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Tree Counting and Detection Automation using CNN

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***Abstract*—In this paper we propose a supervised machine learning algorithm for calculating tree count and tracking palms in high resolution images. CNN image classifier trained on a set of images of palms and not-palm images are applied to the image by using algorithm of sliding window. The resulting consistency map is smoothened by a filter uniformly. Suppression which is non maximum is applied to the smoothened consistency map from which peaks are obtained. Trained with the images of palm trees the system manages to reach the number of trees.**

***Keywords*—CNN, Palm tree counting, Image Processing**

I. INTRODUCTION

The assignment of computerized palm tree detection is also similarly complicated with the aid of the truth that palm tree plantations range wildly in density and spatial association. Localization is the baseline for further evaluation paintings like yield prediction and estimating fertilizer finances. Palm tree localization the usage of photographs is not a broadly-studied trouble. The traditional method is to set up workers to plantations to manually remember trees .

Taking aerial photographs is challenging and also difficulty of crop and field management. The above challenges mention above are a greater concern in the areas of agriculture field because of the presence of the so many trees and inefficient humanly tree counting one by one .

Challenges are difficult when we have to locate palm trees on the surface of the earth. This makes the work of administration department very difficult gives inadequate tree data for the advanced experts in agriculture. For this reason, They give a advanced amd sophisticated framework which helps to make an stock of crowns of the trees through automation of counting and geolocating them using aerial color photographs .

II. LITERATURE REVIEW

1.

[4] used a way to come across palm tree crowns in aerial pictures with high accuracy. using a semi-variogram analysis, they They're able to hit upon window length without hand-engineered numbers. but, their method is best powerful on spatially nicely arranged palm timber without a overlapping of tree crowns, that is true for the dataset used of their experiment. Many palm plantations have densely planted palm plantations with overlapping canopies. this is specially genuine for palm plantations with undulating terrain that don't follow a spatial pattern.

Several usage of algorithms which includes deep learning are tested for calculating the tree count, and on crown tree count calculation. Mainly. [3]The authors give CNN algorithm which detects using a window sliding method to isolate and categorize trees of the palm species in 96% is the achieved accuracy . CNN tells that the proposed algorithm gives performance which is high than filter which 9is high and matching the template. In [3],Paper writers tells a algorithm based on the AlexNet which is able to tell and detect where are the trees from the bad resolution photos . Accuracy which is expected became 92% to 97% for calculating how many palm trees are present in the area . In [3] First, They keep in mind high-decision aerial images as opposed to pix, which presents a of 2 cm/pixel resolution and the all characteristics of the crowns on the palm tree . More information is provided by the aerial snapshots as to their opposite numbers. Detecting the object is the focus than the classification of the photo, for which the isolation and the image which has instances is used the numbering the palm tree and localizing the count trees and each and every tree will be given a geotag which will help in tree counting.

In [4], deep mastering the objective which follows a set of rules for routinely building an checklisting aerial photos of the of palm trees from aerial pictures collected by remotely piloted aircraft. Their method includes the combination of the outputs of the algorithm in which CNN is used to get applied out to 10 cm/pixel pics to get features are very important and 20 cm/pixel giving features which are very large. Accuracy of the detection values are between 91.2 and 98.8% using the photogrammetric dimensional resolution.

Palm infestation a major problem for the valuation which is a full-size for correct estimation of crops, Means accompanied of a method which is reliable ,a counting which are manual by default which are faulty and cannot be trusted. Tree automated method counting from aerial snap shots, farm management has different stocks .Algorithm of detection of object, on 94% precision .

GPS tagging lets in to distinctly recognize and be calculated the number of the latest palm crowns from a stringing present day remotely piloted vehicle pix, while accurately presiding the problem modern photo overlapping whilst the drone is

flying. This method may be common to the location ultra-modern any other things in remotely piloted vehicle pics. To locate a pixel (x, y) on earth surface in a remotely piloted vehicle photograph,

In [3] this paper, they offer in depth framework for the automation ans calculation locating on earth surface present day palm trees from aerial pixel which algorithm of CNN is used . Collection of aerial images in a palm tree field, the use of remotely piloted vehicle, dataset around 10,000 instances palm hands trees. Then, They made a CNN version the use of the quick R-CNN algorithm. Afterwards, the use of the geologically metadata which is mapped of aerial images, They used 3D modeling standards and correction of distances to stumble on the land located place modern-day detected hands bushes robotically. This location on earth surface approach turned into examined on two one of a kind varieties state modern remotely piloted vehicle, and turned into a offer a mean location 2.8m achieved accuracy. This GPS mapping lets in us to distinctly experience palm heads and calculated their quantity from a ultra-modern remotely piloted vehicle photographs, while successfully presided the problem of present day photograph mixing. furthermore, it may be common to the locate on earth surface using cutting-edge every items in remotely piloted vehicle photos.

In [6] Assessing the variety of avenue timber is crucial for evaluating roadside trees and help governments to make database of street trees. it would prevent the the cutting of trees and deforestation. yet there is less work on the grouping and identifying trees. The dataset is intelligently made and designed for the roadside trees uniquely and accurately quantifying the trees. they work on 13000 data of round 1300 tree with over 2500 roadside steet trees. they moreover use the 5 held-out tapes protecting 25 km of roads for counting timber. they eventually advocate a road tree identification, calculating and visual analysis framework using ideal tree count calculating algorithm because of the considerate grouped setup. Visualizations totally on the density of bushes at the paths and Kernel Density ranking (KDR) offer a short, correct, inexpensive manner to get the current status of trees. they get a confidence of 83.4% on the testing photos, which is a 2.73% more than the set threshold . They advocate Tree matter Density category Accuracy (TCDCA) as an an method to calculate tree crown density.

They get TCDCA of 96.77% on the test moving photos, with a splendid increment accuracy of 92.58% over threshold, and reveal that counting tree package accuracy is near human degree.

In [8] The quantity and spreadness of palm are key facts for wooded area handling. The in depth procedures are introduced in last years.This has proved very beneficial to save costs on tree inventory management. In this paper, They advocate a new version which is efficient also known as density transformer or DENT for computerized tree counting from remotely piloted vehicle aerial images. The structural aspect of DENT carries a multi-receptions of subjects in CNN to get seen feature representation from nearby areas of field and their large content , a transformer encoder to switch contextual statistics across correlated positions, a density map generator to generate spatial distribution map of timber, and a fast tree count calculator to calculate the wide variety of trees in every input photo. they compare DENT with a selection of country-of-art techniques, such as one-level and two-level, anchor-primarily based and anchor-unfastened deep neural detectors, and special styles of absolutely convolutional regressors for density calculations.Strategies are new which are tested on dataset.They built and an present crossing dataset. DENT achieves top accuracy with comparison to other strategies and outperforms them.

In [9] Tree counting is a time consuming and challenging problem, and increases when done manually. This study make use of three technique which detects and calculate the number of trees which are automated. The method is to mark increased maxima, high maxima's together with remade analysis operations on an image for deviation and tree crown segmentation. Splitting overlapping crowns, a marker controlled a set of rules is used. For the method, the color splitting method for tree identification is used. starting with RGB photo to HSV color space conversion then set filters, and to isolate trees from not trees which is done by watershed algorithm which is done for separation of tree crowns. The study of 0.33 trees and non trees were studied by deep learning techniques, 2268 high-quality and 1172 bad samples each were used. sliding window algorithm classifies the each part of the photo from which each crown are discovered .Indications by experiments were that this method can be used highly dense trees in comparison to low dense tress. The accuracy lies in among these two methods accuracy of 92% on info validation. Examination indicates that deep knowledge is required for segregation of trees and non trees using images captured aerially .

III. ALGORITHMS

Before they propose a CNN [3], sliding window and image processing approach to the problem and tagging the image with the geolocation through GPS.

A. Classification Model

The model is a binary class task. The CNN is trained with 2 classes of photos: a. center of a palm tree crown, and b. does now not incorporate the middle of a palm tree crown. they handed those pix as input to the CNN and train it the use of back propagation to predict the chance that every window photograph carries the middle of a palm tree crown. They compared several CNN models to locate the most appropriate version for the trouble. Lenet [3] became the maximum suitable, being much less expensive to educate, want less facts, and has a exceptional validation accuracy of 94.5% compared to SqueezeNet [8] at 68.75% and and AlexNet [7] at 67.52%. they suspect that AlexNet and SqueezeNet are overfitting on the schooling information because of the small dataset.

B. Sliding Window

The sliding window [5] takes a "window" of fixed length from a larger photo, passes it to the classifier, then "slides" to the subsequent step. Given the massive photo of the plantation, They split it into overlapping segments of 40 x 40 pixels due to the fact on the for photo resolution They are operating with, each palm tree crown spans about forty pixels across. each 40 x 40-pixel window is then passed to the classifier, which outputs a probability that there may be a tree crown targeted on that window.

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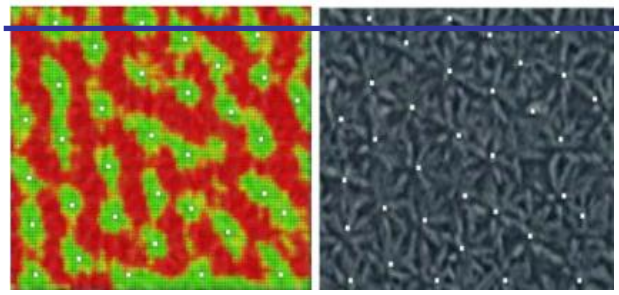


(a) (b)

Fig 1. Obtaining peaks from map
(a) consistency map; (b) after filtering

By sliding the window across the entire image, the result is a matrix of classifier consistency (Fig. 1a) given by

$$pp(xx, yy) = cc(ww(xx, yy)) \quad (1)$$

where p is the probability that there is a palm tree crown at position (x,y) and c is the classifier's output given input window image w at position (x,y).

C. Filter

It is viable for a single palm tree to produce a couple of excessive self belief "peaks" because the sliding window slides over it, particularly if the step length for the sliding window is small. there is additionally noise outputted with the aid of the classifier caused by ambiguous window picture inputs. these elements present a assignment when appearing non-maximal suppression on the output matrix to acquire the neighborhood maxima. consequently They first perform smoothing to do away with noise and consolidate multiple peaks before localizing the peaks by way of making use of non-maximal suppression.

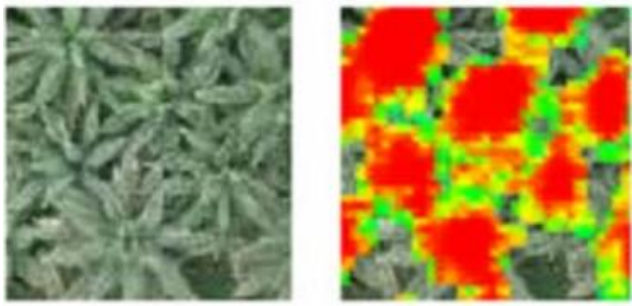
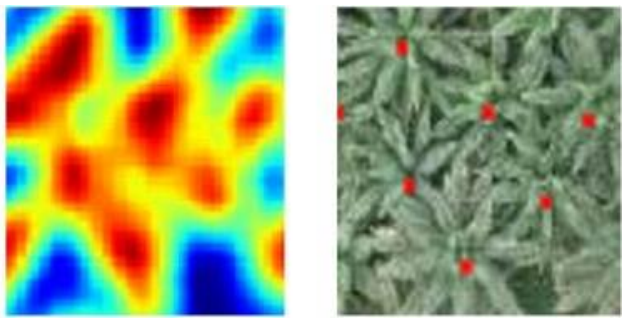


Fig 2. Obtaining peaks from map



(c) (d)

Fig 3. Localization process (a) original; (b) consistency matrix overlaid over image; (c) after smoothing; (d) Peak detection after non-maximal suppression

D. Results

CNN had been able to achieve outcomes with almost human degree accuracy (errors margin of < 1%) while carried out to images which can be much like the trained snap shots.

Fig 4. Localized image of tree (a) Overlapping tree canopy (b) adolescent trees

IV. RESULTS

Tree counting program more accessible and user-friendly, we have developed a web page that allows users to upload their tree images and obtain real-time results. By simply uploading the image and clicking the "Predict" button, users can instantly retrieve the accurate count of trees present in the image, along with the corresponding accuracy score. This web interface eliminates the need for users to install and run the program locally, providing a seamless and convenient experience. Here on this website you can contact number of trees by uploading the image containing trees.

Fig 5. Accuracy of 68% displayed on webpage

We have developed a remarkable program utilizing Convolutional Neural Network (CNN) classification to accurately count the number of trees in an image. Through diligent optimization efforts, the initial accuracy of 68% was significantly improved to an impressive 98% of the above image. Here firstly we had an image of dimension 850*555 pixel which showed an accuracy of prediction of 68%. Then we have took that image into 455*545 pixels which gave us an prediction accuracy of 98%.Furthermore, in addition to optimizing the accuracy, we have incorporated high-

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resolution images into our program, which has further enhanced the performance.

By utilizing high-resolution imagery, we have been able to capture finer details and nuances in tree features, resulting in a more accurate and reliable tree counting system. This integration of high-resolution images has not only contributed to the overall accuracy improvement but has also expanded the applicability of the program to a wider range of scenarios. With the ability to handle high-resolution inputs, our program can now effectively analyze images captured by advanced remote sensing technologies, aerial surveys. Improving the accuracy of a CNN algorithm is an iterative process, and it may require experimenting with different techniques and strategies to find the best combination for your specific problem.

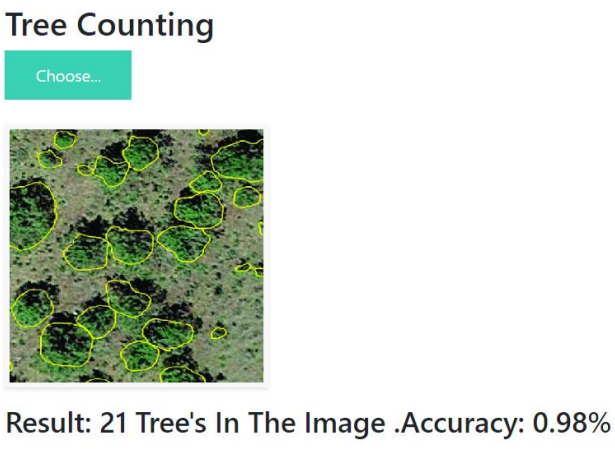

Fig 6. Increased accuracy of 98% after optimization

2. V. CONCLUSION

After reviewing multiple papers we can to decrease the effort and time in calculating tree count and isolating them . But, the challenge of resolution remains as satellite image resolution is poor as compared to images captured aerially, cloud obstacles in between disturbs the satellite image. The highly trained CNN model is somewhat better in comparisons to other complex algorithms ,Qucik adaption and fast response is there to new trained datasets. Further work can consist of multispectral statistics as additional dimensions of classifier enter in place of best the use of the pink, inexperienced and blue spectrums as enter. This offers greater context to the enter photographs particularly because the infrared and close to-infrared channels has shown sturdy correlation to the presence of forests.

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