Tree Recgnition using CNN

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https://github.com/mdstirling92/-ITNPAL1-THREE-RECOGNITION-

City Name 1:Edingburgh

City Name 2:Glasglow

I. INTRODUCTION

The recognition of trees in aerial images is an important problem with a wide range of applications, including urban planning, forest management, and environmental monitoring [1]. However, this problem poses several challenges, including the large scale of aerial images, variation in lighting and weather conditions, and the complex morphology of trees. In this project, we aim to develop a machine learning model that can accurately recognize trees in aerial images. Our motivation for this project is to provide a tool that can aid in the efficient and effective management of forests and green spaces, which is crucial for maintaining the health of our planet.

II. Preprocessing

To prepare the aerial images datasets for training the CNN models, we applied the following preprocessing steps to each image:

Noise Reduction: We used the OpenCV function cv2.fastNlMeansDenoisingColored to reduce noise in the image. This function applies a non-local means algorithm to the image to remove noise while preserving edges and other important details.

Image Filtering: We applied the OpenCV function cv2.medianBlur to filter the image and remove small details that may not be relevant for tree recognition.

Contrast Adjustment: We adjusted the contrast of the image using the OpenCV function cv2.convertScaleAbs to improve the visual quality of the image.

We then resized each image to a fixed size of 128 x 128 pixels using the OpenCV function cv2.resize to ensure that all images are of the same size, which is required for training CNNs.

The above preprocessing steps were applied to all images in the "edinburgh_with_tree", "edinburgh_without_tree", "glasglow_with_tree", and "glasglow_without_tree" directories. After applying these preprocessing steps, we created two separate datasets: one for Edinburgh and one for Glasgow.

III. Dataset

We have collected an aerial dataset of trees from the cities of Edinburgh and Glasgow. Each dataset contains 200 positive images and 200 negative images. The dataset is saved in files named "Edinburgh" and "Glasgow", and each file has different folders if trees and non trees images, which are labeled accordingly in the code.

IV. proposed Solution with justification

To tackle the problem of tree recognition in aerial images, we propose to use Convolutional Neural Networks (CNNs) [2]. CNNs are deep learning model that can automatically extract features from images, making them well-suited for Recognizing images.

They are considered to identify patterns and features in images and have been successfully Tested to a wide range of image recognition tasks, plus object detection, face recognition, and image segmentation [3].

CNNs are particularly well-suited to image classification because they can learn to detect patterns and features in images without the need for manual feature engineering. Instead, they use convolutional layers that learn to identify features at different scales and orientations.

In the given code, the create_model() function defines a CNN Architecture that contains of two convolutional layers with 32 and 64 filters correspondingly, followed by two fully connected layers. The output layer has two units with activation function as Sigmoid, which makes it suitable for binary classification.

Furthermore, by testing Our model with different combinations of hyperparameters such as learning rates, batch sizes, and number of epochs, we can optimize the model's accuracy and achieve better results. Below Is one the performance graph selected from all the graphs created in experimental by different combination of hyperparametes.

Therefore, using a CNN model for image classification is a suitable and effective approach, and we can optimize its performance by adjusting hyperparameters.
We have used two CNN models to train with two different datasets. The first model is trained on a Edinburgh aerial images dataset, while the second model is trained on a glassglow images dataset.

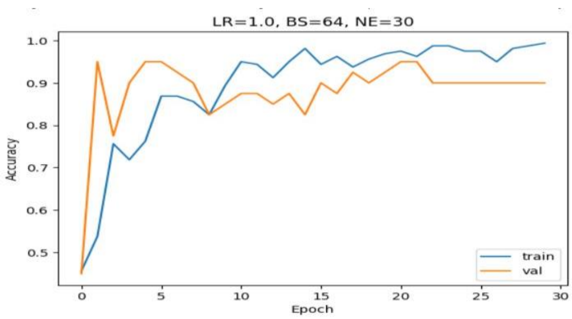

Figure 1: Performance graph on the above mentioned parameters. All other graphs are shown in code file

V. Result

We used two models to recognize trees in aerial images. The first model was trained on the Edinburgh dataset and reached accuracy of 0.9050, F1 of 0.9051, and AUC of 0.9084 when tested on its own test dataset. Fig 2 plot the correct and incorrected classified images for Edinburgh data model trained.

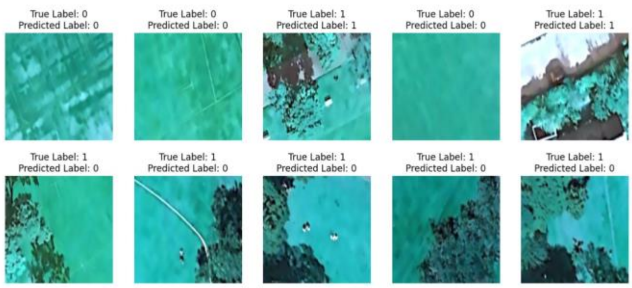

Figure 2

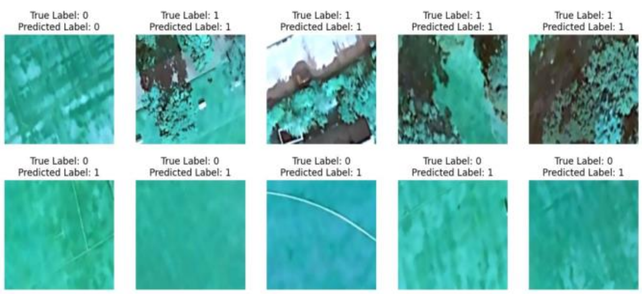

Figure 3

The second model was trained on the Glasgow dataset and reached an accuracy of 0.8500, F1 of 0.8448, and AUC of 0.8387 when tested on its own test dataset. Fig 3 plot the correct and incorrected classified images for Glassglow data model trained.

We also tested the models on each other's trained dataset. The Edinburgh model was tested on the Glasgow test data and achieved an accuracy of 0.7900, F1 of 0.7766, and AUC of 0.7742. Fig 4 plot the correct and incorrected classified images for Edinburgh data model trained and tested on glassglow data.

The Glasgow model was tested on the Edinburgh test data and achieved an accuracy of 0.9250, F1 of 0.9251, and AUC of 0.9278. Fig 5 plot the correct and incorrected classified images for glassglow data model trained and tested on Edinburgh data.

Vi. Discussion of Results

Overall, the results suggest that both models are able to accurately recognize trees in aerial images. However, the model trained on the Edinburgh dataset performed better on the Edinburgh test data, while the model trained on the Glasgow dataset performed better on the Glasgow test data. These findings suggest that training on diverse datasets can improve the model's performance on unseen data.”

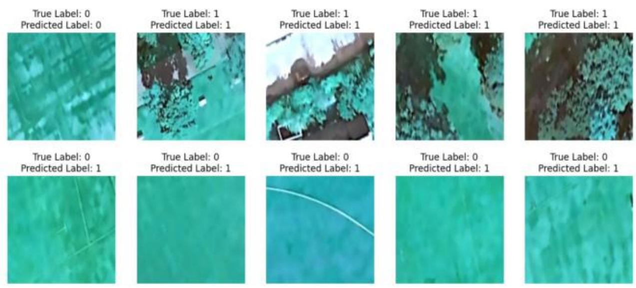

Figure 4

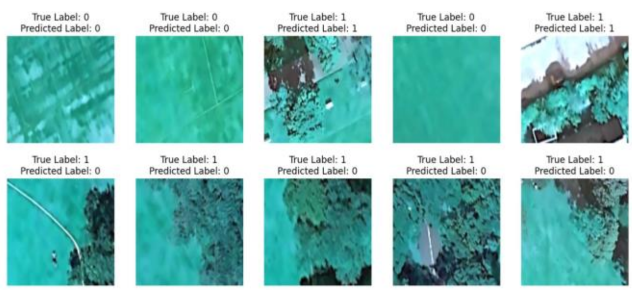

Figure 5

VI. Conclusion

In conclusion, our use of CNN models for tree recognition in aerial images has shown promising results. The use of two different datasets and two separate models has demonstrated the importance of diverse training datasets for improving model performance on unseen data. The accuracy of our proposed models shows the potential for the use of machine learning in forest and green space management.

REFERENCES

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3. Jiang, X., Hadid, A., Pang, Y., Granger, E. and Feng, X. eds., 2019. Deep learning in object detection and recognition.