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Image Processing for Crop Yield Classification

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Abstract: ***Crop yield classification and identification is an important task as it helps to differentiate between the qualities of the crop yield. The current manual method of examination is very cumbersome and moreover this method also takes a lot time and is rather not accurate. To overcome this challenge and for rather accurate results we will be implementing convolution neural network for the identification of the crop types. Now convolution neural network reduces the error to about 0.23 when applied on the identification of crops types from the given data set. Convolution neural network demonstrates the ability to spot crop from a wide range of angles, including upside down, even when partially occluded with competitive performance. So as to reduce the error even further we will be using advanced Image processing techniques to produce multiple images from a single image. This technique is known as Image dataset generation and is highly popular in data science community because of the large number of dataset required in training of the convolution neural network. This also challenges the basic concept of convolution neural network and hence it helps in applying knowledge to a wider field.***

Keywords: convolution neural network, data science, image data set regeneration

1. Introduction

This is basically a research based project where we will be using image processing technique for crop yield classification. Crop yield classification is very important in farms as it helps us know beforehand the proper outcome of the crop. What kind of crop is being produced as well as the variety of the crops. This is very beneficial for the farmers as it helps them know beforehand the crop produce so that the future planning can be made accordingly. This also helps the farmers in setting the rate of the crop accordingly. It also helps them in choosing the potential market and customer so that it helps them in getting good value for their product. This is also very useful for the packaging industry as it can help them in minimizing the packaging cost as well as choosing a suitable method for transportation and storage so that no produce is spoilt.

The techniques that are being used now are cumbersome and not so accurate. There has been acute need to come up with a methodology that was very advanced, that would require minimum number of data, which was very accurate, that was very fast. So to overcome this problem we come up with a research based project which aims at using minimum data and getting the most accurate result in a very quick span of time. Here we will be using an advanced image processing technique known as image data set generation which produces multiple images from a single image. These multiple images will be used to train the convolution neural network. Using this technique we have attained accuracy of 99 per cent. Thus this method is hence very reliable.

Image processing is one of the most interesting field of computer science. It aims on actually improving the reception around you as well providing products for laymen use. Thus increasing accessibility to everyone around you. Image processing has been increasingly used in many disciplines. Thus its applicability is immense. The image processing technique used here is dataset regeneration. It is a pretty advanced technique which generates multiple images from a single image. This is done so by using functions such as rotation, shearing, convolution etc. These images are then used for training the convolution network, this is a neural network which provides maximum accuracy. Thus in all, these two technique can provide optimum results and can be at utmost use for the farmers.

The aim of this research paper is to basically use convolution neural network for identification of crop types. Here we will be using an advanced image processing technique known as image dataset regeneration. In this project we aim to provide maximum efficiency for the dataset that is being entered. Thus this project aims at accuracy of the result. We also keep on changing the fixed constraints on the neural network so that the constrains are not fixed as well as there is more accuracy of the result. Thus reducing the redundancy of the result.

This also aims to help the farmer so that correct classification of the produce is done so that maximum profit is attained by the farmer. It also helps in packaging industry, where they use this data to get the details before hand so that proper efficient packing as well as proper storage can be arranged for the same.

This paper uses a very advanced concept of image processing that is the image dataset regeneration. We will be using advanced Image processing techniques to produce multiple images from a single image. This technique is known as Image dataset generation and is highly popular in Data Science community because of the large number of dataset required in training of the CONV net. We will be using advanced Image processing techniques to produce multiple images from a single image. This technique is known as Image dataset generation and is highly popular in Data Science

community because of the large number of dataset required in training of the CONV net. In machine taking in, a convolution neural system (CNN, or ConvNet) is a class of profound, bolster forward manufactured neural systems that has effectively been connected to investigating visual symbolism.

Our general research objective is to configuration, create, and convey a computerized framework for fast and exact crop yield classification. The framework diminishes work force, furthermore, builds work productivity by applying PC vision-based, quick information securing. In the interim, it enhances forecast exactness by depending on a large-scale information securing. At this phase of the exploration, we center around two particular targets:

(1) Create framework equipment and significant calculation modules for information procurement also, yield classification;
(2) Lead preparatory execution tests in a plantation.

2. Related Works

Cultivators want a mechanized framework to lead exact harvest yield estimation;

In any case, there are no off-the-rack apparatuses serving this need. Scientists have been taking a shot at the advancement of related innovations for a couple of decades.

1. An uncontrollably embraced answer for computerized natural product yield estimation is to utilize PC vision to distinguish and tally natural product on trees. Swanson et al.
2. Created PC vision frameworks to evaluate the product yield of produce individually. Notwithstanding, there is no detailed research prompting palatable yield estimation crops.

Current endeavours on Macintosh yield estimation utilizing PC vision can be grouped in two classifications:

1. Estimation by checking crops and
2. Estimation by identifying bloom thickness. A couple of analysts have taken a shot at the principal class utilizing shading pictures, hyperspectral pictures and warm pictures. Their normal point is that they just manage crop identification from a solitary or numerous plantation scenes; be that as it may, no further research is accounted for about yield estimation, which requires constant discovery and checking. Taken a shot at the second class. They tested pictures of blossoming trees from a crop plantation, and found a relationship between blossom thickness and harvest yield.

Be that as it may, this bloom thickness based technique isn't exact in light of the fact that different eccentric factors, (for example, climate conditions) amid the long stretch between blossom and collect could influence the connection to shift step by step.

When directing the Mac checking based yield estimation, PC vision frameworks confront three difficulties because of the qualities of plantation situations:

- Challenge 1: fluctuation in common brightening. It keeps from building up a solid vision-based technique to recognize crop from a plantation scene.
- Challenge 2: organic product impediment caused by foliage, branches, and other natural product.
- Challenge 3: various identifications of same apple in successive pictures. Unsuccessful enlistment of these identifications will cause miscalculating.

Our general research objective is to configuration, create, and send a computerized framework for quick and precise crop yield classification. The framework decreases work power, also, expands work effectiveness by applying PC vision-based, quick information securing. In the meantime, it enhances expectation precision by depending on a large scale information securing.

At this phase of the examination, we center around two particular destinations:

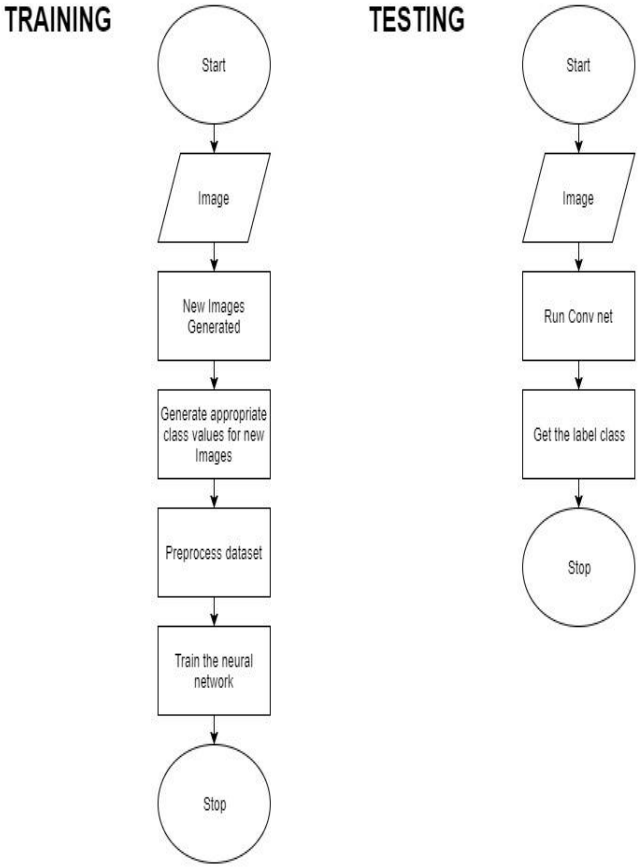
1. Create framework equipment and significant calculation modules for information obtaining what's more, yield estimation;
2. Lead preparatory execution tests in a plantation.

3. Methodology

The system that is been used now for crop yield classification is very cumbersome and tiresome. It unnecessarily uses a lot of data. The results provided by the system are also not accurate and moreover the technology that is being used now is totally outdated. Thus the system that we have introduced tries to overcome this problem. The system makes the used of an advanced image processing technique known as image data set regeneration. Image data set regeneration takes in an image and then generates multiple images from this one image. This regeneration of images is done by using various functions such as rotate, shift and shear. These functions help in creating multiple images out of a single image. By this technique about 500 images are created from a single image. Now these images are used to train neural network. Here we are using convolution neural network. This network takes in the data at hand and then trains the network. We have made the network such that the constraints in the network are kept varying. This helps in reducing the redundancy. The complete code is done on IPython framework using Python2.7. The compilation time is thus minimum.

This project is highly aimed toward Image processing hence we will be using the Image Processing frameworks present along with some Data Science frameworks. The complete code is done on IPython framework using Python2.7. The Image processing libraries used are PIL/PILLOW and Keras. Image (for the new image generation). Before training the neural network we need to produce new images from the existing dataset. We need these extra images so that we can avoid the convolution

net from over fitting. These new generated dataset can be now used to train our Neural Network. The created machine is capable of identifying crop and the most important part is that using advanced Image Processing techniques we were able to achieve this a small initial database of images.



4. Experimental Setup

The images of any crop can be trained on this network. But there are a few hardware as well as software requirement that the system has:

H/W Requirements (details about Application Specific Hardware):

- Processor i3,
- 4Gb RAM,
- 2Gb graphic card,
- Installed libraries – PIL numpy pandas keras sklearn numpy tensorflow h5py.
- Required environments: Ipython, python 2.7 ,
- UNIX based OS.

S/W Requirements (details about Application Specific Software):

- K-20 GPU enabled EC2,
- S3 Bucket for image uploads,
- Python compatible environment (python2.7+) for training the convolution network.

5. Results and Discussion

Till now we have successfully generated new images from the old images using image data regeneration.

We start with the top image and generate multiple images via python code from it using image processing via randomization of features like zoom, rotation, ZCA whitening etc.

This means that we are tackling the biggest problem of convolution network i.e. we will not need a large initial database of images to train convolution network.

We use these images to train the convolution network.

Thus the results generated by convolution network using these images is very accurate as verified by the test cases and results.

Apple has been detected.

Mango has been detected.


Potato has been detected.


Tomato has been detected.


Wheat has been detected.

6. Coclusions, Limitations and Future Scope

The system-"Image processing for crop yield classification" is very appropriate for detection of the crop type in a given field. The earlier methods devised are very tedious and not accurate. Thus we are successful in overcoming this problem

As one can imagine that this project is one where we are challenging one of the core problems of Convolution Neural networks that the initial database needs to be huge, hence this project required me to learn about the present techniques being used.

These techniques are highly computationally and storage exhaustive and hence need good hardware. Also coding for these problems is tedious because of very few help available.

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