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# IMAGE CLASSIFICATION

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***Abstract*__** Image classification is crucial side of image processing for machine learning without involving any human support at any step. However, the wide variety of vehicles has made vehicle classification and counting a challenging task. In this paper, we used Convolutional Neural Network (CNN) based object detection models and train them for detecting the different diseases (different classes) in the mango leaves using collected data.

***Keywords*__** CNN, Image classification, Deep learning, Neural network

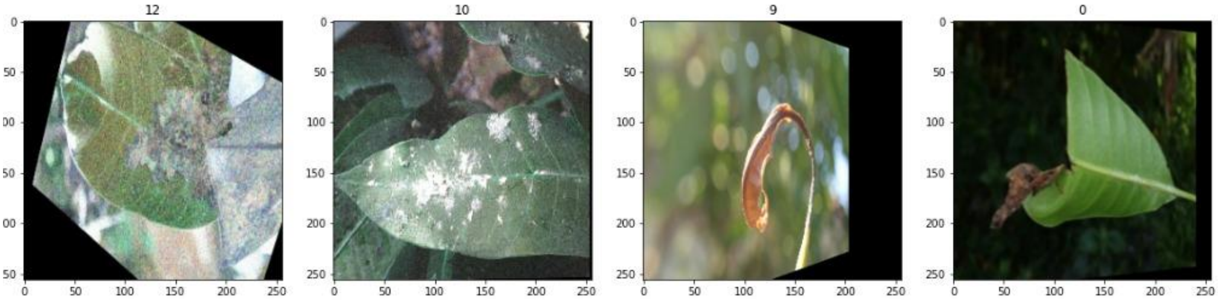
## I. INTRODUCTION

In recent years, representation-based classification approaches have come into focus and enhanced classification accuracy. There has been a significant advancement in image classification using advanced machine-learning algorithms. Predictive performance has significantly improved, resulting in the use of deep learning, albeit at the expense of increased model complexity and opacity [2]. Image classification was developed to reduce the disparity between computer vision and human eyesight by providing the computer with information. Image classification includes visual classifications and objects recognition as well. Image classification has significant applications for defects and disease, ground classification and segmentation of satellites, and content-based access to image databases [1]. Computers were manually instructed to detect pictures, objects in images, and what qualities to watch out for as artificial intelligence research took off in the 1950s through the 1980s. This technique, which uses conventional techniques known as "Expert Systems," necessitates that people go to the trouble of selecting features for each unique scene of an item that must be recognized and encoding these features in mathematical models that the computer can interpret. The aim of this research is teaching computers to recognize and comprehend visual data. The idea of machine learning was first introduced in the 1990s. Rather than instructing computers on what to look for when recognizing scenes and objects in images and videos, we would instead design algorithms that would enable computers to discover how to recognize scenes and objects on their own. Machine learning made it possible for computers to learn to recognize virtually any image or item that we wanted them to [3]. Convolutional neural networks (CNN) are the theory underlying recent advances in deep learning. CNNs have defied expectations and ascended to the throne as the most advanced computer vision method. CNNs are without a doubt the most well-known of the several neural network types (others include recurrent neural networks (RNN), long short-term memory (LSTM), artificial neural networks (ANN), etc.). In the world of image data, these convolutional neural network models are widely used. On computer vision tasks like picture categorization, object detection, image recognition, etc., they perform remarkably well [7].

## II. METHODOLGY

We divided our projects into many parts, first part was building a data pipeline using “tensorflow” library in python, then to get our images we used a google extension to fetch them directly form google and be able to download them into our created file. After managing the types of our image and clearing the unwanted and extra/corrupted data, we started putting them into a forum of an array and giving them values of [0]and [1] to manage them more easily.

```
fig, ax = plt.subplots(ncols=4, figsize=(20,20))
for idx, img in enumerate(batch[0][:4]):
    ax[idx].imshow(img)
    ax[idx].title.set_text(batch[1][idx])
```



After that we split our data into; (validation – training – and testing) then we created our convolutional neural network using the two activation functions “Sigmoid”

$$S(x) = \frac{1}{1+e^{-x}} = \frac{e^x}{e^x+1} = 1 - S(-x).$$

and “Relu” functions

$$f(x) = x^+ = \max(0, x),$$

To create the training model

```
cnn.add(Conv2D(16, (3,3), 1, activation='relu', input_shape=(256,256,3)))
cnn.add(MaxPooling2D())
cnn.add(Conv2D(32, (3,3), 1, activation='relu'))
cnn.add(MaxPooling2D())
cnn.add(Conv2D(16, (3,3), 1, activation='relu'))
cnn.add(MaxPooling2D())
cnn.add(Flatten())
cnn.add(Dense(256, activation='relu'))
cnn.add(Dense(16, activation='softmax'))
```

And finally, after the model train, it predicts whether the inserted image is a healthy or an unhealthy plant.

```
    yhat1 = new_model.predict(X)
    temp = []
    for i in yhat1:
        temp.append(i.max())
    pre.update_state(y, temp)
    re.update_state(y, temp)
    acc.update_state(y, yhat1)


print(pre.result(), re.result(), acc.result())
```

## III. RESULTS

```python
fig = plt.figure()
plt.plot(history.history['loss'], color='teal', label='loss')
plt.plot(history.history['val_loss'], color='orange', label='val_loss' )
plt.plot(history.history['accuracy'], color='red', label='acc', )
plt.plot(history.history['val_accuracy'], color='green', label='val_acc', )

fig.suptitle('Loss', fontsize=20)
plt.legend(loc="upper left")
plt.show()
```

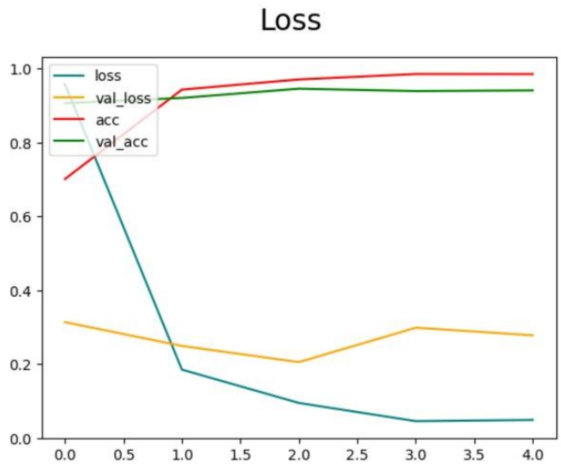



Image classification

## IV. Conclusion and future work

The test of random images was successful. The image dataset was directly retrieved from the Google repository. For classification purposes, CNN is applied. From the studies, the deep-learning algorithm is effective because the images are accurately identified even when their types change, or they are modified.

However, the performance of some complex image classifications must be improved, despite the method based on CNN producing good results for some simple image classification tasks. The method created in this paper has good image classification features. But there are also shortcomings. The model still needs to be modified to be more accurate, and there is space for development in the used methods as well. Therefore, more research is needed to better understand these components of image classification and to be able to apply it in larger size of data. We intend to work on bigger models with larger datasets in the future and in more productive fields.

## V. REFRENCES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