [==============================] - 76s 10s/step - loss: 0.1244 - accuracy: 0.9402 - val_loss: 0.0776 - val_accuracy: 0.9688
```

✓ **Working process of layers in CNN model**

A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other.





The pre-taking care of expected in a ConvNet is a great deal of lower when diverged from other portrayal estimations. While in rough methods channels are hand-planned, with enough arrangement, ConvNets can get comfortable with these channels/ascribes. The plan of a ConvNet is basically identical to that of the accessibility illustration of Neurons in the Human Brain and was charged up by the relationship of the Visual Cortex. Individual neurons answer supports simply in a restricted region of the visual field known as the Receptive Field. Their association involves four layers with 1,024 information units, 256 units in the essential mystery layer, eight units in the subsequent mystery layer, and two outcome units.

ALEXNET

AlexNet is the name of a convolutional brain network which generally affects the field of AI, explicitly in the utilization of profound figuring out how to machine vision. AlexNet was the first convolutional network .

AlexNet engineering comprises of 5 convolutional layers, 3 max-pooling layers, 2 standardization layers, 2 completely associated layers, and 1 SoftMax layer. Each convolutional layer comprises of convolutional channels and a nonlinear initiation work ReLU. The pooling layers are utilized to perform max pooling.

Convolutional layers

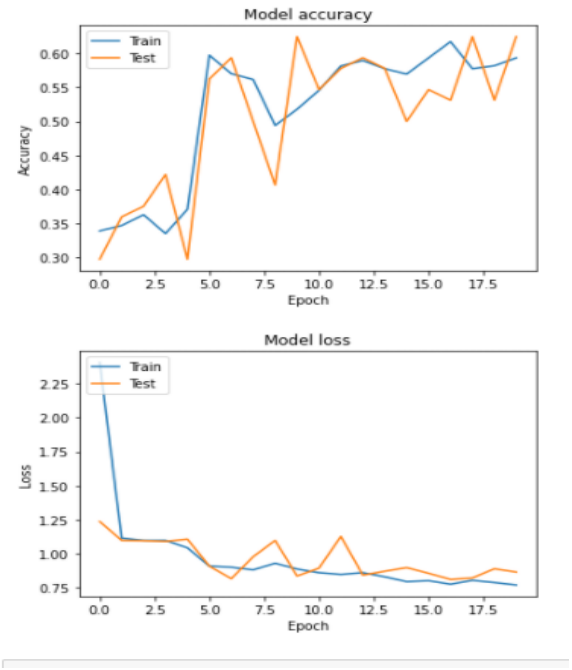
Convolutional layers are the layers where filters are applied to the original image, or to other feature maps in a deep CNN. This is where most of the user-specified parameters are in the network. The most important parameters are the number of kernels and the size of the kernels.

Pooling layers

Pooling layers are like convolutional layers, yet they fill a particular role, for example, max pooling, which takes the greatest worth in a specific channel district, or normal pooling, which takes the typical worth in a channel area. These are regularly used to lessen the dimensionality of the organization.

Dense or Fully connected layers

Fully connected layers are put before the characterization result of a CNN and are utilized to straighten the outcomes before arrangement. This is like the result layer of a MLP.



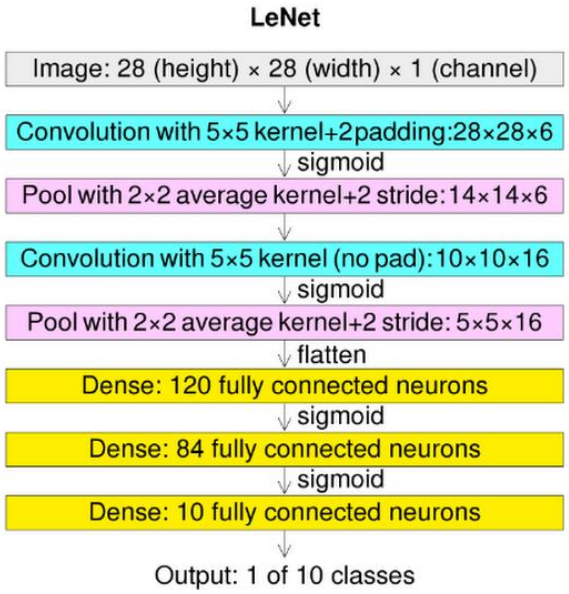
LENET

LeNet was one among the earliest convolutional brain networks which advanced the occasion of profound learning. After innumerous long periods of investigation and a lot of convincing emphasess, the final product was named LeNet..

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 83, 83, 32)        896
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 41, 41, 32)        0
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 13, 13, 128)       36992
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 6, 6, 128)         0
_________________________________________________________________
flatten (Flatten)            (None, 4608)              0
_________________________________________________________________
dense (Dense)                (None, 256)               1179904
_________________________________________________________________
dense_1 (Dense)              (None, 3)                 771
=================================================================
Total params: 1,218,563
Trainable params: 1,218,563
Non-trainable params: 0
_________________________________________________________________
```

Architecture of LeNet-5:

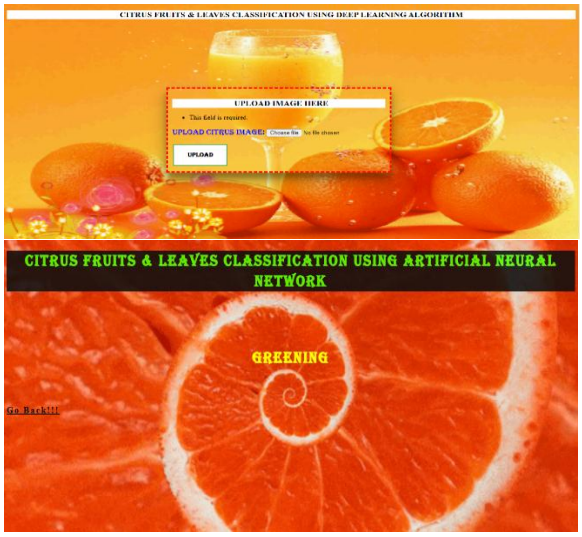
LeNet-5 CNN design is comprised of 7 layers. The layer organization comprises of 3 convolutional layers, 2 subsampling layers and 2 completely associated layers.



DEPLOY

Conveying the model in Django Framework and anticipating yield

In this module the prepared profound learning model is changed over into progressive information design document (.h5 record) which is then sent in our Django system for giving better UI and foreseeing the result whether the given RGB pictures is CANKER/GREENING/HEALTHY/LIMON CRIOLLO/LIMON MANDARINO/MANDARINA ISRAELI/MANDARINA PIELDESAPO.



Django

Django is a critical level Python web system that empowers quick advancement of secure and viable sites. Worked by experienced engineers, Django deals with a large part of the issue of web advancement, so you can focus in on making your application without hoping to reiterate an all around tackled issue.It is free and open source, has a flourishing and dynamic local area, extraordinary documentation, and numerous choices for nothing and paid-for help

VI. Conclusion

In this venture, an examination to group Citrus Fruits and Leaf Classification over static pictures it was created to utilize profound learning procedures. This is a perplexing issue that has previously been moved toward a few times with various procedures. While great outcomes have been accomplished utilizing highlight designing, this task zeroed in on include realizing, which is one of DL guarantees. While highlight designing isn't required, picture pre-handling supports arrangement accuracy. Henceforth, it decreases commotion on the information. These days, Agriculture based AI Citrus natural products and leaf incorporates is vigorously required. The arrangement completely founded on highlight learning doesn't appear to be close yet a direct result of a significant restriction. Hence, Citrus organic products and leaf characterization could be accomplished through profound learning methods.

Future Work

Executing the Citrus Fruits and Leaf in a continuous environment. To robotize this interaction by show the forecast bring about web application or work area application. To enhance the work to carry out in Artificial Intelligence climate.

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