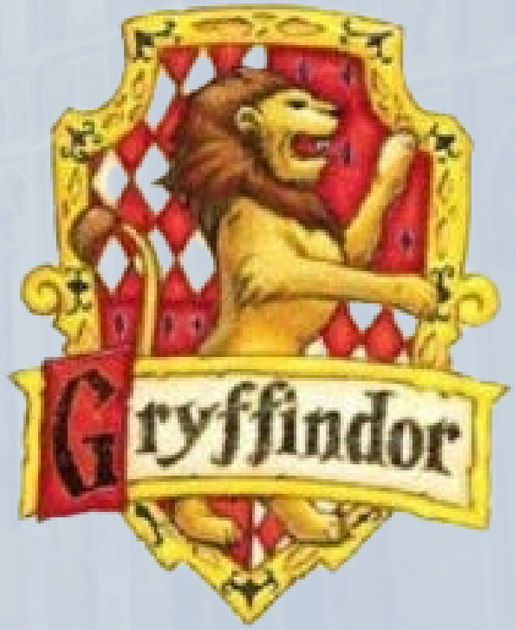
CCSE CODE CRAFT
PYTHON EDITION

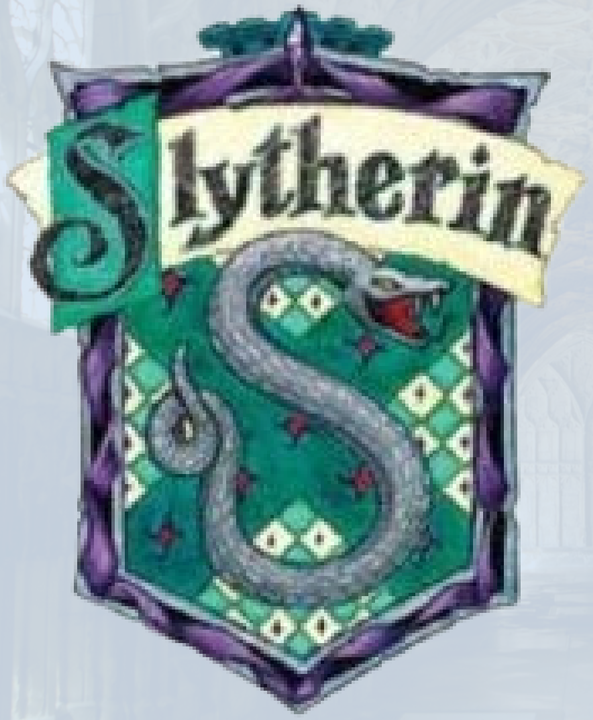
WEDNESDAY | 27 DEC 2023

GREETINGS

YOUR WIZARD HOUSE?

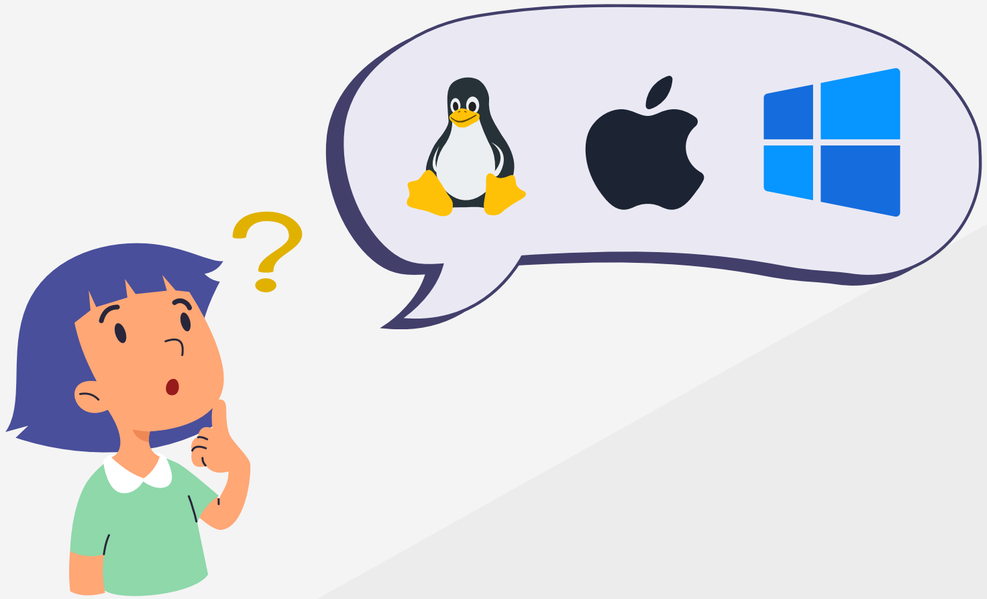


YOUR WIZARD HOUSE?



LANGUAGE SKILLS

What skills have you grabbed so far?



WHY THE NAME IS PYTHON?

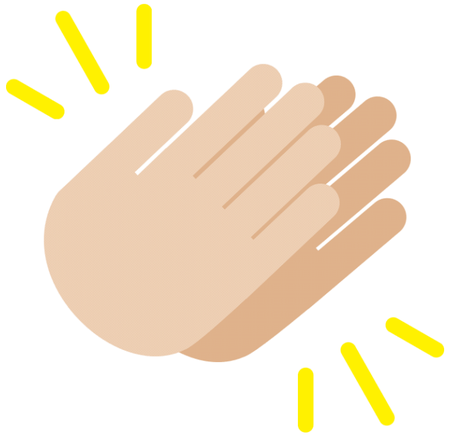
Monty Python

Snake?

Programming

PYTHON

Scripting



GREAT EFFORT

Every attempt is a step closer to succes.
It's a stepping stone toward understanding better

Scripting

```
num1 = 5
num2 = 10
sum_result = num1 + num2
print(f"The sum of {num1} and {num2} is {sum_result}")
```

Programming

```
def add(x, y):
    return x + y

while True:
    print("Options:")
    print("Enter 'add' for addition")
    print("Enter 'quit' to end the program")

    user_input = input(": ")

    if user_input == "quit":
        break
    elif user_input == "add":
        num1 = float(input("Enter first number: "))
        num2 = float(input("Enter second number: "))
        result = add(num1, num2)
        print(f"Result: {result}")
    else:
        print("Invalid input")
```

TUTORIAL 1

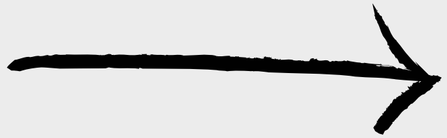
BASIC

TOOLS

replit

https://replit.com

+colab



https://colab.research.google.com

PRINT STATEMENT

```
#1 - Print Statement

print("Hello World")
print("\nHello World")
print("Hello World\n")
print ("\nHello UPM \n\tHello CCSE \n\tHello Slyherin")
```

\n --> “Enter” key
\t --> “Tab” key

Run 120ms on 20:27:50, 12/18

```
Hello World

Hello World
Hello World


Hello UPM
    Hello CCSE
    Hello Slyherin
```

PPRINT STATEMENT

```python
from pprint import pprint

matrix = [
    [1, 2, 3],
    [4, 5, 6],
    [7, 8, 9]
]

pprint(matrix)
```

```
[[1, 2, 3],
 [4, 5, 6],
 [7, 8, 9]]
```

DATA TYPE

Text Type	:	`str`
Numeric Types	:	`int`, `float`, `complex`
Sequence Types	:	`list`, `tuple`, `range`
Mapping Type	:	`dict`
Set Types	:	`set`, `frozenset`
Boolean Type	:	`bool`
Binary Types	:	`bytes`, `bytearray`, `memoryview`
None Type	:	`NoneType`

```
#2 - Data Type
##Integer
x = int(3.142)
print (x)
##Float
y = float(3.142)
print (y)
#Complex Number
z = complex(3.142)
print (z)
```

IF-ELSE STATEMENT

```
#3 - If-else statement
##If only
d = 333
e = 200
if d > e:
  print("d is greater than e")

##If-else
f = 333
g = 200
if f > g:
  print("f is greater than g")
else:
  print("f is not greater than g")

##If-elif-else
  f = 333
  g = 200
  if f > g:
    print("f is greater than g")
  elif f==g:
    print("f is equal to g")
  else:
    print("f is not greater than g")
```

if

elif

else

LOOP

```python
## While Loop
## Example: Print numbers from 1 to 5 using a while loop
i = 1
while i <= 5:
    print(i)
    i += 1
```

While Loop

```python
## For Loop
## Example: Print numbers from 1 to 5 using a for loop
for i in range(1, 6):
    print(i)
```

For Loop

```python
## Do Loop (Python doesn't have a do-while loop))
## Example of a "do loop" in Python
while True:
    # Code to be executed repeatedly
    user_input = input("Do you want to continue? (yes/no): ")
    if user_input.lower() == "no":
        break  # Exit the loop if the user enters "no"
```

Do Loop (Artificial)

LOOP (MULTIPLICATION TABLE)

```
## Example: Printing a simple multiplication table using nested loops
for i in range(1, 6):
    for j in range(1, 11):
        print(i * j, end="\t")
    print()  # Move to the next row
```

Multiplication table of 1 to 10

FUNCTIONS

```python
#5 - Function
def my_function():
  print("Hello from a function")

my_function()
```

FUNCTIONS

```
def my_function2(fname):
  print(fname + " Refsnes")

my_function2("Emil")
my_function2("Tobias")
my_function2("Linus")
```

TUTORIAL 2 (PROGRAMMING)

HOT EXAM QUESTIONS

QUESTION 1

Write Python code to solve the following problem. You are given a list of numbers. Write a function called find_average that takes this list as input and returns the average (mean) of the numbers in the list. Round the result to two decimal places.
Use the following list as input:

numbers = [10, 5, 8, 2, 15, 7]

Your code should:

1. Define the find_average function.
2. Inside the function, calculate the average of the numbers in the list.
3. Round the result to two decimal places.
4. Return the average as a float.

QUESTION 1

```python
def find_average(numbers):
    if not numbers:
        return None  # Return None for an empty list

    # Calculate the sum of numbers and the total count
    total_sum = sum(numbers)
    count = len(numbers)

    # Calculate the average and round to two decimal places
    average = round(total_sum / count, 2)

    return average

# Test the function with the provided numbers list
numbers = [10, 5, 8, 2, 15, 7]
result = find_average(numbers)
print(result)
```

QUESTION 2

Write Python code to solve the following problem. You are given a list of integers. Write a function called find_max_min that takes this list as input and returns a tuple containing the maximum and minimum values in the list.
Use the following list as input:

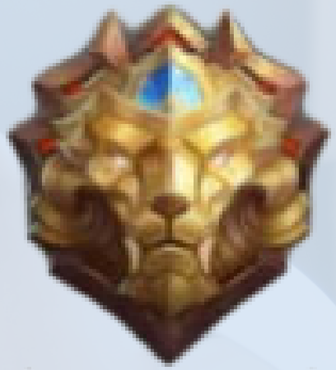
numbers = [10, 5, 8, 2, 15, 7]

Your code should:

1. Define the find_max_min function.
2. Inside the function, find the maximum and minimum values in the list.
3. Return a tuple containing the maximum and minimum values.

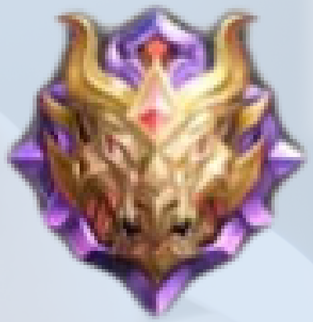
QUESTION 2

```python
def find_max_min(numbers):
    if not numbers:
        return None  # Return None for an empty list

    max_val = min_val = numbers[0]  # Initialize max and min with the first
        element

    for num in numbers:
        if num > max_val:
            max_val = num
        elif num < min_val:
            min_val = num

    return (max_val, min_val)

# Test the function with the provided numbers list
numbers = [10, 5, 8, 2, 15, 7]
result = find_max_min(numbers)
print(result)
```



TUTORIAL 3 (SCRIPTING)

UTILITIES SHOWCASE



TUTORIAL 4

PROJECT EXAMPLES

FUNCTIONALITIES

Machine Learning

Artificial Intelligence

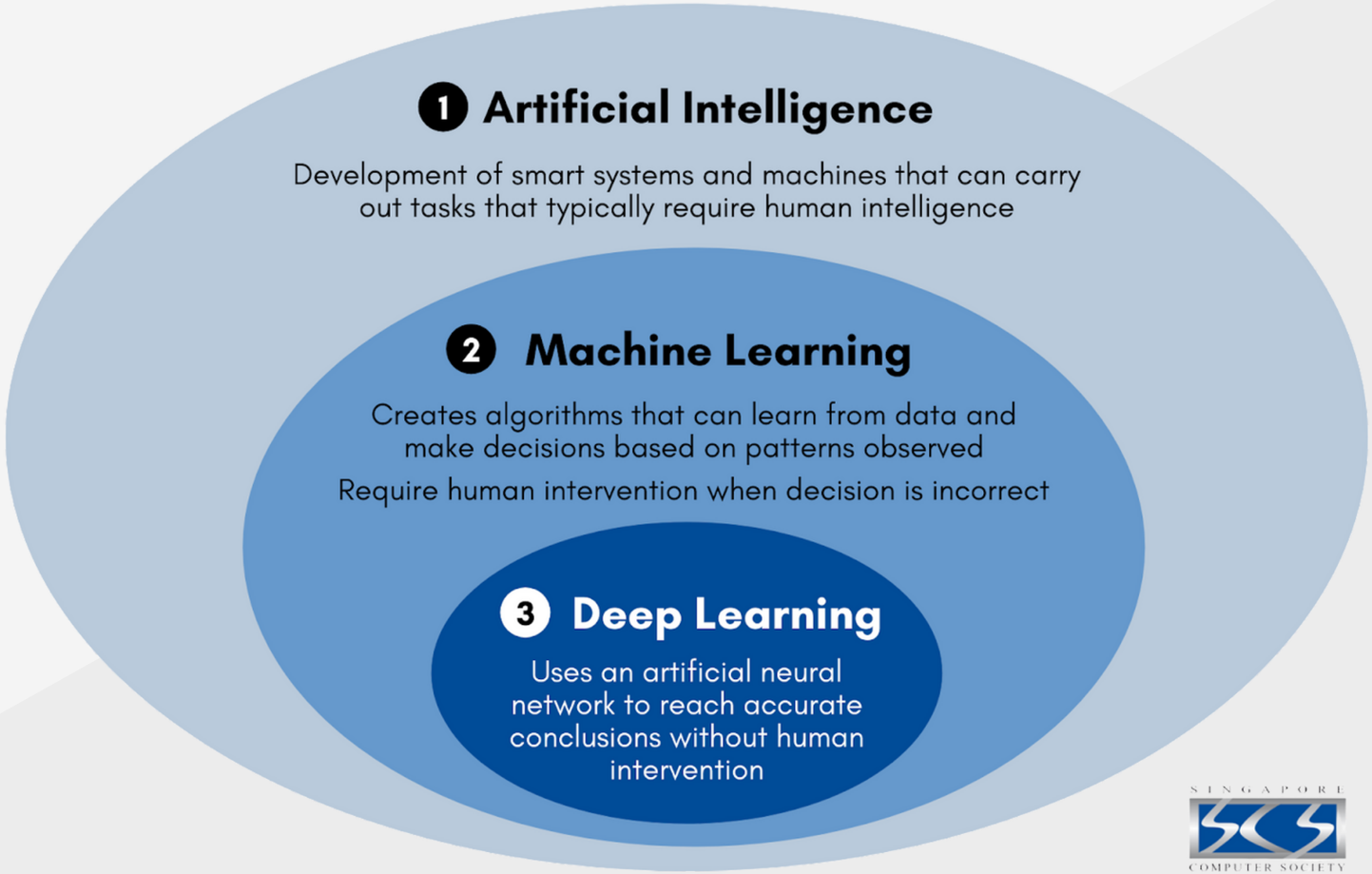
Deep Learning

Web Development

Automation

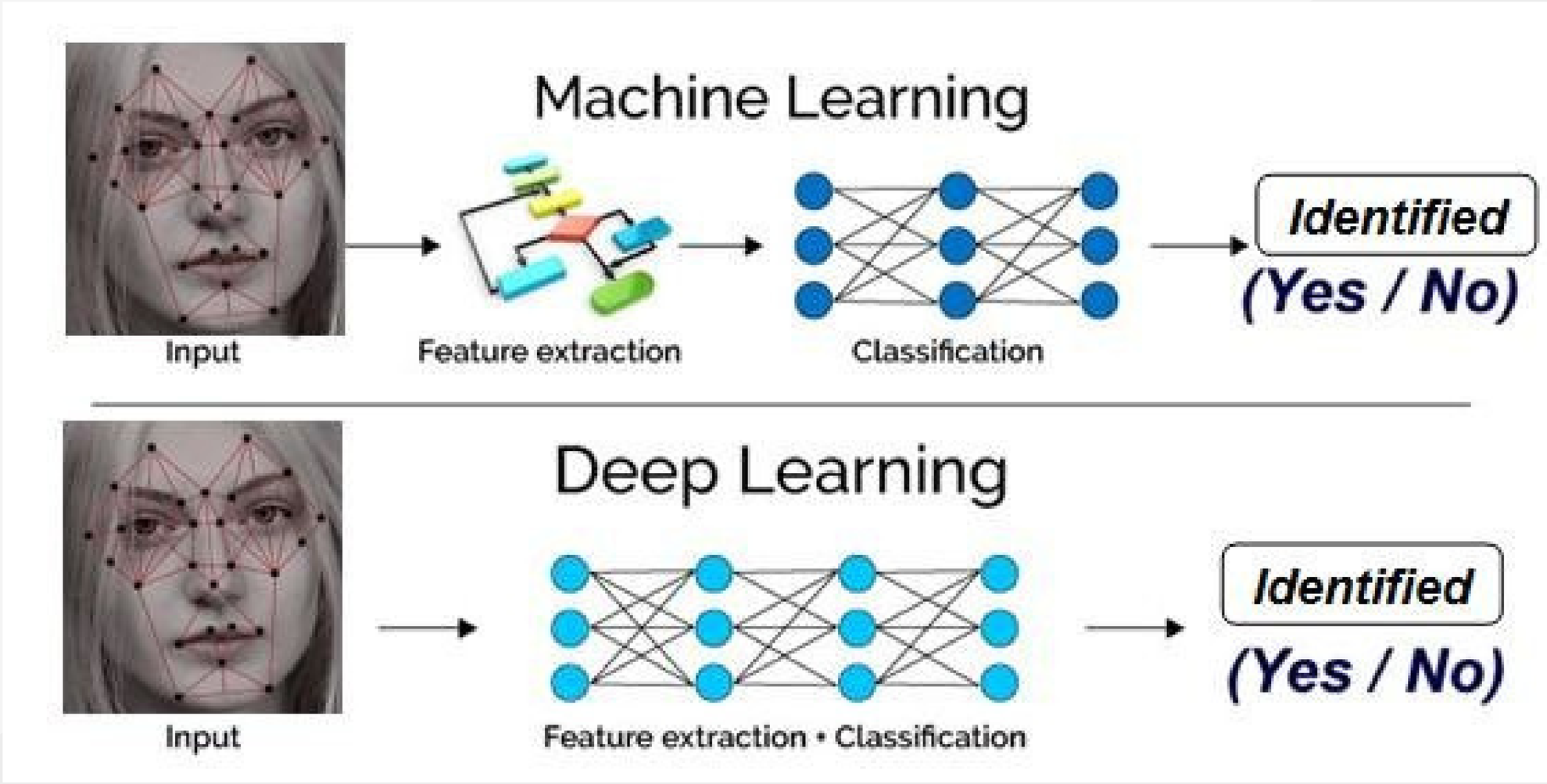
Embedded Systems

DIFFERENCES

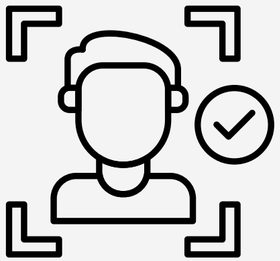


https://www.scs.org.sg/articles/machine-learning-vs-deep-learning

DIFFERENCES



http://dx.doi.org/10.35741/issn.0258-2724.54.5.29



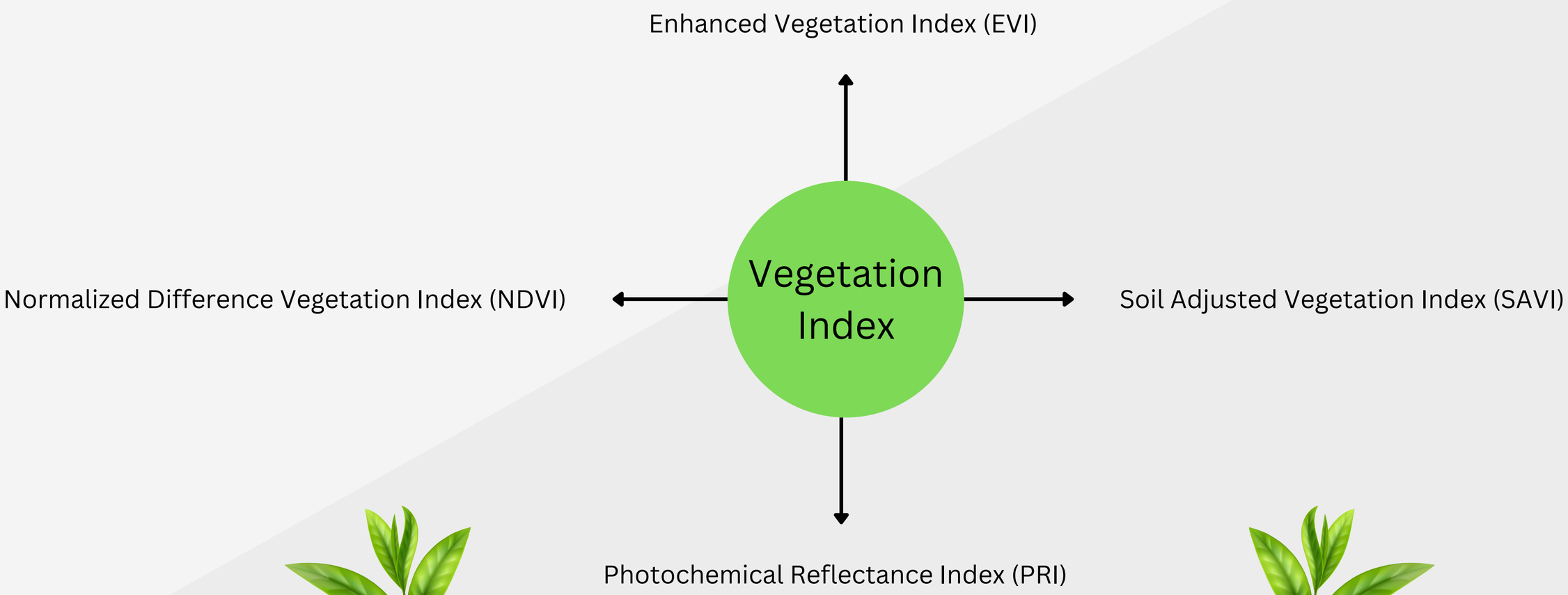
Google Colab: Access Webcam for Images and Video

Object Detection

YOLOv4 Object Detection on Webcam In Google Colab

Tea Leaves Disease Classification

TEA LEAVES DISEASE CLASSIFICATION



https://www.kaggle.com/code/rizqyad/tea-leaves-disease-classification
https://data.mendeley.com/datasets/j32xdt2ff5/2

TEA LEAVES DISEASE CLASSIFICATION

GRAY BLIGHT

WHITE SPOT

ANTHRACNOSE

BROWN BLIGHT

[1] S. I. Ng et al., “Time for Tea: Factors of Service Quality, Memorable Tourism Experience and Loyalty in Sustainable Tea Tourism Destination,” Sustainability, vol. 14, no. 21, p. 14327, Nov. 2022, doi: https://doi.org/10.3390/su142114327.
[2] S. Huang, L. Tang, J. P. Hupy, Y. Wang, and G. Shao, “A commentary review on the use of normalized difference vegetation index (NDVI) in the era of popular remote sensing,” Journal of Forestry Research, vol. 32, no. 1, pp. 1–6, May 2020, doi: https://doi.org/10.1007/s11676-020-01155-1.
[3] “The Different Types of Tea,” BOH Tea, Feb. 26, 2021. https://bohtea.com/published-articles/the-many-varied-types-of-tea/
[4] M. A. S. Herman, C. M. Nur A’in, S. Ahmad, and S. Ramachandran, “Willingness to pay for highlands’ agro-tourism recreational facility: A case of Boh Tea plantation, Cameron Highlands, Malaysia,” IOP Conference Series: Earth and Environmental Science, vol. 19, p. 012009, Mar. 2014, doi: https://doi.org/10.1088/1755-1315/19/1/012009.

TEA LEAVES DISEASE CLASSIFICATION

PROGRAMMING LANGAUGE & TOOLS USE IN THE PROJECT

- Google Collab.
- Python

[1] S. I. Ng et al., “Time for Tea: Factors of Service Quality, Memorable Tourism Experience and Loyalty in Sustainable Tea Tourism Destination,” Sustainability, vol. 14, no. 21, p. 14327, Nov. 2022, doi: https://doi.org/10.3390/su142114327.
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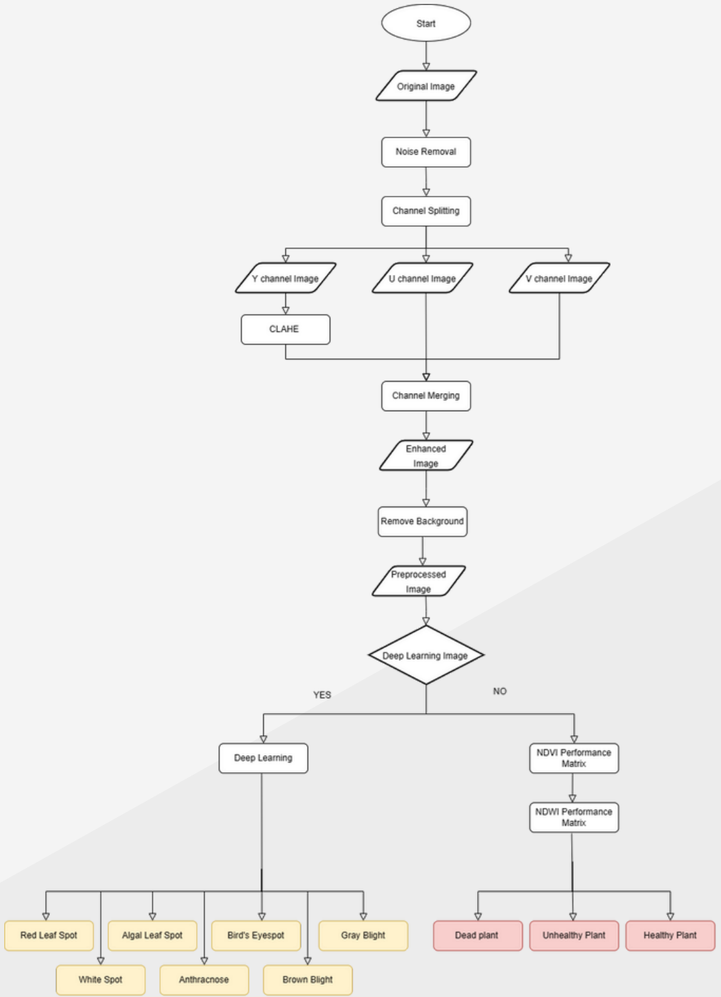
TEA LEAVES DISEASE CLASSIFICATION



Main Feature

- **NDVI & NDWI to determine the condition of plant.**
- **Deep learning to detect type of disease**

Pre-processing Feature

- **Noise removal using time-domain filter (Smoothing)**
- **CLAHE to improve contrast.**
- **Feature Extraction to get Tea Leaves images**

[1] S. I. Ng et al., “Time for Tea: Factors of Service Quality, Memorable Tourism Experience and Loyalty in Sustainable Tea Tourism Destination,” Sustainability, vol. 14, no. 21, p. 14327, Nov. 2022, doi: https://doi.org/10.3390/su142114327.
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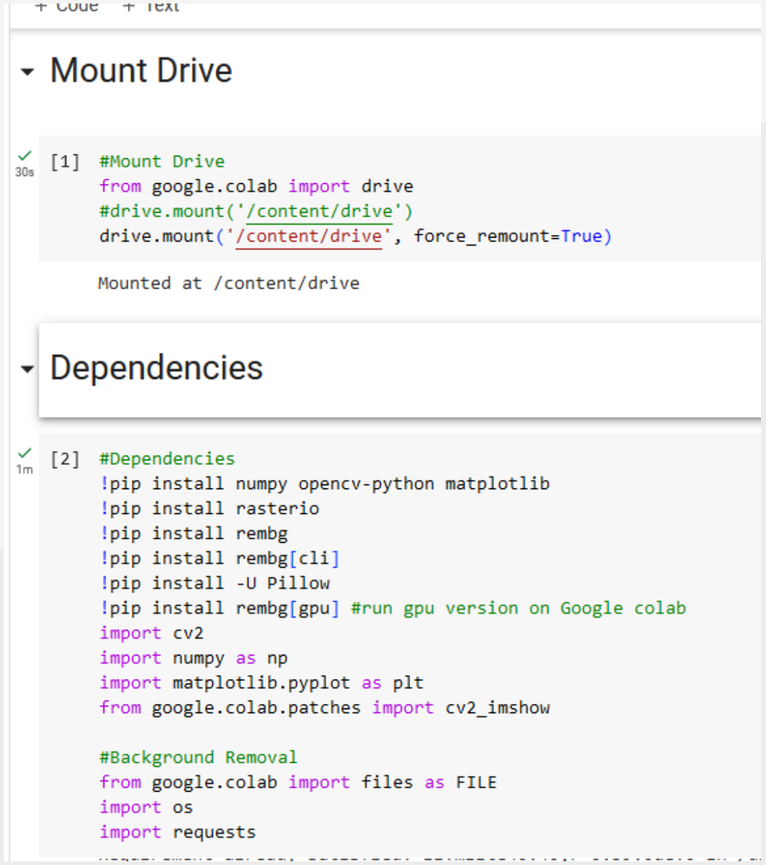
TEA LEAVES DISEASE CLASSIFICATION



+ Code + Text

Mount Drive

[1] 30s
```
#Mount Drive
from google.colab import drive
#drive.mount('/content/drive')
drive.mount('/content/drive', force_remount=True)
```

```
Mounted at /content/drive
```

Dependencies

[2] 1m
```
#Dependencies
!pip install numpy opencv-python matplotlib
!pip install rasterio
!pip install rembg
!pip install rembg[cli]
!pip install -U Pillow
!pip install rembg[gpu] #run gpu version on Google colab
import cv2
import numpy as np
import matplotlib.pyplot as plt
from google.colab.patches import cv2_imshow

#Background Removal
from google.colab import files as FILE
import os
import requests
```


[1] S. I. Ng et al., “Time for Tea: Factors of Service Quality, Memorable Tourism Experience and Loyalty in Sustainable Tea Tourism Destination,” Sustainability, vol. 14, no. 21, p. 14327, Nov. 2022, doi: https://doi.org/10.3390/su142114327.
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[3] “The Different Types of Tea,” BOH Tea, Feb. 26, 2021. https://bohtea.com/published-articles/the-many-varied-types-of-tea/
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TEA LEAVES DISEASE CLASSIFICATION

Sharpen Image

```python
import cv2
import numpy as np
import os

def sharpen_image(image):
    # Apply the sharpening kernel
    kernel = np.array([[0, -1, 0],
                       [-1, 5, -1],
                       [0, -1, 0]])
    sharpened = cv2.filter2D(image, -1, kernel)

    return sharpened

# Input and output directories
input_directories  = '/content/drive/MyDrive/tea_sickness_dataset/input/algal_leaf','/content/drive/MyDrive/tea_sickness_dataset/input/ant
output_directories = '/content/drive/MyDrive/tea_sickness_dataset/output/1_sharpen_image','/content/drive/MyDrive/tea_sickness_dataset/out
#input_directories = '/content/drive/MyDrive/CCSE/imaging/tea_sickness_dataset/input/algal_leaf','/content/drive/MyDrive/CCSE/imaging/tea_
#output_directories = '/content/drive/MyDrive/CCSE/imaging/tea_sickness_dataset/output/1_sharpen_image','/content/drive/MyDrive/CCSE/imagi

# Process each input directory with its corresponding output directory
for input_directory, output_directory in zip(input_directories, output_directories):
    # Get the list of input files
    input_files = os.listdir(input_directory)

    # Process each input file
    for file_name in input_files:
        # Check if the file is an image (assuming all image files have the ".jpg" extension)
        if file_name.endswith('.jpg'):
            # Load the input image
            input_path = os.path.join(input_directory, file_name)
            image = cv2.imread(input_path)

            # Check if the image was loaded successfully
            if image is not None:
                # Perform image sharpening
```

[1] S. I. Ng et al., “Time for Tea: Factors of Service Quality, Memorable Tourism Experience and Loyalty in Sustainable Tea Tourism Destination,” Sustainability, vol. 14, no. 21, p. 14327, Nov. 2022, doi: https://doi.org/10.3390/su142114327.
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TEA LEAVES DISEASE CLASSIFICATION

Noise Reduction

```
import cv2
import os
from google.colab import drive
from google.colab.patches import cv2_imshow

def noise_reduction(input_path, output_path):
    # Read the input image
    img = cv2.imread(input_path)

    # Check if the image was loaded successfully
    if img is not None:
        # Apply Gaussian blur for noise reduction
        dst = cv2.GaussianBlur(img, (3, 3), cv2.BORDER_DEFAULT)

        # Display the images (optional)
        #cv2_imshow(img)
        #cv2_imshow(dst)
        cv2.waitKey(0)
        cv2.destroyAllWindows()

        # Create the output directory if it doesn't exist
        os.makedirs(os.path.dirname(output_path), exist_ok=True)

        # Save the output image
        cv2.imwrite(output_path, dst)
        print(f"Output image saved as {output_path}")
    else:
        print(f"Failed to load the image: {input_path}")


# Mount Google Drive
drive.mount('/content/drive')

# Input and output directories
input_directories = ['/content/drive/MyDrive/tea_sickness_dataset/output/1_sharpen_image/algal_leaf',
                     '/content/drive/MyDrive/tea_sickness_dataset/output/1_sharpen_image/anthracnose',
```

[1] S. I. Ng et al., “Time for Tea: Factors of Service Quality, Memorable Tourism Experience and Loyalty in Sustainable Tea Tourism Destination,” Sustainability, vol. 14, no. 21, p. 14327, Nov. 2022, doi: https://doi.org/10.3390/su142114327.
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TEA LEAVES DISEASE CLASSIFICATION

Adaptive Histogram Equalization (AHE) Variant using CLAHE

```python
import cv2
import os
from google.colab.patches import cv2_imshow

# Function to perform adaptive histogram equalization
def adaptive_equalization(image):
    # Convert the image to Lab color space
    lab = cv2.cvtColor(image, cv2.COLOR_BGR2LAB)

    # Split the Lab image into L, a, and b channels
    l, a, b = cv2.split(lab)

    # Apply adaptive histogram equalization on the L channel
    clahe = cv2.createCLAHE(clipLimit=2.0, tileGridSize=(8, 8))
    equalized_l = clahe.apply(l)

    # Merge the equalized L channel with the original a and b channels
    equalized_lab = cv2.merge([equalized_l, a, b])

    # Convert the equalized Lab image back to BGR color space
    equalized_image = cv2.cvtColor(equalized_lab, cv2.COLOR_LAB2BGR)

    return equalized_image

# Input and output directories
input_directory = [
    '/content/drive/MyDrive/tea_sickness_dataset/output/2_denoise_image/algal_leaf',
    '/content/drive/MyDrive/tea_sickness_dataset/output/2_denoise_image/anthracnose',
    '/content/drive/MyDrive/tea_sickness_dataset/output/2_denoise_image/bird_eye_spot',
    '/content/drive/MyDrive/tea_sickness_dataset/output/2_denoise_image/brown_blight',
    '/content/drive/MyDrive/tea_sickness_dataset/output/2_denoise_image/gray_light',
    '/content/drive/MyDrive/tea_sickness_dataset/output/2_denoise_image/healthy',
    '/content/drive/MyDrive/tea_sickness_dataset/output/2_denoise_image/red_leaf_spot',
    '/content/drive/MyDrive/tea_sickness_dataset/output/2_denoise_image/white_spot'
```

[1] S. I. Ng et al., “Time for Tea: Factors of Service Quality, Memorable Tourism Experience and Loyalty in Sustainable Tea Tourism Destination,” Sustainability, vol. 14, no. 21, p. 14327, Nov. 2022, doi: https://doi.org/10.3390/su142114327.
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TEA LEAVES DISEASE CLASSIFICATION

Background Removal

```
[ ] import os

    input_directories = [
        '/content/drive/MyDrive/tea_sickness_dataset/output/3_CLAHE/algal_leaf',
        '/content/drive/MyDrive/tea_sickness_dataset/output/3_CLAHE/anthracnose',
        '/content/drive/MyDrive/tea_sickness_dataset/output/3_CLAHE/bird_eye_spot',
        '/content/drive/MyDrive/tea_sickness_dataset/output/3_CLAHE/brown_blight',
        '/content/drive/MyDrive/tea_sickness_dataset/output/3_CLAHE/gray_light',
        '/content/drive/MyDrive/tea_sickness_dataset/output/3_CLAHE/healthy',
        '/content/drive/MyDrive/tea_sickness_dataset/output/3_CLAHE/red_leaf_spot',
        '/content/drive/MyDrive/tea_sickness_dataset/output/3_CLAHE/white_spot'
    ]

    output_directories = [
        '/content/drive/MyDrive/tea_sickness_dataset/output/4_Background_Removal/algal_leaf',
        '/content/drive/MyDrive/tea_sickness_dataset/output/4_Background_Removal/anthracnose',
        '/content/drive/MyDrive/tea_sickness_dataset/output/4_Background_Removal/bird_eye_spot',
        '/content/drive/MyDrive/tea_sickness_dataset/output/4_Background_Removal/brown_blight',
        '/content/drive/MyDrive/tea_sickness_dataset/output/4_Background_Removal/gray_light',
        '/content/drive/MyDrive/tea_sickness_dataset/output/4_Background_Removal/healthy',
        '/content/drive/MyDrive/tea_sickness_dataset/output/4_Background_Removal/red_leaf_spot',
        '/content/drive/MyDrive/tea_sickness_dataset/output/4_Background_Removal/white_spot'
    ]

    # Create the output directories if they don't exist
    for output_directory in output_directories:
        os.makedirs(output_directory, exist_ok=True)

    # Process each input and output directory pair
    for input_directory, output_directory in zip(input_directories, output_directories):
        # Get the list of input files
        input_files = os.listdir(input_directory)

        # Process each input file
        for file_name in input_files:
            # Construct the input and output paths for each file
```

[1] S. I. Ng et al., “Time for Tea: Factors of Service Quality, Memorable Tourism Experience and Loyalty in Sustainable Tea Tourism Destination,” Sustainability, vol. 14, no. 21, p. 14327, Nov. 2022, doi: https://doi.org/10.3390/su142114327.
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TEA LEAVES DISEASE CLASSIFICATION

Remove background

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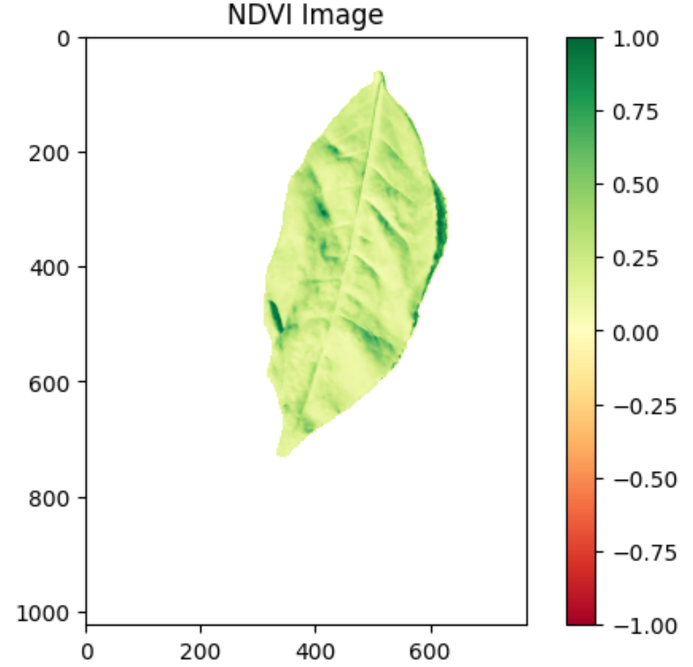
TEA LEAVES DISEASE CLASSIFICATION

```python
# Input and output directories
import cv2
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
import os

# Function to calculate NDVI and classify the plant
def process_image(image_path):
    # Load the image
    image = cv2.imread(image_path)

    # Split the channels
    blue, green, red = cv2.split(image)

    # Convert the channels to float for calculations
    red = red.astype(float)
    green = green.astype(float)

    # Calculate the numerator (NIR - red)
    numerator = green - red

    # Calculate the denominator (NIR + red)
    denominator = green + red

    # Exclude denominator values of 0 and assign them as NaN in NDVI array
    denominator[denominator == 0] = np.nan

    # Calculate NDVI
    ndvi = numerator / denominator

    # Calculate the average NDVI excluding NaN values
    average_ndvi = np.nanmean(ndvi)

    # Classification based on NDVI value ranges
    if average_ndvi >= 0.33:
        classification = "Healthy Plant"
    elif average_ndvi >= 0 and average_ndvi < 0.33:
```

```
Average NDVI: 0.23976870181626805
Classification: Unhealthy Plant
```




```
True
```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TEA LEAVES DISEASE CLASSIFICATION

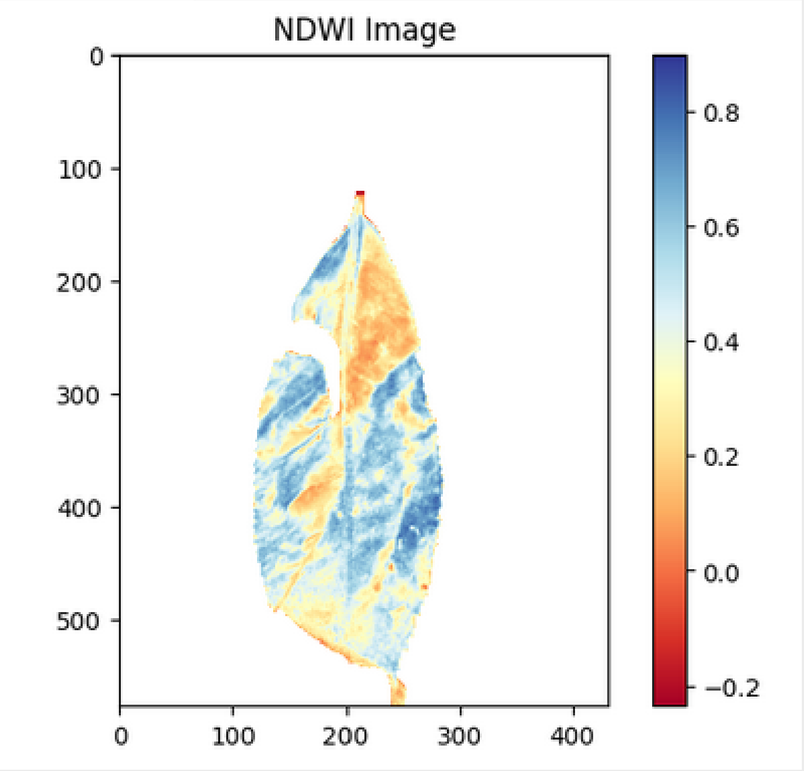
```python
import cv2
import numpy as np
import matplotlib.pyplot as plt

image = cv2.imread('/content/test2.png')
image = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)  # Convert BGR to RGB

green = image[:, :, 1].astype(float)  # Green channel
nir = image[:, :, 2].astype(float)  # NIR channel

# Calculate NDWI
ndwi = (green - nir) / (green + nir)

# Plot NDWI image
plt.imshow(ndwi, cmap='RdYlBu')
plt.colorbar()
plt.title("NDWI Image")
plt.show()
```



[1] S. I. Ng et al., “Time for Tea: Factors of Service Quality, Memorable Tourism Experience and Loyalty in Sustainable Tea Tourism Destination,” Sustainability, vol. 14, no. 21, p. 14327, Nov. 2022, doi: https://doi.org/10.3390/su142114327.
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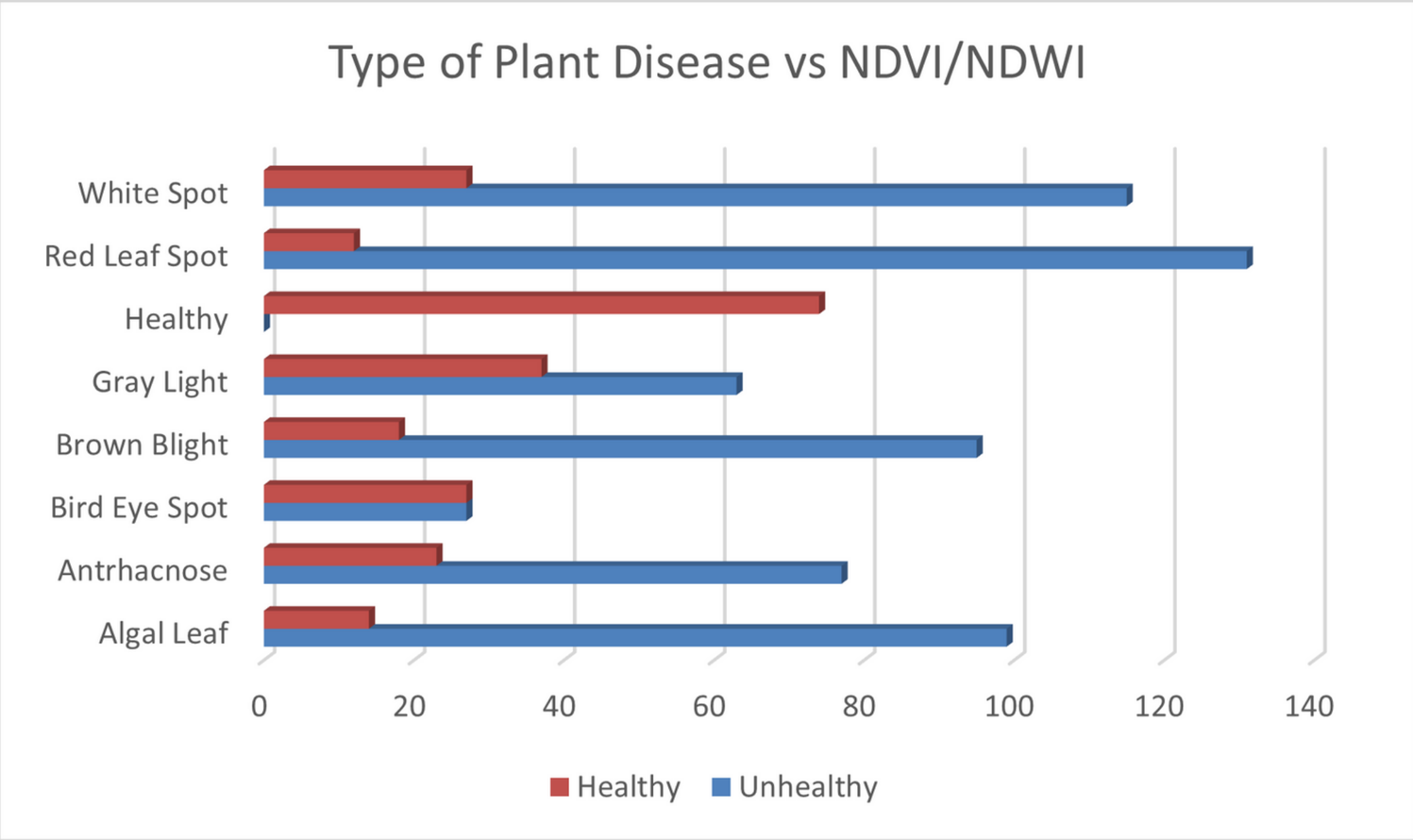
TEA LEAVES DISEASE CLASSIFICATION



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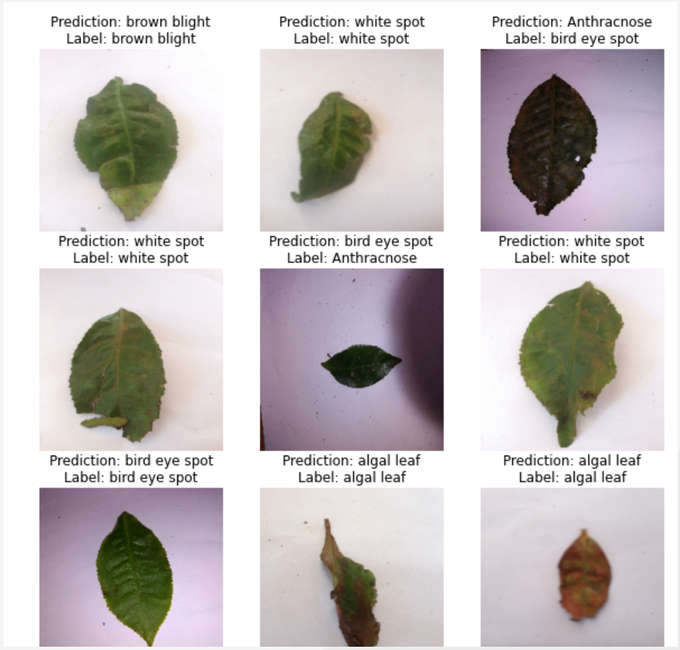
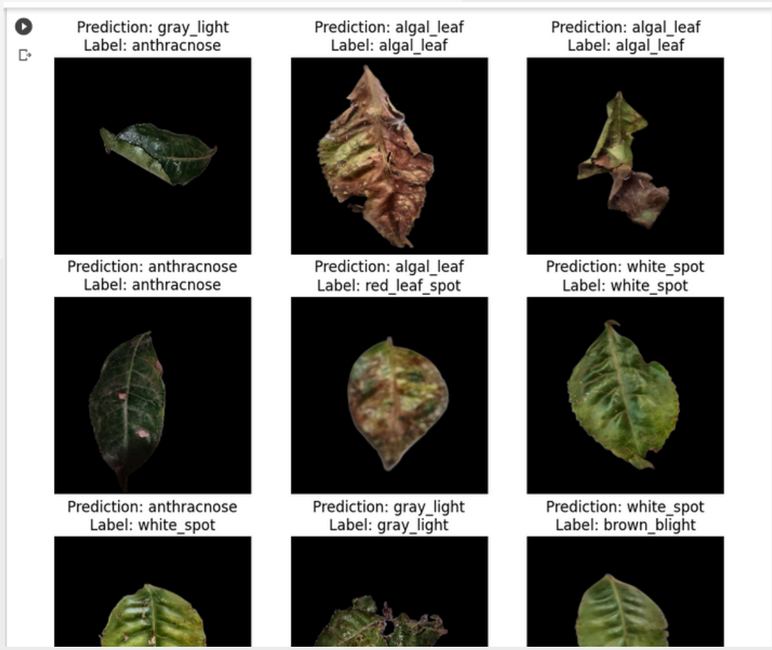


Deep learning plant health detection
(Without proposed pre-processing method)



Deep learning plant health detection
(With proposed pre-processing method

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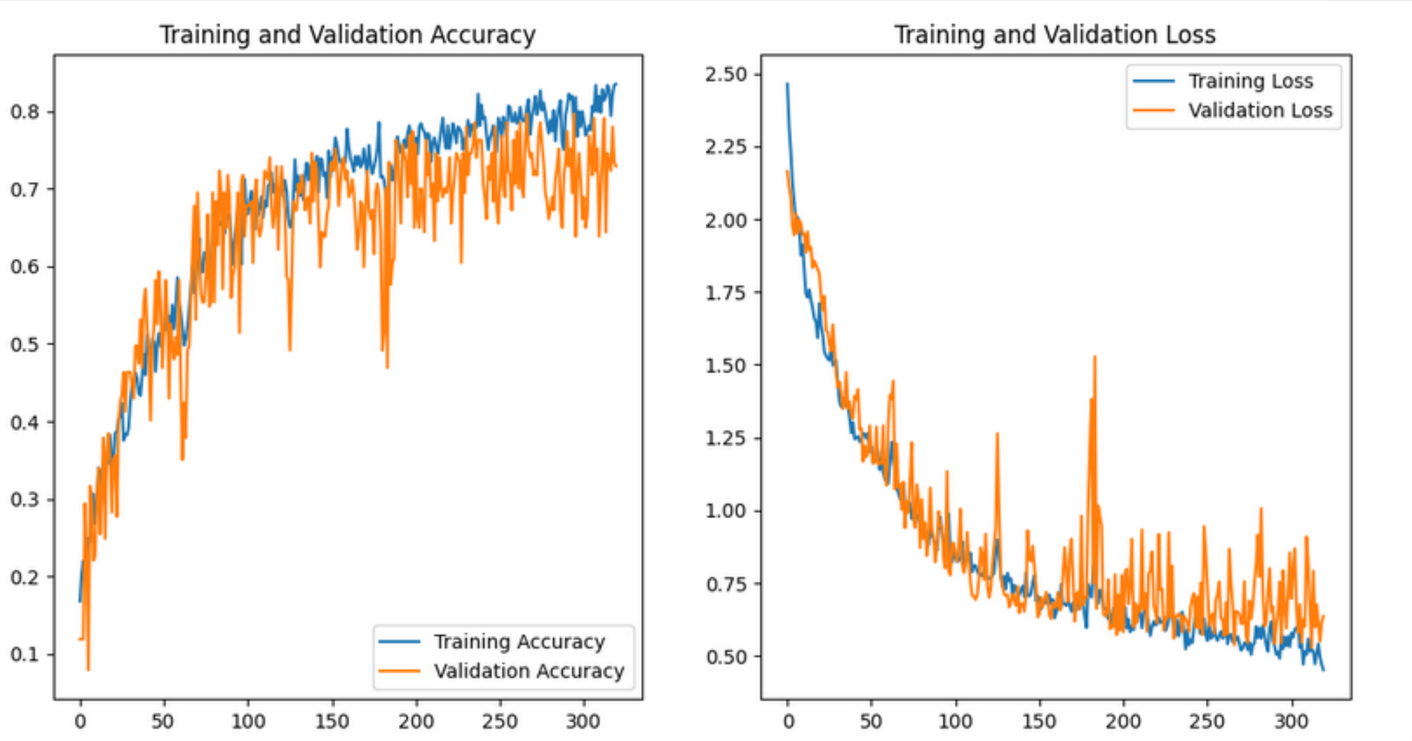

Before Pre-Processing Image

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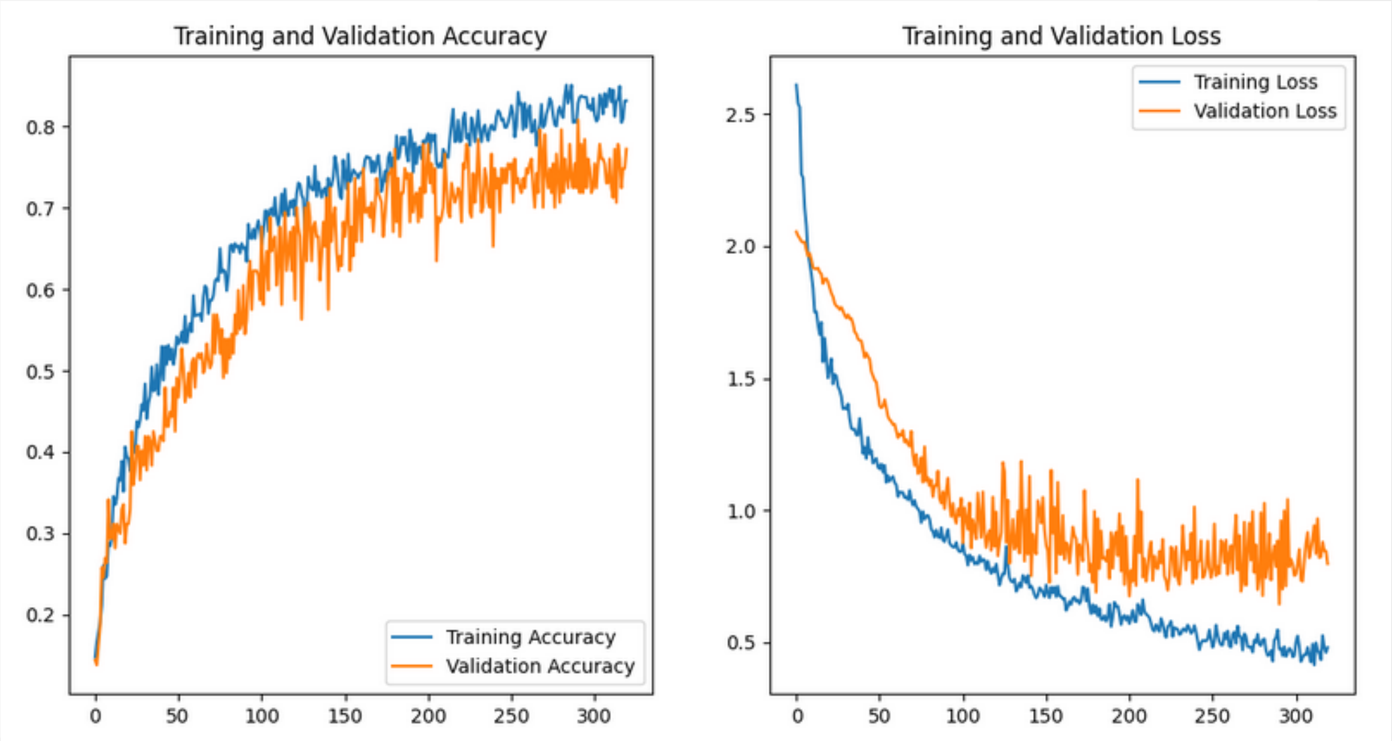

After Pre-Processing Image

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TEA LEAVES DISEASE CLASSIFICATION

Precision (13.43%)

Accuracy (2.78%)

	precision	recall	f1-score	support
0	0.54	0.78	0.64	18
1	0.74	1.00	0.85	14
2	0.00	0.00	0.00	10
3	0.81	0.57	0.67	23
4	0.73	0.80	0.76	20
5	1.00	1.00	1.00	7
6	1.00	0.93	0.97	15
7	0.58	0.67	0.62	21
accuracy			0.72	128
macro avg	0.67	0.72	0.69	128
weighted avg	0.68	0.72	0.69	128

Before

	precision	recall	f1-score	support
0	0.74	0.95	0.83	21
1	0.73	0.79	0.76	14
2	0.50	0.10	0.17	10
3	0.89	0.50	0.64	16
4	0.65	1.00	0.78	20
5	1.00	1.00	1.00	11
6	0.94	0.75	0.83	20
7	0.65	0.69	0.67	16
accuracy			0.76	128
macro avg	0.76	0.72	0.71	128
weighted avg	0.77	0.76	0.73	128

After

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THANK YOU

TOGETHER WE REVOLUTIONIZE COMPUTING