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LEAF DISEASE DETECTION

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1. Abstract :

Leaf Disease detection uses that can determine which leaves or plants are afflicted with a disease and then providing the best way to treat the condition, giving us a suitable treatment that we can employ as a defence mechanism against the disease. An important sector of the economy in many emerging countries is agriculture. Therefore, in order to stop significant plant loss, it becomes crucial to identify diseased plant leaves and classify them. Farmers' losses can be prevented with quicker and more accurate responses. To identify the type of sickness, follow these four steps: preprocessing of images, feature extraction, categorization, and diagnosis CNN, or Convolution Neural Network. To overcome this problem early complaint identification, bracket and discovery is needed. lately, deep literacy is veritably popular object recognition and discovery. complication Neural Network id part of deep literacy which is extensively used in object discovery part. In these different infrastructures of complication Neural Network are used. by applying convolutional neural networks(CNNs) familiar with some of the notorious infrastructures, specially the" ResNet" armature, using a stoked dataset containing images of healthy and diseased leaves (each splint is manually cut and placed on a invariant background) with respectable delicacy rates in the exploration terrain. This Deep literacy fashion has shown veritably good performance for colorful object discovery problems. The model fulfills its part by classifying images into two orders(complaint-free) and diseased). According to the results attained, the developed system achieves better discovery performances than those proposed in the state of the art.

2. Introduction :

Approximately 72% of Indians are employed in agriculture. It's critical to identify plant diseases in order to minimise yield losses. Manually observing plant diseases is very tough. It also requires a significant amount of time and a great deal of effort and knowledge about plant diseases. Therefore, plant disease detection can be accomplished through the use of image processing and machine learning models. In this project, we have outlined the method for using photos of the plants' leaves to identify plant illnesses. A subfield of signal processing called image processing is responsible for extracting valuable information or attributes from images.
Machine learning is a sub part of artificial intelligence which works automatically or give instructions to do a particular task in moment’s period, Deep Learning had come the most precise result for the complaint discovery in factory. The infected leaves are collected and also labelled according to complaint. The labelled images are farther converted to pixels for further information. Neural network models automatically classify images into classes using automatic point birth. After point birth, optimal subset of point is named and also one of the bracket ways are applied. The disquisition of a" Deep Learning" approach for agrarian uses has boosted in exploration and opens the door to new uses and earnings performance compared to current styles. Especially, "Deep Learning" is employed to ascertain the emergence of traits in a synthetic manner and to provide a lucid finding on a suggested data set. The purpose of this system is to improve performance and lower the memory footmark.

In general," CNN" is the stylish system for any vaticination problem involving input image dataand requires minimum pre-processing. It's structured to classify large- scale images in this environment, severalexploration workshops have been carried out to ameliorate the performance of" CNN" on tasks related to computer vision, due to the discovery of factory conditions. Advances in" CNN" can be classified in different ways, including activation, loss function, data improvement, optimization algorithms.

3. Dataset

In this work, intimately available New Plant conditions Dataset is used. This dataset consists of about 87K rgbimages of healthy and diseased crop leaves which is distributed into 38 different classes. The total dataset is divided into 80/20 rate of training and confirmation set conserving the directory structure. A new directory containing 33 test images is created latterly for vaticination purpose.

4. Proposed Methodology

A CNN convolutional neural network is maybe the most extensively usable system for rooting reasonable information from huge datasets. The armature of CNN is illustrated in Figure 1, which allows effective processing of image data. A deep CNN armature consists of several layers of different types. Generally, it begins with one or further convolutional layers followed by one or further grouping layers, activation layers, and ends with one or further completely connected layers. In the complication subcaste, the complication operation is performed to excerpt features, and the affair is passed to the activation function. As long as, the clustering subcaste is generally used to reduce the size of the point chart and provides robust literacy results for the input data. The complication and pooling layers are also passed through in several ways to gain global features from the input data. Eventually, the uprooted characteristics are passed to the completely connected subcaste where bracket is performed in this subcaste. The typical feature engineering machine learning difficulty has been lessened by the potent machine learning technique known as deep learning. Deep learning deserves all the credit, and domain expertise is no longer required. Artificial neural network (ANN) is the central component of deep learning. Artificial neural networks are mathematical representations of the main principles of brain function, complete with neurons and synapses to connect them. TensorFlow is one of the most widely used libraries for neural network implementation.

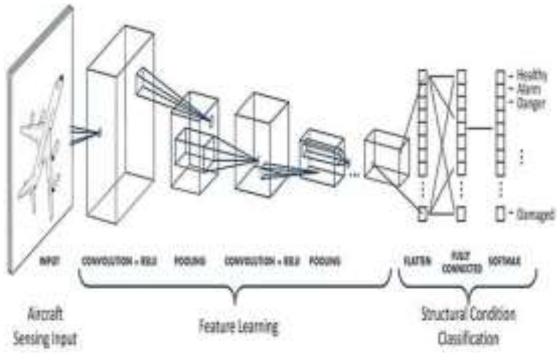


Figure 1. CNN Architecture

CNN architectures have changed over time as a result of academics constant efforts to enhance performance and efficiency through the development of a new architectures and design methodologies. AlexNet, VGGNet, GoogLeNet, ResNet, and, more recently, models like Efficient Net and Transformer-based architectures for vision tasks are notable CNN architectures. CNNs' capacity to automatically learn hierarchical data representations is one of its main features. CNNs may generate excellent predictions on unobserved examples by learning to extract pertinent features from raw input data through training on huge datasets.Training a CNN involves optimizing its parameters (weights and biases) to minimize a predefined loss function. This is typically done using gradient-based optimization techniques such as stochastic gradient descent (SGD) and its variants. Backpropagation, a technique for efficiently computing gradients, is used to update the parameters in the direction that reduces the loss. Pretrained CNN models, which have been trained on large datasets such as ImageNet, are often used as starting points for specific tasks. By fine-tuning these pretrained models on smaller datasets or custom tasks, practitioners can leverage the features learned by the CNNs while adapting them to their specific requirements Convolutional layers are the core building blocks of CNNs. In these layers, small filters (also called kernels) slide over the input data, performing element-wise multiplication and summation to produce feature maps. These feature maps capture different aspects of the input data, such as edges textures and,shapes.

The convolutional neural network uses a special mathematical operation called convolution instead of matrix multiplication in at least one of its layers. It is officially formed by a stack of layers. The convolution layer (CONV) which processes the data of a receiver field. The pooling layer (POOL); which compresses the information by reducing the size of the intermediate image. The correction layer (Relu), with reference to the activation function (Linear Rectification Unit). The Fully Connected Layer (FC), which is a perceptron-type layer. during the learning process. The input image is pre-processed and fed to the ensemble of the five trained models. The model outputs are fed into a decision layer that gives the final prediction. By introducing skip connections, ResNet effectively addresses the vanishing gradients problem and enables the training of extremely deep networks with hundreds or even thousands of layers.

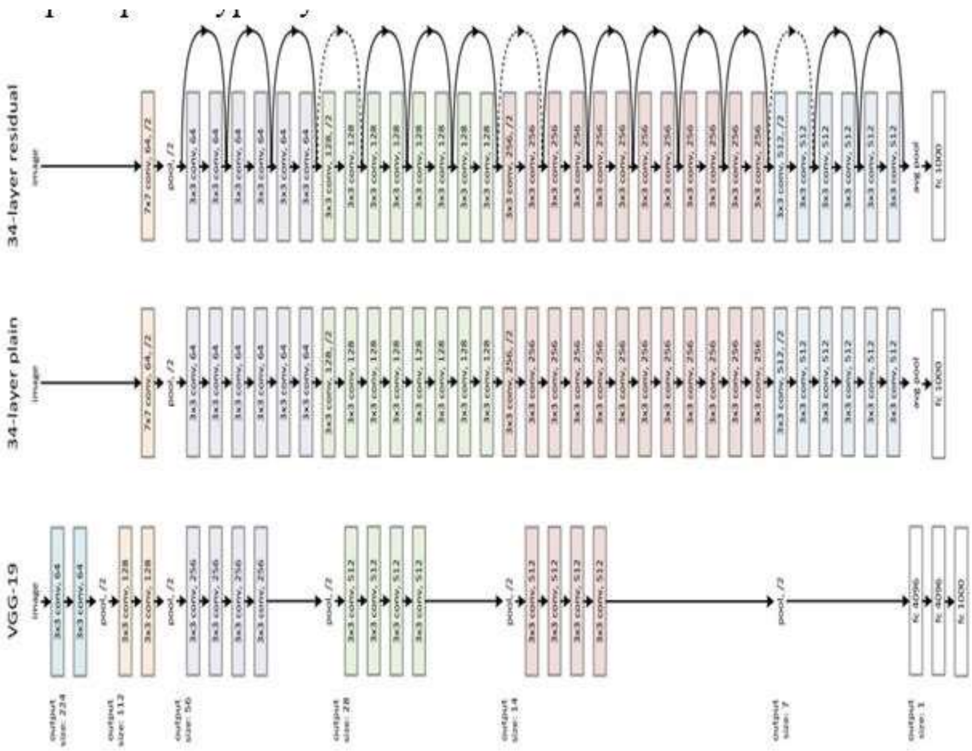


Figure 2. ResNet Architecture

Training step: Allows you to set the initial weight to enter to the hidden layer. This step consists of two processes, namely feedback and retro-propagation. The pre-processed image dataset is now used to train CNNand ResNet separately. As all these are pre-trained models, we had to train them using transfer learning. We have selected pre-trained models as our dataset size was not sufficient to train an entire CNN from scratchfor desirable results. Instead, we use the trained models convolution and max-pooling layers as feature extractors which were used to train the fully connected layers ahead. The dense layers were used along with Relu activation layers and a SoftMax layer at the end to convert the features to the required output. Testing step :It is a classification process using the weights obtained

This depth enables the network to learn highly abstract and hierarchical representations of the input data, leading to state-of-the-art performance on various computer vision tasks, including image classification, object detection, and semantic segmentation. Since its introduction, the ResNet architecture has become a cornerstone in the field of deep learning and has inspired numerous subsequent architectures and research developments. Its impact extends beyond computer vision, with applications in domains such as natural language processing, speech recognition, and reinforcement learning. Overall, ResNet represents a major advancement in the design and training of deep neural networks.

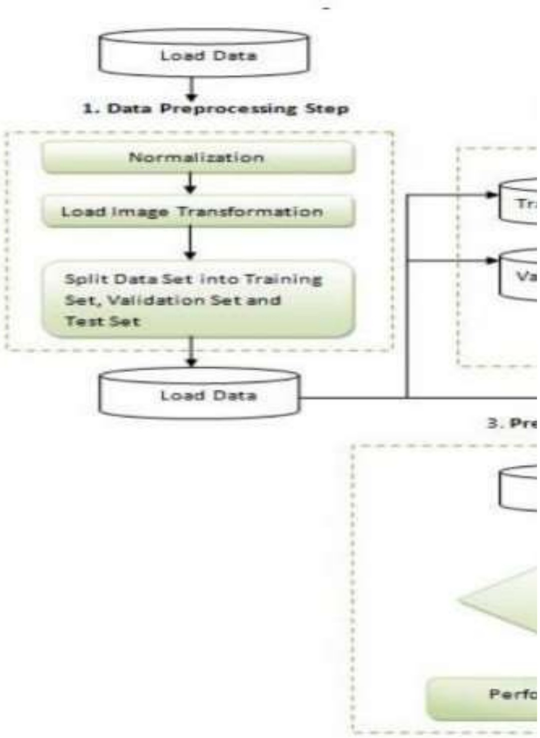


Figure 3. Flow chart

5. Result & Discussion

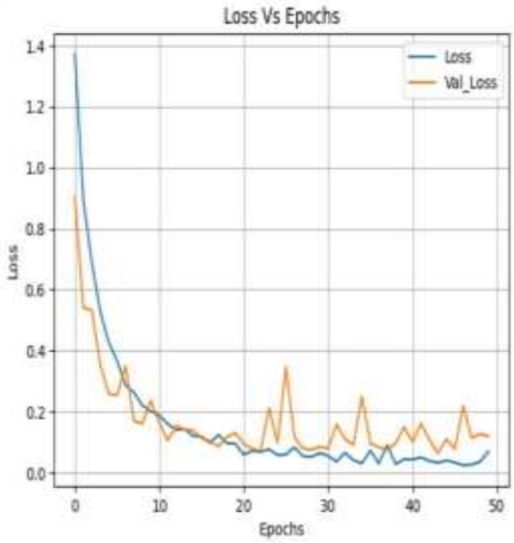
MODEL	TRAINING ACCURACY	VALIDATION ACCURACY	VALIDATION LOSS
CNN	0.96623	9434	0.285
ResNet	0.985	0.9634	0.1551

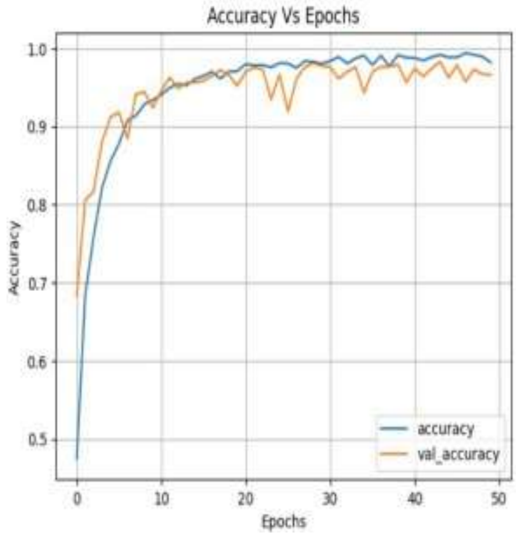
In the above table the accuracy difference between convolutional neural network and residual neural networkis mentioned clearly .since we came to a conclusion saying that residual neural network obtains higher accuracy than CNN ,we are going to use different optimizer in ResNet.

OPTIMIZER	TRAINING ACCURACY	VALIDATION ACCURACY	VALIDATION LOSS
Adam	0.9853	0.9634	0.1551
SGD	0.9901	0.9763	0.1243

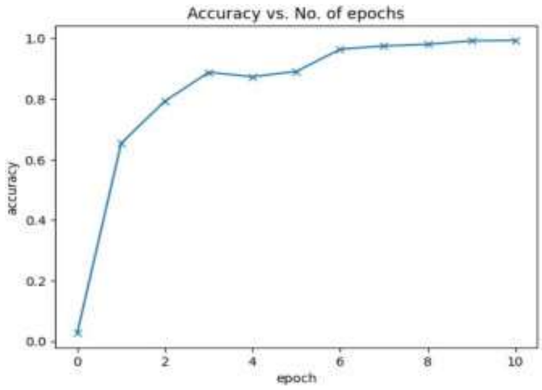
6. Output

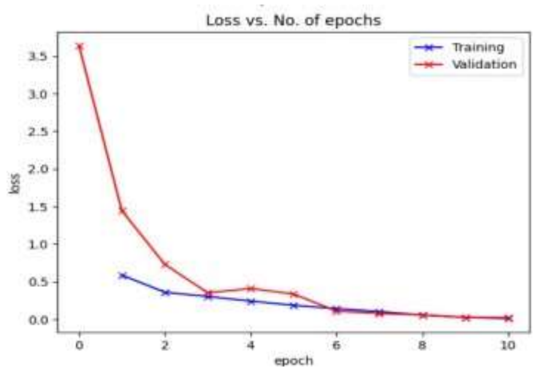
A. CNN*:*



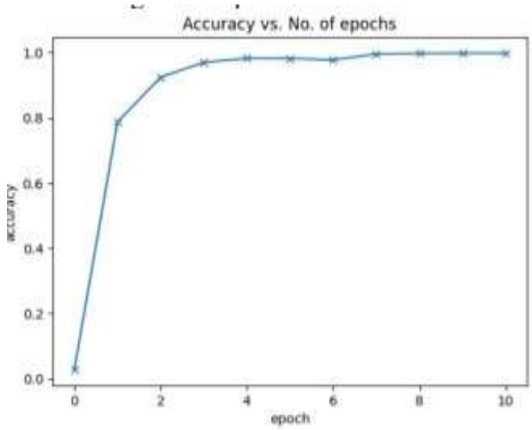


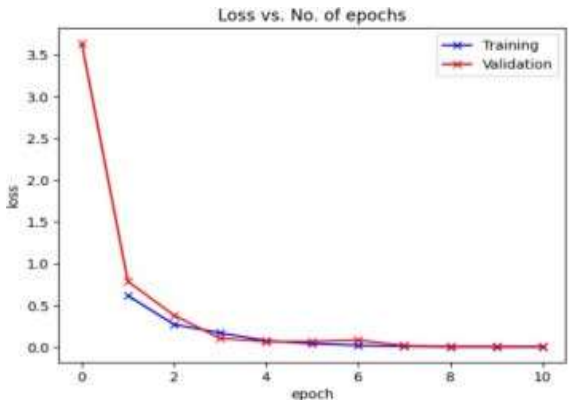
B . Resnet using Adam Optimizer:





C. ResNet using SGD Optimizer :





7. CONCLUSIONS

In this design we've successfully classified the images of Identification of Plant Leaf conditions Bracket, are moreover affected with the Plant Leaf conditions using the deep literacy. Then, we've considered the dataset of Plant Leaf conditions Bracket images which will be of different types and different shops(healthy or unhealthy) and trained using, CNN along with some Resnet(different optimizers) literacy system. After the training we've tested by uploading the image and classified it.

This can be utilized in future to classify the types of different Diseases easily that which can tend to easy to Predicated the treatment for plant in early stages and can take the initial curing of plants and take measures tonot affect other plants.

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