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Lampiran 1. Python Notebook untuk Pembuatan Model Machine Learning pada Tingkat Pertumbuhan Bayam Hijau


```
from google.colab import drive
drive.mount('/content/drive')
```

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

```
from PIL import Image
import numpy as np
import matplotlib.pyplot as plt

def segment_image(image_array):
    # Tentukan rentang warna yang ingin disegmentasi dalam format RGB
    color_ranges = [
        # Rentang warna minggu 2
        (np.array([16, 83, 1]), np.array([107, 133, 86])),
        (np.array([21, 61, 0]), np.array([64, 147, 56])),
        (np.array([112, 156, 0]), np.array([151, 205, 10])),
        # Rentang warna minggu 3
        (np.array([28, 114, 29]), np.array([72, 182, 83])),
        (np.array([48, 193, 106]), np.array([80, 205, 161])),
        # Rentang warna minggu 4
        (np.array([92, 207, 47]), np.array([240, 247, 239])),
        (np.array([57, 145, 15]), np.array([157, 246, 116])),
        (np.array([12, 166, 102]), np.array([40, 226, 151])),
        (np.array([5, 113, 71]), np.array([34, 175, 126])),
        (np.array([0, 121, 73]), np.array([8, 144, 124])),
        (np.array([0, 110, 66]), np.array([14, 138, 69])),
        (np.array([1, 105, 58]), np.array([18, 118, 79])),
        (np.array([27, 237, 187]), np.array([142, 243, 233])),
        (np.array([0, 167, 132]), np.array([9, 193, 157])),
        (np.array([0, 87, 55]), np.array([3, 111, 71])),
        (np.array([0, 129, 108]), np.array([14, 199, 153]))
    ]

     # Rentang warna yang ingin dihindari dalam format RGB
    avoid_ranges = [
        # Rentang warna minggu 2
        (np.array([3, 180, 186]), np.array([73, 215, 217])),
        (np.array([54, 112, 77]), np.array([70, 133, 99])),
        (np.array([57, 106, 81]), np.array([74, 125, 92])),
        (np.array([40, 92, 75]), np.array([74, 130, 101])),
        (np.array([23, 93, 79]), np.array([47, 104, 87])),
        (np.array([69, 112, 69]), np.array([82, 125, 81])),
        (np.array([30, 85, 80]), np.array([40, 90, 90])),
        (np.array([96, 128, 82]), np.array([116, 149, 93])),
        (np.array([62, 100, 76]), np.array([106, 138, 93])),
        (np.array([183, 234, 168]), np.array([191, 241, 186])),
        (np.array([110, 137, 79]), np.array([187, 212, 103])),
        (np.array([137, 154, 79]), np.array([197, 201, 130])),
        (np.array([103, 211, 197]), np.array([135, 241, 232])),
        (np.array([43, 87, 66]), np.array([78, 100, 78])),
        (np.array([18, 83, 79]), np.array([28, 90, 86])),
        (np.array([85, 87, 32]), np.array([95, 115, 66])),
        (np.array([20, 78, 71]), np.array([41, 93, 79])),
        (np.array([86, 129, 89]), np.array([115, 159, 101])),
        (np.array([121, 202, 158]), np.array([127, 214, 182])),
        (np.array([46, 83, 52]), np.array([111, 126, 65])),
        (np.array([31, 82, 64]), np.array([73, 115, 90])),
        (np.array([146, 222, 177]), np.array([198, 243, 233])),
        (np.array([70, 232, 231]), np.array([111, 245, 243])),
        (np.array([86, 124, 67]), np.array([117, 162, 93])),
        (np.array([9, 83, 72]), np.array([48, 106, 83])),
        # Rentang warna minggu 3
        (np.array([27, 66, 37]), np.array([40, 83, 53])),
        (np.array([20, 65, 45]), np.array([32, 81, 63])),
        (np.array([25, 67, 47]), np.array([52, 92, 65])),
        (np.array([240, 242, 239]), np.array([240, 242, 239]))

    ]

    # Membuat masker warna untuk rentang warna yang ingin dihindari
    avoid_color_mask = np.zeros(image_array.shape[:2], dtype=bool)
    for lower_color, upper_color in avoid_ranges:
        avoid_color_mask |= np.all((image_array >= lower_color) & (image_array <= upper_color), axis=-1)

    # Membuat masker warna untuk rentang warna yang ingin disegmentasi
```

```
    color_mask = np.zeros(image_array.shape[:2], dtype=bool)
    for lower_color, upper_color in color_ranges:
        color_mask |= np.all((image_array >= lower_color) & (image_array <= upper_color), axis=-1)

    # Menghilangkan area yang ingin dihindari dari masker warna hasil segmentasi
    color_mask &= ~avoid_color_mask

    return color_mask


def show_image(image_array,color_mask):
    # Buat gambar hasil segmentasi
    segmented_array = np.zeros_like(image_array)
    segmented_array[color_mask] = image_array[color_mask]

    # Tampilkan gambar asli dan gambar yang telah disegmentasi
    fig, axes = plt.subplots(1, 2, figsize=(10, 5))
    axes[0].imshow(image_array)
    axes[0].set_title('Original Image')
    axes[0].axis('off')

    axes[1].imshow(segmented_array)
    axes[1].set_title('Segmented Image')
    axes[1].axis('off')

    plt.show()


def upload_image(filename):
    try:
        image = Image.open(filename)
        image_array = np.array(image)
        color_mask = segment_image(image_array)
        return image_array, color_mask
    except Exception as e:
        print(e)
        return None, None


test = [
    '/content/drive/MyDrive/bayam hijau/minggu 2/2023-08-28_13_19_38.jpg',
    '/content/drive/MyDrive/bayam hijau/minggu 3/2023-09-06_12_31_19.jpg',
    '/content/drive/MyDrive/bayam hijau/minggu 4/2023-09-13_00_45_18.jpg',
    '/content/drive/MyDrive/bayam hijau/minggu 3/2023-09-08_15_38_22.jpg',
    '/content/drive/MyDrive/bayam hijau/minggu 2/2023-09-02_14_39_23.jpg',
    '/content/drive/MyDrive/bayam hijau/minggu 2/2023-08-29_01_21_31.jpg',
    '/content/drive/MyDrive/bayam hijau/minggu 4/2023-09-13_03_46_40.jpg',
    '/content/drive/MyDrive/bayam hijau/minggu 4/2023-09-15_10_17_44.jpg',
    '/content/drive/MyDrive/bayam hijau/minggu 2/2023-09-05_10_14_36.jpg',
    '/content/drive/MyDrive/bayam hijau/minggu 2/2023-09-04_06_54_48.jpg'
]

for loop in test:
  image_array, color_mask = upload_image(loop)
  num_pixels = np.sum(color_mask)
  print(num_pixels)
  print(loop)
  show_image(image_array, color_mask)
```

184210
/content/drive/MyDrive/bayam hijau/minggu 2/2023-08-28_13_19_38.jpg

Original Image

Segmented Image

367390
/content/drive/MyDrive/bayam hijau/minggu 3/2023-09-06 12 31 19.jpg

Original Image

Segmented Image

594381
/content/drive/MyDrive/bayam hijau/minggu 4/2023-09-13_00_45_18.jpg

Original Image

Segmented Image

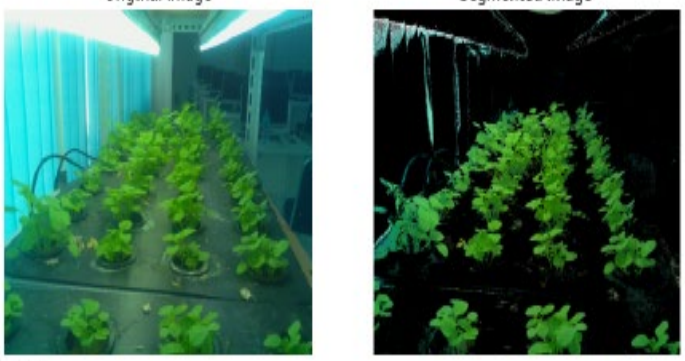
411910
/content/drive/MyDrive/bayam hijau/minggu 3/2023-09-08_15_38_22.jpg

Original Image

Segmented Image

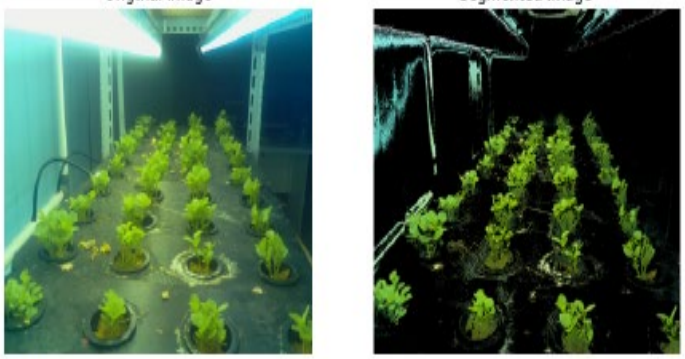
312860
/content/drive/MyDrive/bayam hijau/minggu 2/2023-09-02 14 39 23.jpg

Original Image Segmented Image



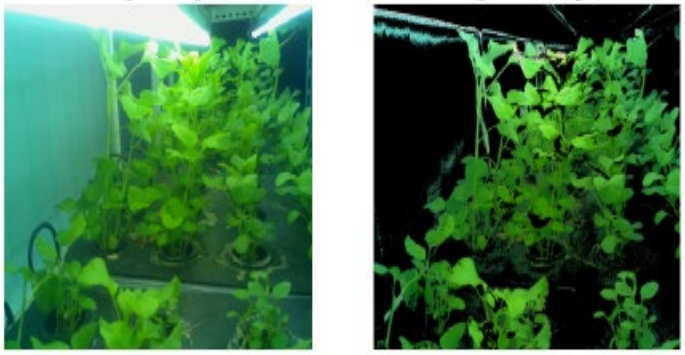
259912
/content/drive/MyDrive/bayam hijau/minggu 2/2023-08-29 01 21 31.jpg

Original Image Segmented Image



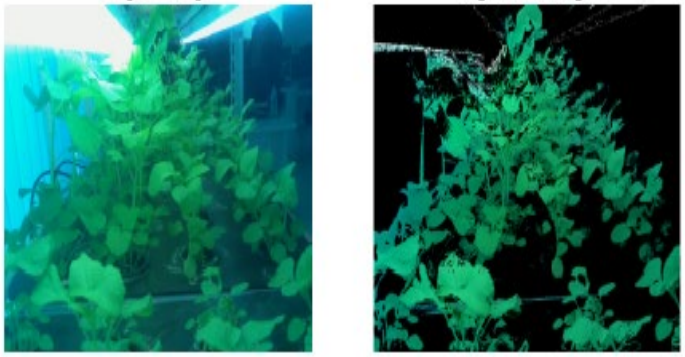
576074
/content/drive/MyDrive/bayam hijau/minggu 4/2023-09-13_03_46_40.jpg

Original Image Segmented Image



506229
/content/drive/MyDrive/bayam hijau/minggu 4/2023-09-15_10_17_44.jpg

Original Image Segmented Image



380756
/content/drive/MyDrive/bayam hijau/minggu 2/2023-09-05_10_14_36.jpg

Original Image Segmented Image

```
#evaluate the algorithm to classify

def classify_image(filename):
    _, color_mask = upload_image(filename)
    if color_mask is None:
      return "wrong data"
    num_pixels = np.sum(color_mask)

    if num_pixels <= 360000:
      return (0, num_pixels, filename)
    elif num_pixels <= 500000:
      return (1, num_pixels, filename)
    else:
      return (2, num_pixels, filename)
```



```
image_pixels = []
image_groups = []
predict_groups = []

import os

for image in os.listdir("/content/drive/MyDrive/bayam hijau/minggu 2"):
    results = classify_image("/content/drive/MyDrive/bayam hijau/minggu 2/"+image)

    # untuk clustering, 1 kali saja hehe
    image_pixels.append(results[1])
    image_groups.append(0)
    predict_groups.append(results[0])


for image in os.listdir("/content/drive/MyDrive/bayam hijau/minggu 3"):
    results = classify_image("/content/drive/MyDrive/bayam hijau/minggu 3/"+image)
    if results == "wrong data":
      continue

    # untuk clustering, 1 kali saja hehe
    image_pixels.append(results[1])
    image_groups.append(1)
    predict_groups.append(results[0])

for image in os.listdir("/content/drive/MyDrive/bayam hijau/minggu 4"):
    results = classify_image("/content/drive/MyDrive/bayam hijau/minggu 4/"+image)

    # untuk clustering, 1 kali saja hehe
    image_pixels.append(results[1])
    image_groups.append(2)
    predict_groups.append(results[0])
```

```
cannot identify image file '/content/drive/MyDrive/bayam hijau/minggu 3/2023-09-06_12_49_33.jpg'
```

```
# Import necessary libraries
import numpy as np
from sklearn.cluster import KMeans
from sklearn.metrics import confusion_matrix, accuracy_score
import matplotlib.pyplot as plt


print(confusion_matrix(image_groups, predict_groups))
print(f"Accuracy (might need rearrangement): {accuracy_score(image_groups, predict_groups)}")
```

```
[[180  14   0]
 [  0  23  12]
 [  0  17  47]]
Accuracy (might need rearrangement): 0.8532423208191127
```

```
# Import necessary libraries
from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, classification_report
import numpy as np

# Split the data into training and test sets (70% train, 30% test)
X_train, X_test, y_train, y_test = train_test_split(image_pixel_values, image_groups, test_size=0.3, random_state=42)

# Create a random forest classifier and train it
clf = RandomForestClassifier(n_estimators=200, random_state=0)
clf.fit(X_train, y_train)

# Predict the labels of the test set
y_pred = clf.predict(X_test)

# Print the accuracy and classification report
print(f"Accuracy: {accuracy_score(y_test, y_pred) * 100:.2f}%")
```

```
Accuracy: 87.50%
```

```
cm = confusion_matrix(y_test, y_pred)
print(cm)
```

```
[[61  1  0]
 [ 0  5  4]
 [ 0  6 11]]
```

```
# save the model
import joblib
joblib.dump(clf, 'bayam_putih.pkl')
```

```
['bayam_putih.pkl']
```

Lampiran 2. Python Notebook untuk Pembuatan Model Machine Learning pada Tingkat Pertumbuhan Bayam Batik


```
from google.colab import drive
drive.mount('/content/drive')
```

```
!unzip /content/drive/MyDrive/camerapi.zip -d /content/camerapi
```

```
Archive:  /content/drive/MyDrive/camerapi.zip
  inflating: /content/camerapi/camerapi/2023-05-16_19-39-47
  inflating: /content/camerapi/camerapi/2023-05-16_20-39-48
  inflating: /content/camerapi/camerapi/2023-05-16_21-39-50
  inflating: /content/camerapi/camerapi/2023-05-16_22-39-51
  inflating: /content/camerapi/camerapi/2023-05-16_23-39-53
  inflating: /content/camerapi/camerapi/2023-05-17_00-39-55
  inflating: /content/camerapi/camerapi/2023-05-17_01-39-56
  inflating: /content/camerapi/camerapi/2023-05-17_02-39-58
  inflating: /content/camerapi/camerapi/2023-05-17_03-40-00
  inflating: /content/camerapi/camerapi/2023-05-17_04-40-01
  inflating: /content/camerapi/camerapi/2023-05-17_05-40-03
  inflating: /content/camerapi/camerapi/2023-05-17_06-40-05
  inflating: /content/camerapi/camerapi/2023-05-17_07-40-06
  inflating: /content/camerapi/camerapi/2023-05-17_08-40-08
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  inflating: /content/camerapi/camerapi/2023-05-17_10-40-11
  inflating: /content/camerapi/camerapi/2023-05-17_11-40-12
  inflating: /content/camerapi/camerapi/2023-05-17_12-40-14
  inflating: /content/camerapi/camerapi/2023-05-17_13-40-16
  inflating: /content/camerapi/camerapi/2023-05-17_14-40-17
  inflating: /content/camerapi/camerapi/2023-05-17_15-40-19
  inflating: /content/camerapi/camerapi/2023-05-17_16-40-20
  inflating: /content/camerapi/camerapi/2023-05-17_17-40-22
  inflating: /content/camerapi/camerapi/2023-05-17_18-40-24
  inflating: /content/camerapi/camerapi/2023-05-17_19-40-25
  inflating: /content/camerapi/camerapi/2023-05-17_20-19-17
  inflating: /content/camerapi/camerapi/2023-05-17_21-19-19
  inflating: /content/camerapi/camerapi/2023-05-17_22-19-20
  inflating: /content/camerapi/camerapi/2023-05-17_23-19-22
  inflating: /content/camerapi/camerapi/2023-05-18_00-19-23
  inflating: /content/camerapi/camerapi/2023-05-18_01-19-25
  inflating: /content/camerapi/camerapi/2023-05-18_02-19-27
  inflating: /content/camerapi/camerapi/2023-05-18_03-19-28
  inflating: /content/camerapi/camerapi/2023-05-18_04-19-30
  inflating: /content/camerapi/camerapi/2023-05-18_05-19-31
  inflating: /content/camerapi/camerapi/2023-05-18_06-19-33
  inflating: /content/camerapi/camerapi/2023-05-18_07-19-34
  inflating: /content/camerapi/camerapi/2023-05-18_08-19-36
  inflating: /content/camerapi/camerapi/2023-05-18_09-19-38
  inflating: /content/camerapi/camerapi/2023-05-18_10-19-39
  inflating: /content/camerapi/camerapi/2023-05-18_11-19-41
  inflating: /content/camerapi/camerapi/2023-05-18_12-19-42
  inflating: /content/camerapi/camerapi/2023-05-18_13-19-44
  inflating: /content/camerapi/camerapi/2023-05-18_14-19-46
  inflating: /content/camerapi/camerapi/2023-05-18_15-19-47
  inflating: /content/camerapi/camerapi/2023-05-18_16-19-49
  inflating: /content/camerapi/camerapi/2023-05-18_17-19-50
  inflating: /content/camerapi/camerapi/2023-05-18_18-19-52
  inflating: /content/camerapi/camerapi/2023-05-18_19-19-53
  inflating: /content/camerapi/camerapi/2023-05-18_20-19-55
  inflating: /content/camerapi/camerapi/2023-05-18_21-19-57
  inflating: /content/camerapi/camerapi/2023-05-18_22-19-58
  inflating: /content/camerapi/camerapi/2023-05-18_23-20-00
  inflating: /content/camerapi/camerapi/2023-05-19_00-20-01
  inflating: /content/camerapi/camerapi/2023-05-19_01-20-03
  inflating: /content/camerapi/camerapi/2023-05-19_02-20-05
  inflating: /content/camerapi/camerapi/2023-05-19_03-20-06
```

```
!rm /content/camerapi/camerapi/2023-05-28_20-07-24
```

```
import os

def makedir(dir):
  if not os.path.exists(dir):
    os.makedirs(dir, exist_ok=True)

makedir("/content/week2")
makedir("/content/week3")
makedir("/content/week4")
```

```
import re
import os

week_2_data = []
week_3_data = []
week_4_data = []

for data in os.listdir("/content/camerapi/camerapi"):
  re_data = re.search(r"(\d+)-(\d+)-(\d+)_(\d+)-(\d+)-(\d+)", data)
  month, date = int(re_data[2]), int(re_data[3])
  # print(month,date)

  if month == 5:
    if date < 20:
      week_2_data.append(data)
    elif date < 24:
      week_3_data.append(data)
    else:
      week_4_data.append(data)
  else:
    if date < 5:
      week_4_data.append(data)


import shutil

for data in range(len(week_2_data)):
  shutil.copy("/content/camerapi/camerapi/"+week_2_data[data], "/content/week2/"+week_2_data[data])

for data in range(len(week_3_data)):
  shutil.copy("/content/camerapi/camerapi/"+week_3_data[data], "/content/week3/"+week_3_data[data])

for data in range(len(week_4_data)):
  shutil.copy("/content/camerapi/camerapi/"+week_4_data[data], "/content/week4/"+week_4_data[data])


print(len(week_2_data))
```

```
77
```

```
print(len(week_3_data))
```

```
96
```

```
print(len(week_4_data))
```

```
173
```

```
from PIL import Image
import numpy as np
import matplotlib.pyplot as plt

def segment_image(image_array):
    # Tentukan rentang warna yang ingin disegmentasi dalam format RGB
    color_ranges = [
        # Rentang warna minggu 2
        (np.array([65, 101, 50]), np.array([121, 144, 119])),
        (np.array([62, 88, 43]), np.array([124, 167, 99])),
        (np.array([68, 76, 75]), np.array([128, 146, 136])),
        (np.array([87, 97, 80]), np.array([133, 175, 139])),
        (np.array([70, 99, 71]), np.array([131, 183, 133])),
        (np.array([67, 80, 68]), np.array([99, 117, 101])),
        (np.array([84, 96, 88]), np.array([110, 122, 111])),
        (np.array([59, 70, 57]), np.array([143, 177, 130])),
        (np.array([72, 90, 66]), np.array([134, 164, 131])),
        (np.array([69, 127, 107]), np.array([139, 137, 140])),
        (np.array([61, 84, 48]), np.array([143, 188, 133])),
        (np.array([76, 88, 74]), np.array([119, 148, 123])),
        (np.array([85, 104, 78]), np.array([157, 171, 136])),
        (np.array([83, 103, 84]), np.array([151, 198, 151])),
        # Rentang warna minggu 3
        (np.array([97, 94, 64]), np.array([170, 196, 141])),
        # Rentang warna minggu 4
        (np.array([44, 137, 65]), np.array([96, 208, 168])),
        (np.array([23, 77, 60]), np.array([57, 114, 129]))
    ]
```

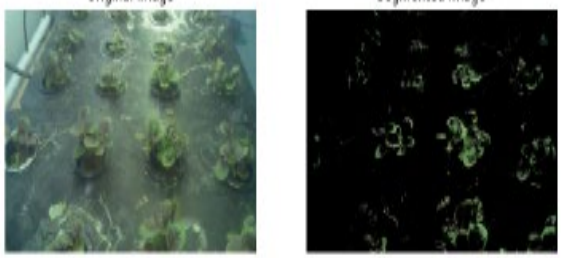
```
    # Rentang warna yang ingin dihindari dalam format RGB
    avoid_ranges = [
        # # Rentang warna minggu 2
        (np.array([52, 62, 57]), np.array([109, 107, 111])),
        (np.array([101, 120, 101]), np.array([126, 153, 127])),
        (np.array([76, 98, 95]), np.array([103, 123, 117])),
        (np.array([88, 127, 107]), np.array([93, 137, 140])),
        (np.array([63, 84, 89]), np.array([102, 136, 137])),
        (np.array([96, 150, 139]), np.array([116, 165, 170])),
        (np.array([113, 138, 121]), np.array([168, 198, 153])),
        (np.array([95, 116, 94]), np.array([117, 161, 161])),
        # Rentang warna minggu 3
        (np.array([75, 106, 96]), np.array([139, 142, 156])),
        (np.array([103, 162, 160]), np.array([112, 165, 164])),
        # Rentang warna minggu 4
        (np.array([15, 54, 61]), np.array([59, 115, 110]))
    ]

    # Membuat masker warna untuk rentang warna yang ingin dihindari
    avoid_color_mask = np.zeros(image_array.shape[:2], dtype=bool)
    for lower_color, upper_color in avoid_ranges:
        avoid_color_mask |= np.all((image_array >= lower_color) & (image_array <= upper_color), axis=-1)

    # Membuat masker warna untuk rentang warna yang ingin disegmentasi
    color_mask = np.zeros(image_array.shape[:2], dtype=bool)
    for lower_color, upper_color in color_ranges:
        color_mask |= np.all((image_array >= lower_color) & (image_array <= upper_color), axis=-1)

    # Menghilangkan area yang ingin dihindari dari masker warna hasil segmentasi
    color_mask &= ~avoid_color_mask

    return color_mask


def show_image(image_array,color_mask):
    # Buat gambar hasil segmentasi
    segmented_array = np.zeros_like(image_array)
    segmented_array[color_mask] = image_array[color_mask]

    # Tampilkan gambar asli dan gambar yang telah disegmentasi
    fig, axes = plt.subplots(1, 2, figsize=(10, 5))
    axes[0].imshow(image_array)
    axes[0].set_title('Original Image')
    axes[0].axis('off')

    axes[1].imshow(segmented_array)
    axes[1].set_title('Segmented Image')
    axes[1].axis('off')

    plt.show()


def upload_image(filename):
    try:
        image = Image.open(filename)
        image_array = np.array(image)
        color_mask = segment_image(image_array)
        return image_array, color_mask
    except Exception as e:
        print(e)
        return None, None


test = [
    "/content/camerapi/camerapi/2023-05-16_19-39-47",
    "/content/camerapi/camerapi/2023-05-22_00-21-56",
    "/content/camerapi/camerapi/2023-05-20_17-21-07",
    "/content/camerapi/camerapi/2023-05-28_21-07-26",
    "/content/camerapi/camerapi/2023-05-29_01-07-32",
    "/content/camerapi/camerapi/2023-06-04_02-11-25",
    "/content/camerapi/camerapi/2023-06-10_22-29-51",
    "/content/week2/2023-05-17_16-40-20",
    "/content/week2/2023-05-19_17-20-28",
    "/content/week3/2023-05-23_22-23-10"
]
```



```
for loop in test:
  image_array, color_mask = upload_image(loop)
  num_pixels = np.sum(color_mask)
  print(num_pixels)
  print(loop)
  show_image(image_array, color_mask)
```

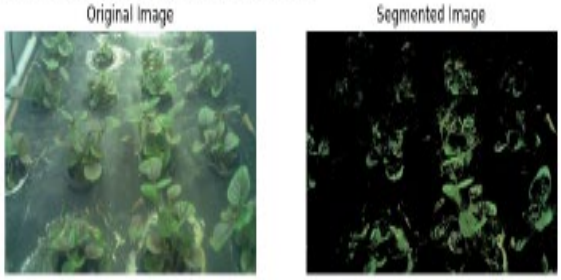
111683
/content/camerapi/camerapi/2023-05-16_19-39-47

Original Image Segmented Image



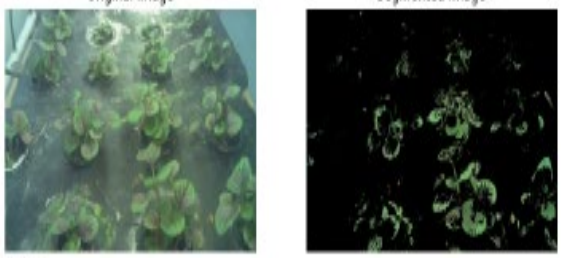
227937
/content/camerapi/camerapi/2023-05-22_00-21-56

Original Image Segmented Image



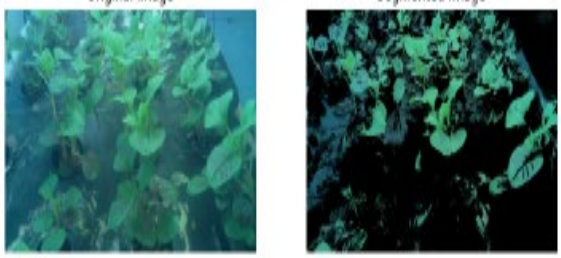
178569
/content/camerapi/camerapi/2023-05-20_17-21-07

Original Image Segmented Image



634827
/content/camerapi/camerapi/2023-05-28_21-07-26

Original Image Segmented Image



576540
/content/camerapi/camerapi/2023-05-29_01-07-32

Original Image Segmented Image

```
#evaluate the algorithm to classify

def classify_image(filename):
    _, color_mask = upload_image(filename)
    if color_mask is None:
      return "wrong data"
    num_pixels = np.sum(color_mask)

    if num_pixels <= 200000:
      return (0, num_pixels, filename)
    elif num_pixels <= 500000:
      return (1, num_pixels, filename)
    else:
      return (2, num_pixels, filename)


image_pixels = []
image_groups = []
predict_groups = []
wrong_image = []

import os

for image in os.listdir("/content/week2"):
    results = classify_image("/content/week2/"+image)

    # untuk clustering, 1 kali saja hehe
    image_pixels.append(results[1])
    image_groups.append(0)
    predict_groups.append(results[0])

    if results[0] != 0:
      wrong_image.append([image, results[2]])


for image in os.listdir("/content/week3"):
    results = classify_image("/content/week3/"+image)
    if results == "wrong data":
      continue

    # untuk clustering, 1 kali saja hehe
    image_pixels.append(results[1])
    image_groups.append(1)
    predict_groups.append(results[0])

    if results[0] != 1:
      wrong_image.append([image, results[2]])

for image in os.listdir("/content/week4"):
    results = classify_image("/content/week4/"+image)

    # untuk clustering, 1 kali saja hehe
    image_pixels.append(results[1])
    image_groups.append(2)
    predict_groups.append(results[0])

    if results[0] != 2:
      wrong_image.append([image, results[2]])
```

```
---------------------------------------------------------------------------
KeyboardInterrupt                         Traceback (most recent call last)
<ipython-input-23-36ea22aaba6e> in <cell line: 8>()
      7
      8 for image in os.listdir("/content/week2"):
----> 9     results = classify_image("/content/week2/"+image)
     10
     11     # untuk clustering, 1 kali saja hehe

                                3 frames
/usr/local/lib/python3.10/dist-packages/numpy/core/overrides.py in all(*args, **kwargs)

KeyboardInterrupt:
```

SEARCH STACK OVERFLOW

```
# Import necessary libraries
import numpy as np
```

Lampiran 3. Python Notebook untuk Pembuatan Model Machine Learning pada Tingkat Pertumbuhan Bayam Merah


```
from google.colab import drive
drive.mount('/content/drive')
```

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

```
!unzip "/content/drive/MyDrive/bayam_merah_fix_data (1).zip" -d /content/bayam_merah
```

```
Archive:  /content/drive/MyDrive/bayam_merah_fix_data (1).zip
  extracting: /content/bayam_merah/content/week2/2023-11-13_17:44:05_1194.88_6.4_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_23:36:44_1185.45_6.66_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_00:32:43_1171.09_6.7_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_02:37:19_1187.34_6.3_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-13_16:43:53_1188.4_6.66_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-19_00:41:46_1160.28_6.15_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-15_00:50:15_1159.36_6.15_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_17:30:08_1170.2_6.42_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-13_14:43:31_1173.58_6.66_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_09:38:40_1169.35_6.23_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_06:46:28_1150.06_6.23_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-19_07:43:05_1152.95_6.05_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_23:50:03_1180.11_6.54_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_20:32:04_1168.02_6.69_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-13_19:44:27_1157.36_6.02_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-13_23:45:23_1181.55_6.64_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_03:37:31_1157.78_6.02_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_09:34:20_1189.66_6.17_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_20:40:53_1177.13_6.8_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_10:07:18_1183.41_6.68_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_14:35:28_1156.7_6.67_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_11:47:10_1156.44_6.6_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_04:46:05_1185.7_6.99_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_21:32:16_1184.69_6.96_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_10:38:52_1193.15_6.56_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_14:48:16_1152.78_6.16_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_16:29:54_1157.46_6.97_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_13:35:25_1164.59_6.79_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-19_11:43:52_1169.04_6.13_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_05:33:33_1193.63_6.71_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_17:48:55_1181.54_6.58_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_07:33:57_1191.94_6.41_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_10:34:50_1177.39_6.15_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_14:18:30_1158.12_6.62_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-15_11:52:19_1185.4_6.12_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_17:40:25_1186.81_6.23_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_19:40:41_1180.61_6.38_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_10:46:58_1160.09_6.04_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_23:41:35_1162.71_6.64_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_05:37:55_1157.74_6.9_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_19:31:53_1184.95_6.6_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_12:35:13_1188.21_6.55_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-19_12:44:03_1168.37_6.81_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-15_12:52:34_1157.94_6.06_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-19_06:42:54_1173.11_6.86_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_09:07:05_1159.83_6.89_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_07:46:31_1165.28_6.4_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-15_13:52:46_1191.02_6.81_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_18:31:40_1165.39_6.94_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_22:36:30_1178.26_6.57_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-15_04:50:56_1163.82_6.08_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_08:38:29_1188.26_6.05_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_19:49:17_1162.09_6.25_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_18:36:09_1189.5_6.4_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_13:47:42_1190.02_6.05_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_06:33:45_1164.99_6.63_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_08:46:34_1173.27_6.69_24.8_79.8.jpg
```

```
import os
```

```
len(os.listdir("/content/bayam_merah/content/week2"))
```

```
130
```

```
len(os.listdir("/content/bayam_merah/content/week3"))
```

```
123
```

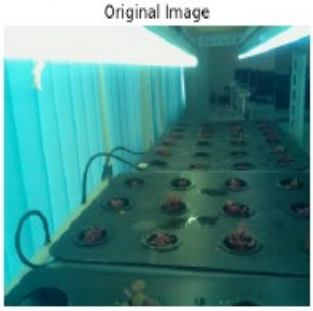
```
len(os.listdir("/content/bayam_merah/content/week4"))
```

```
from PIL import Image
import numpy as np
import matplotlib.pyplot as plt

def segment_image(image_array):
    # Tentukan rentang warna yang ingin disegmentasi dalam format RGB
    color_ranges = [
        # Rentang warna minggu 2
        (np.array([70, 117, 17]), np.array([136, 213, 91])),
        (np.array([25, 96, 6]), np.array([72, 152, 63])),
        (np.array([58, 53, 13]), np.array([93, 122, 84])),
        (np.array([72, 90, 74]), np.array([89, 112, 87])),
        (np.array([83, 85, 27]), np.array([97, 117, 91])),
        (np.array([48, 115, 62]), np.array([66, 136, 77])),
        (np.array([77, 100, 85]), np.array([81, 108, 91])),
        # Rentang warna minggu 3
        (np.array([60, 114, 0]), np.array([102, 199, 51])),
        (np.array([109, 127, 74]), np.array([129, 158, 93])),
        (np.array([87, 146, 49]), np.array([108, 191, 85])),
        (np.array([73, 47, 67]), np.array([87, 136, 92])),
        (np.array([39, 54, 59]), np.array([63, 83, 81])),
        # Rentang warna minggu 4
        (np.array([104, 183, 77]), np.array([155, 238, 126])),
        (np.array([117, 188, 0]), np.array([176, 243, 7])),
        (np.array([195, 236, 145]), np.array([241, 245, 229])),
        (np.array([92, 189, 0]), np.array([120, 216, 55])),
        (np.array([24, 52, 6]), np.array([65, 103, 45])),
        (np.array([35, 78, 59]), np.array([55, 99, 81])),
        (np.array([43, 113, 17]), np.array([71, 153, 45])),
        (np.array([24, 52, 6]), np.array([65, 103, 45])),
        (np.array([129, 213, 0]), np.array([174, 243, 36])),
        (np.array([25, 60, 49]), np.array([52, 98, 72])),
        (np.array([55, 84, 52]), np.array([69, 101, 63])),
        (np.array([34, 87, 58]), np.array([53, 128, 70])),
        (np.array([62, 107, 61]), np.array([83, 154, 78])),
        (np.array([68, 96, 71]), np.array([83, 106, 81])),
        (np.array([26, 53, 44]), np.array([69, 101, 72])),
        (np.array([25, 71, 53]), np.array([65, 96, 75])),
        (np.array([50, 135, 59]), np.array([67, 144, 76])),
        (np.array([30, 51, 35]), np.array([69, 130, 80]))
    ]

     # Rentang warna yang ingin dihindari dalam format RGB
    avoid_ranges = [
        # Rentang warna minggu 2
        (np.array([58, 82, 58]), np.array([66, 88, 64])),
        # (np.array([41, 88, 73]), np.array([72, 108, 84])),
        (np.array([32, 69, 62]), np.array([59, 89, 89])),
        (np.array([58, 82, 58]), np.array([66, 88, 64])),
        (np.array([103, 136, 89]), np.array([158, 197, 127])),
        (np.array([44, 91, 77]), np.array([63, 102, 84])),
        # Rentang warna minggu 3
        (np.array([62, 96, 69]), np.array([74, 110, 84])),
        (np.array([68, 106, 77]), np.array([104, 141, 99])),
        (np.array([25, 79, 58]), np.array([52, 108, 72])),
        (np.array([17, 56, 53]), np.array([28, 71, 61])),
        (np.array([19, 63, 37]), np.array([30, 73, 63])),
        (np.array([21, 66, 57]), np.array([31, 80, 73])),
        (np.array([66, 93, 59]), np.array([109, 135, 87])),
        (np.array([19, 58, 56]), np.array([29, 68, 65])),
        (np.array([52, 87, 72]), np.array([63, 102, 87])),
        (np.array([20, 91, 76]), np.array([51, 105, 85])),
        # Rentang warna minggu 4
        (np.array([30, 65, 52]), np.array([40, 74, 62])),
        (np.array([33, 65, 44]), np.array([51, 93, 71])),
        (np.array([55, 90, 66]), np.array([62, 97, 73])),
        (np.array([31, 87, 76]), np.array([42, 92, 83])),
        (np.array([24, 54, 40]), np.array([36, 67, 53])),
        (np.array([22, 59, 54]), np.array([29, 67, 62])),
        (np.array([88, 119, 71]), np.array([166, 200, 114])),
    ]

    # Membuat masker warna untuk rentang warna yang ingin dihindari
    avoid_color_mask = np.zeros(image_array.shape[:2], dtype=bool)
    for lower_color, upper_color in avoid_ranges:
        avoid_color_mask |= np.all((image_array >= lower_color) & (image_array <= upper_color), axis=-1)
```

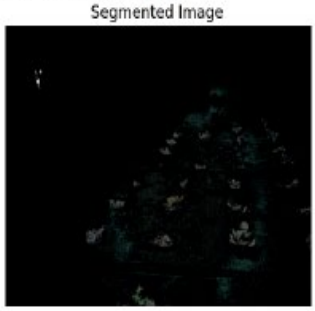
```
    # Membuat masker warna untuk rentang warna yang ingin disegmentasi
    color_mask = np.zeros(image_array.shape[:2], dtype=bool)
    for lower_color, upper_color in color_ranges:
        color_mask |= np.all((image_array >= lower_color) & (image_array <= upper_color), axis=-1)

    # Menghilangkan area yang ingin dihindari dari masker warna hasil segmentasi
    color_mask &= ~avoid_color_mask

    return color_mask


def show_image(image_array,color_mask):
    # Buat gambar hasil segmentasi
    segmented_array = np.zeros_like(image_array)
    segmented_array[color_mask] = image_array[color_mask]

    # Tampilkan gambar asli dan gambar yang telah disegmentasi
    fig, axes = plt.subplots(1, 2, figsize=(10, 5))
    axes[0].imshow(image_array)
    axes[0].set_title('Original Image')
    axes[0].axis('off')

    axes[1].imshow(segmented_array)
    axes[1].set_title('Segmented Image')
    axes[1].axis('off')

    plt.show()


def upload_image(filename):
    try:
        image = Image.open(filename)
        image_array = np.array(image)
        color_mask = segment_image(image_array)
        return image_array, color_mask
    except Exception as e:
        print(e)
        return None, None


test = [
    "/content/bayam_merah/content/week2/2023-11-13_14:43:31_1173.58_6.66_24.8_79.8.jpg",
    "/content/bayam_merah/content/week2/2023-11-19_01:41:57_1173.21_6.72_24.8_79.8.jpg",
    "/content/bayam_merah/content/week3/2023-11-20_12:20:58_1169.13_6.38_24.8_79.8.jpg",
    "/content/bayam_merah/content/week3/2023-11-26_00:51:13_1188.81_6.94_24.8_79.8.jpg",
    "/content/bayam_merah/content/week4/2023-11-28_02:44:03_1184.31_6.69_24.8_79.8.jpg",
    "/content/bayam_merah/content/week4/2023-12-06_22:53:49_1170.07_6.65_24.8_79.8.jpg"
]

for loop in test:
  image_array, color_mask = upload_image(loop)
  num_pixels = np.sum(color_mask)
  print(num_pixels)
  print(loop)
  show_image(image_array, color_mask)
```

```
46704
/content/bayam_merah/content/week2/2023-11-13_14:43:31_1173.58_6.66_24.8_79.8.jpg
```

Original Image

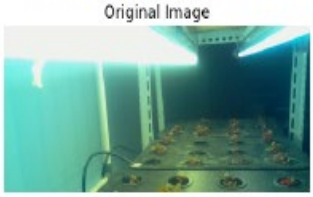


Segmented Image

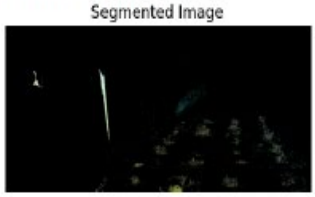


```
53488
/content/bayam_merah/content/week2/2023-11-19_01:41:57_1173.21_6.72_24.8_79.8.jpg
```

Original Image



Segmented Image



```
#evaluate the algorithm to classify

def classify_image(filename):
    _, color_mask = upload_image(filename)
    if color_mask is None:
      return "wrong data"
    num_pixels = np.sum(color_mask)

    if num_pixels <= 54000:
      return (0, num_pixels, filename)
    elif num_pixels <= 120000:
      return (1, num_pixels, filename)
    else:
      return (2, num_pixels, filename)
```

```
image_pixels = []
image_groups = []
predict_groups = []
wrong_image = []

import os

for image in os.listdir("/content/bayam_merah/content/week2"):
    results = classify_image("/content/bayam_merah/content/week2/"+image)

    # untuk clustering, 1 kali saja hehe
    image_pixels.append(results[1])
    image_groups.append(0)
    predict_groups.append(results[0])
```

```
# Import necessary libraries
import numpy as np
from sklearn.metrics import confusion_matrix, accuracy_score
import matplotlib.pyplot as plt


print(confusion_matrix(image_groups, predict_groups))
print(f"Accuracy (might need rearrangement): {accuracy_score(image_groups, predict_groups)}")
```

```
[[ 72  58   0]
 [ 21  98   4]
 [  0  47 164]]
Accuracy (might need rearrangement): 0.7198275862068966
```

```
    predict_groups.append(results[0])
```

```
# show the wrong data
for image, filename in wrong_image:
  image_array, color_mask = upload_image(filename)
  num_pixels = np.sum(color_mask)
  print(num_pixels)
  print(filename)
  show_image(image_array, color_mask)
```

```
image_pixel_values = np.array(image_pixels).reshape(-1, 1)
```

```
    predict_groups.append(results[0])
```

```
# Import necessary libraries
from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import train_test_split
```

Lampiran 4. Python Notebook untuk Pembuatan Model Machine Learning pada Tingkat Nutrisi Bayam


```
from google.colab import drive
drive.mount('/content/drive')
```

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

```
!unzip "/content/drive/MyDrive/bayam_merah_fix_data (1).zip" -d /content/bayam_merah
```

```
Archive:  /content/drive/MyDrive/bayam_merah_fix_data (1).zip
  extracting: /content/bayam_merah/content/week2/2023-11-13_17:44:05_1194.88_6.4_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_23:36:44_1185.45_6.66_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_00:32:43_1171.09_6.7_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_02:37:19_1187.34_6.3_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-13_16:43:53_1188.4_6.66_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-19_00:41:46_1160.28_6.15_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-15_00:50:15_1159.36_6.15_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_17:30:00_1170.2_6.42_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-13_14:43:31_1173.58_6.66_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_09:38:40_1169.35_6.23_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_06:46:28_1150.06_6.23_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-19_07:43:05_1152.95_6.05_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_23:50:03_1180.11_6.54_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_20:32:04_1168.02_6.69_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-13_19:44:27_1157.36_6.02_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-13_23:45:23_1181.55_6.64_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_03:37:31_1157.78_6.02_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_09:34:20_1189.66_6.17_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_20:40:53_1177.13_6.8_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_10:07:18_1183.41_6.68_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_14:35:28_1156.7_6.67_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_11:47:10_1156.44_6.6_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_04:46:05_1185.7_6.99_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_21:32:16_1184.69_6.96_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_10:38:52_1193.15_6.56_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_14:48:16_1152.78_6.16_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_16:29:54_1157.46_6.97_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_13:35:25_1164.59_6.79_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-19_11:43:52_1169.04_6.13_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_05:33:33_1193.63_6.71_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_17:48:55_1181.54_6.58_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_07:33:57_1191.94_6.41_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_10:34:50_1177.39_6.15_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_14:18:30_1158.12_6.62_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-15_11:52:19_1185.4_6.12_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_17:40:25_1186.81_6.23_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_19:40:41_1180.61_6.38_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_10:46:58_1160.09_6.04_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_23:41:35_1162.71_6.64_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_05:37:55_1157.74_6.9_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_19:31:53_1184.95_6.6_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_12:35:13_1188.21_6.55_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-19_12:44:03_1168.37_6.81_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-15_12:52:34_1157.94_6.06_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-19_06:42:54_1173.11_6.86_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_09:07:05_1159.83_6.89_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_07:46:31_1165.28_6.4_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-15_13:52:46_1191.02_6.81_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-16_18:31:40_1165.39_6.94_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_22:36:30_1178.26_6.57_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-15_04:50:56_1163.82_6.08_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-18_08:38:29_1188.26_6.85_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_19:49:17_1162.09_6.25_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_18:36:09_1189.5_6.4_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_13:47:42_1190.02_6.05_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-17_06:33:45_1164.99_6.63_24.8_79.8.jpg
  extracting: /content/bayam_merah/content/week2/2023-11-14_08:46:34_1173.27_6.69_24.8_79.8.jpg
```

```
import os
print(len(os.listdir("/content/drive/MyDrive/new malnutrisi")))
print(len(os.listdir("/content/drive/MyDrive/new overnutrisi")))
```

```
43
47
```

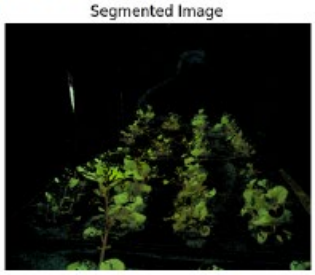
```
from PIL import Image
import numpy as np
import matplotlib.pyplot as plt

def segment_image(image_array):
    # Tentukan rentang warna yang ingin disegmentasi dalam format RGB
    color_ranges = [
        # Rentang warna minggu 2
        (np.array([70, 117, 17]), np.array([136, 213, 91])),
        (np.array([25, 96, 6]), np.array([72, 152, 63])),
        (np.array([58, 53, 13]), np.array([93, 122, 84])),
        (np.array([72, 90, 74]), np.array([89, 112, 87])),
        (np.array([83, 85, 27]), np.array([97, 117, 91])),
        (np.array([48, 115, 62]), np.array([66, 136, 77])),
        (np.array([77, 100, 85]), np.array([81, 108, 91])),
        # Rentang warna minggu 3
        (np.array([60, 114, 0]), np.array([102, 199, 51])),
        (np.array([109, 127, 74]), np.array([129, 158, 93])),
        (np.array([87, 146, 49]), np.array([108, 191, 85])),
        (np.array([73, 47, 67]), np.array([87, 136, 92])),
        (np.array([39, 54, 59]), np.array([63, 83, 81])),
        # Rentang warna minggu 4
        (np.array([104, 183, 77]), np.array([155, 238, 126])),
        (np.array([117, 188, 0]), np.array([176, 243, 7])),
        (np.array([195, 236, 145]), np.array([241, 245, 229])),
        (np.array([92, 189, 0]), np.array([120, 216, 55])),
        (np.array([24, 52, 6]), np.array([65, 103, 45])),
        (np.array([35, 78, 59]), np.array([55, 99, 81])),
        (np.array([43, 113, 17]), np.array([71, 153, 45])),
        (np.array([24, 52, 6]), np.array([65, 103, 45])),
        (np.array([129, 213, 0]), np.array([174, 243, 36])),
        (np.array([25, 60, 49]), np.array([52, 98, 72])),
        (np.array([55, 84, 52]), np.array([69, 101, 63])),
        (np.array([34, 87, 58]), np.array([53, 128, 70])),
        (np.array([62, 107, 61]), np.array([83, 154, 78])),
        (np.array([68, 96, 71]), np.array([83, 106, 81])),
        (np.array([26, 53, 44]), np.array([69, 101, 72])),
        (np.array([25, 71, 53]), np.array([65, 96, 75])),
        (np.array([50, 135, 59]), np.array([67, 144, 76])),
        (np.array([30, 51, 35]), np.array([69, 130, 80]))
    ]

     # Rentang warna yang ingin dihindari dalam format RGB
    avoid_ranges = [
        # Rentang warna minggu 2
        (np.array([58, 82, 58]), np.array([66, 88, 64])),
        # (np.array([41, 88, 73]), np.array([72, 108, 84])),
        (np.array([32, 69, 62]), np.array([59, 89, 89])),
        (np.array([58, 82, 58]), np.array([66, 88, 64])),
        (np.array([103, 136, 89]), np.array([158, 197, 127])),
        (np.array([44, 91, 77]), np.array([63, 102, 84])),
        (np.array([196, 241, 207]), np.array([240, 244, 239])),
        (np.array([62, 88, 56]), np.array([75, 104, 75])),
        # Rentang warna minggu 3
        (np.array([62, 96, 69]), np.array([74, 110, 84])),
        (np.array([68, 106, 77]), np.array([104, 141, 99])),
        (np.array([25, 79, 58]), np.array([52, 108, 72])),
        (np.array([17, 56, 53]), np.array([28, 71, 61])),
        (np.array([19, 63, 37]), np.array([30, 73, 63])),
        (np.array([21, 66, 57]), np.array([31, 80, 73])),
        (np.array([66, 93, 59]), np.array([109, 135, 87])),
        (np.array([19, 58, 56]), np.array([29, 68, 65])),
        (np.array([52, 87, 72]), np.array([63, 102, 87])),
        (np.array([20, 91, 76]), np.array([51, 105, 85])),
        (np.array([45, 73, 46]), np.array([59, 84, 59])),
        (np.array([47, 65, 30]), np.array([60, 76, 35])),
        # Rentang warna minggu 4
        (np.array([30, 65, 52]), np.array([40, 74, 62])),
        (np.array([33, 65, 44]), np.array([51, 93, 71])),
        (np.array([55, 90, 66]), np.array([62, 97, 73])),
        (np.array([31, 87, 76]), np.array([42, 92, 83])),
        (np.array([24, 54, 40]), np.array([36, 67, 53])),
        (np.array([22, 59, 54]), np.array([29, 67, 62])),
        (np.array([88, 119, 71]), np.array([166, 200, 114])),
        (np.array([57, 72, 29]), np.array([63, 78, 33])),
    ]
```

```
    # Membuat masker warna untuk rentang warna yang ingin dihindari
    avoid_color_mask = np.zeros(image_array.shape[:2], dtype=bool)
    for lower_color, upper_color in avoid_ranges:
        avoid_color_mask |= np.all((image_array >= lower_color) & (image_array <= upper_color), axis=-1)

    # Membuat masker warna untuk rentang warna yang ingin disegmentasi
    color_mask = np.zeros(image_array.shape[:2], dtype=bool)
    for lower_color, upper_color in color_ranges:
        color_mask |= np.all((image_array >= lower_color) & (image_array <= upper_color), axis=-1)

    # Menghilangkan area yang ingin dihindari dari masker warna hasil segmentasi
    color_mask &= ~avoid_color_mask

    return color_mask


def show_image(image_array,color_mask):
    # Buat gambar hasil segmentasi
    segmented_array = np.zeros_like(image_array)
    segmented_array[color_mask] = image_array[color_mask]

    # Tampilkan gambar asli dan gambar yang telah disegmentasi
    fig, axes = plt.subplots(1, 2, figsize=(10, 5))
    axes[0].imshow(image_array)
    axes[0].set_title('Original Image')
    axes[0].axis('off')

    axes[1].imshow(segmented_array)
    axes[1].set_title('Segmented Image')
    axes[1].axis('off')

    plt.show()


def upload_image(filename):
    try:
        image = Image.open(filename)
        image_array = np.array(image)
        color_mask = segment_image(image_array)
        return image_array, color_mask
    except Exception as e:
        print(e)
        return None, None


test = [
    "/content/bayam_merah/content/week4/2023-12-06_22:53:49_1170.07_6.65_24.8_79.8.jpg",
    "/content/bayam_merah/content/week4/2023-12-07_09:56:05_1159.02_6.3_24.8_79.8.jpg",
    "/content/drive/MyDrive/new malnutrisi/Copy of 2024-02-20_07:38:27.jpg",
    "/content/drive/MyDrive/new malnutrisi/Copy of 2024-02-21_08:45:24.jpg",
    "/content/drive/MyDrive/new overnutrisi/Copy of 2024-02-24_18:58:08.jpg",

]

for loop in test:
  image_array, color_mask = upload_image(loop)
  num_pixels = np.sum(color_mask)
  print(num_pixels)
  print(loop)
  show_image(image_array, color_mask)
```

```
178910
/content/bayam_merah/content/week4/2023-12-06_22:53:49_1170.07_6.65_24.8_79.8.jpg
```

Original Image

Segmented Image



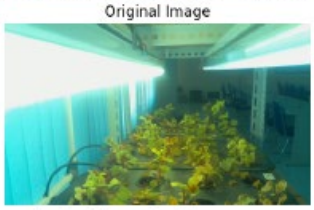
```
125016
/content/bayam_merah/content/week4/2023-12-07_09:56:05_1159.02_6.3_24.8_79.8.jpg
```

Original Image

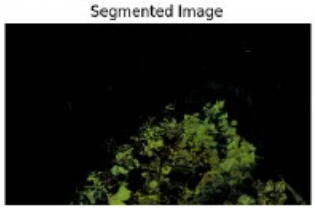
Segmented Image

```
182262
/content/drive/MyDrive/new malnutrisi/Copy of 2024-02-20 07:38:27.jpg
```

Original Image



Segmented Image



```
#evaluate the algorithm to classify

def classify_image(filename):
    _, color_mask = upload_image(filename)
    if color_mask is None:
      return "wrong data"
    num_pixels = np.sum(color_mask)

    if num_pixels <= 180000:
      return (0, num_pixels, filename)
    elif num_pixels <= 240000:
      return (1, num_pixels, filename)
    else:
      return (2, num_pixels, filename)
```

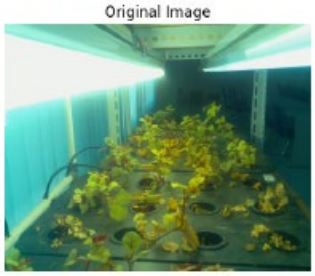
```
image_pixels = []
image_groups = []
predict_groups = []
wrong_image = []

import os

for image in os.listdir("/content/drive/MyDrive/new malnutrisi"):
    results = classify_image("/content/drive/MyDrive/new malnutrisi/"+image)

    # untuk clustering, 1 kali saja hehe
    image_pixels.append(results[1])
    image_groups.append(1)
    predict_groups.append(results[0])

    if results[0] != 0:
      wrong_image.append([image, results[2]])

week4_files = os.listdir("/content/bayam_merah/content/week4")
# week4_files.sort(reverse=True)

for image in week4_files[:50]:
    results = classify_image("/content/bayam_merah/content/week4/"+image)
    if results == "wrong data":
      continue

    # untuk clustering, 1 kali saja hehe
    image_pixels.append(results[1])
    image_groups.append(0)
    predict_groups.append(results[0])

    if results[0] != 1:
      wrong_image.append([image, results[2]])

for image in os.listdir("/content/drive/MyDrive/new overnutrisi"):
    results = classify_image("/content/drive/MyDrive/new overnutrisi/"+image)

    # untuk clustering, 1 kali saja hehe
    image_pixels.append(results[1])
    image_groups.append(2)
    predict_groups.append(results[0])

    if results[0] != 2:
      wrong_image.append([image, results[2]])


# Import necessary libraries
import numpy as np
from sklearn.metrics import confusion_matrix, accuracy_score
import matplotlib.pyplot as plt


print(confusion_matrix(image_groups, predict_groups))
print(f"Accuracy (might need rearrangement): {accuracy_score(image_groups, predict_groups)}")
```

```
[[47  3  0]
 [ 4 21 18]
 [ 1 12 34]]
Accuracy (might need rearrangement): 0.7285714285714285
```

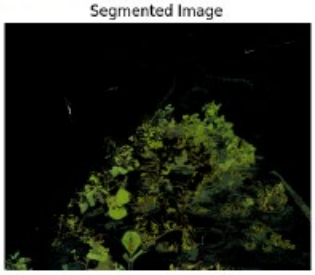
```
# show the wrong data
for image, filename in wrong_image:
  image_array, color_mask = upload_image(filename)
  num_pixels = np.sum(color_mask)
  print(num_pixels)
  print(filename)
  show_image(image_array, color_mask)
```

211160
/content/drive/MyDrive/new malnutrisi/Copy of 2024-02-21_06:44:56.jpg

Original Image

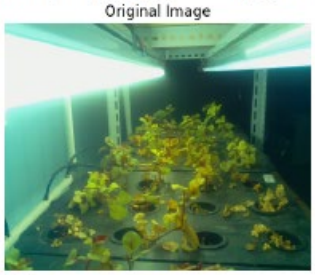


Segmented Image

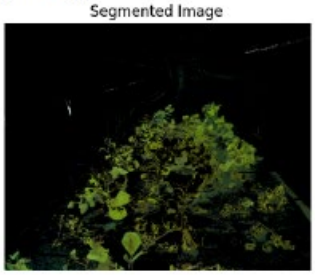


218427
/content/drive/MyDrive/new malnutrisi/Copy of 2024-02-21_05:44:43.jpg

Original Image

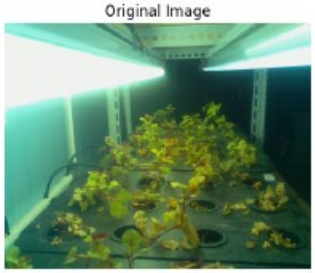


Segmented Image

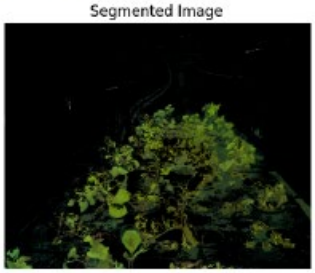


252989
/content/drive/MyDrive/new malnutrisi/Copy of 2024-02-21 02:43:58.jpg

Original Image

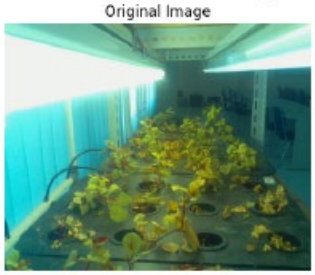


Segmented Image

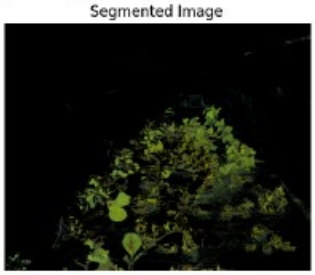


183803
/content/drive/MyDrive/new malnutrisi/Copy of 2024-02-21_08:45:24.jpg

Original Image

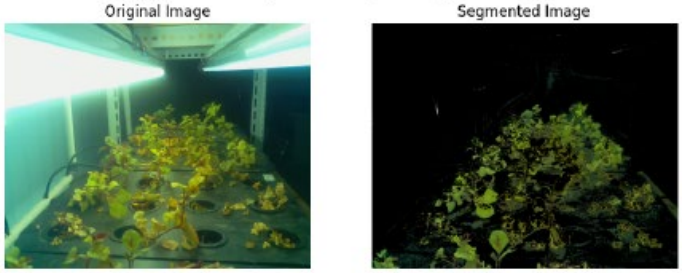


Segmented Image



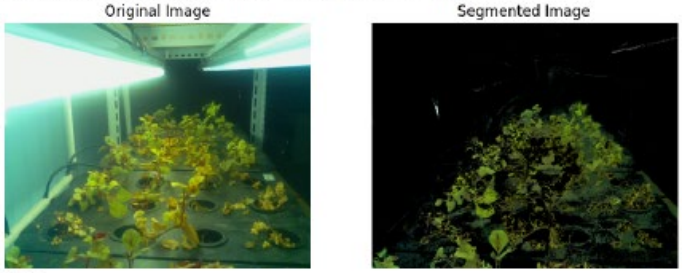
239934
/content/drive/MyDrive/new malnutrisi/Copy of 2024-02-21 03:44:16.jpg

Original Image Segmented Image



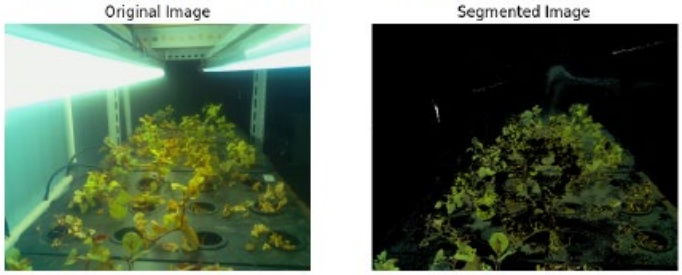
261384
/content/drive/MyDrive/new malnutrisi/Copy of 2024-02-21_04:44:30.jpg

Original Image Segmented Image



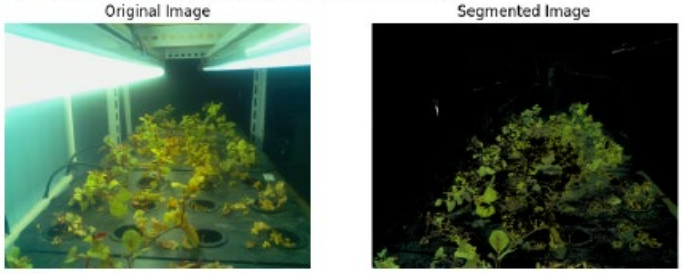
278388
/content/drive/MyDrive/new malnutrisi/Copy of 2024-02-20_19:42:19.jpg

Original Image Segmented Image



245807
/content/drive/MyDrive/new malnutrisi/Copy of 2024-02-20_18:42:06.jpg

Original Image Segmented Image

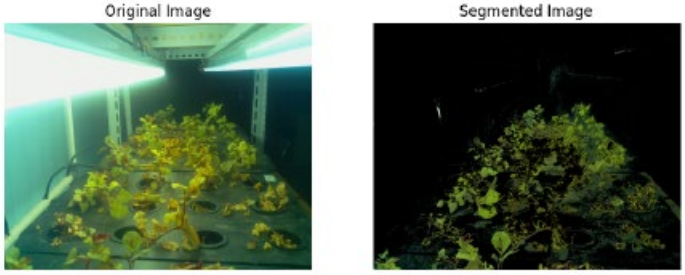


252218
/content/drive/MyDrive/new malnutrisi/Copy of 2024-02-20 23:43:15.jpg

Original Image Segmented Image

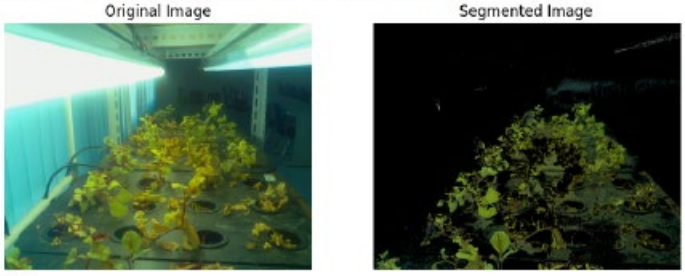
241028
/content/drive/MyDrive/new malnutrisi/Copy of 2024-02-20 21:42:45.jpg

Original Image Segmented Segmented Image



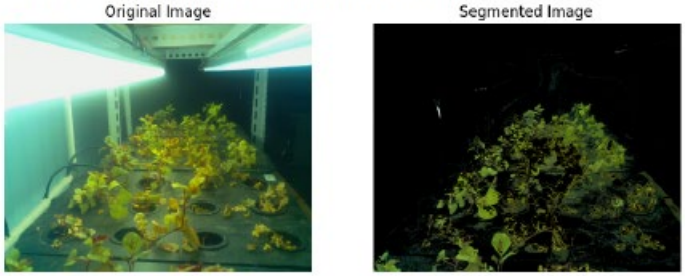
274196
/content/drive/MyDrive/new malnutrisi/Copy of 2024-02-20_17:41:51.jpg

Original Image Segmented Image



239761
/content/drive/MyDrive/new malnutrisi/Copy of 2024-02-20_20:42:32.jpg

Original Image Segmented Image



250373
/content/drive/MyDrive/new malnutrisi/Copy of 2024-02-21_00:43:29.jpg

Original Image Segmented Image

Lampiran 5. Arduino Code untuk Pengambilan Data Sensor

```
#include <EEPROM.h>
#include "DFRobot_PH.h"
#include "DHT.h"
#include "DFRobot_EC.h"
#include "GravityTDS.h"

#define EcSensorPin A2
#define TdsSensorPin A1
#define PhSensorPin A0
#define DHTSensorPin 7
#define DHTTYPE DHT22

GravityTDS gravityTds;

int phval = 0;
unsigned long int avgval;
int buffer_arr[10],temp;

float voltage,ec_value,ph_value,temperature = 25;
DFRobot_EC ec;
DFRobot_PH ph;
DHT dht(DHTSensorPin, DHTTYPE);

void setup() {
  // put your setup code here, to run once:
  Serial.begin(115200);
  Serial.setTimeout(100);

  gravityTds.setPin(TdsSensorPin);
  gravityTds.setAref(5.0);
  gravityTds.setAdcRange(1024);
  gravityTds.begin();

  ec.begin();
  ph.begin();
  dht.begin();
}

void loop() {
  // put your main code here, to run repeatedly:
  float tds, ph, ec, temp, hum;
  String data;

  tds = tdsValue();
  ph = phValue();
  ec = ecValue();
  temp = dht.readTemperature();
  hum = dht.readHumidity();

  reportToRaspi(tds, ph, ec, temp, hum);
  delay(1000);
}

void reportToRaspi(float tds, float ph, float ec, float temp, float hum){
  Serial.print(tds);
  Serial.print("-");
  Serial.print(ph);
  Serial.print("-");
  Serial.print(ec);
  Serial.print("-");
  Serial.print(temp);
  Serial.print("-");
  Serial.print(hum);
  Serial.println("");
}

float tdsValue(){
```

```
68.   gravityTds.setTemperature(temperature);  // set the temperature and execute
temperature compensation
69.   gravityTds.update();  //sample and calculate
70.   float tdsValue = gravityTds.getTdsValue();  // then get the value
71.   return(tdsValue);
72. }
73.
74. float phValue(){
75.   static unsigned long timepoint = millis();
76.     if(millis()-timepoint>1000U){                  //time interval: 1s
77.         timepoint = millis();
78.         //temperature = readTemperature();         // read your temperature
sensor to execute temperature compensation
79.         voltage = analogRead(PhSensorPin)/1024.0*5000;  // read the voltage
80.         ph_value = ph.readPH(voltage,temperature);  // convert voltage to pH
with temperature compensation
81.     }
82.   ph.calibration(voltage,temperature);           // calibration process by
Serail CMD
83.   return(ph_value);
84. }
85.
86. float ecValue(){
87.   static unsigned long timepoint = millis();
88.   if(millis()-timepoint>1000U)  //time interval: 1s
89.   {
90.     timepoint = millis();
91.     voltage = analogRead(EcSensorPin)/1024.5*5000;   // read the voltage
92.     //temperature = readTemperature();          // read your temperature sensor
to execute temperature compensation
93.     ec_value =  ec.readEC(voltage,temperature);  // convert voltage to EC with
temperature compensation
94.
95.   }
96.   ec.calibration(voltage,temperature);
97.   return(ec_value);
98. }
99.
```

Lampiran 6. Kode Klasifikasi Tingkat Pertumbuhan Tanaman

```
import pickle

from picamera import PiCamera
from PIL import Image
import RPi.GPIO as GPIO
import numpy as np
import time
import requests
import json

def set_relay(condition, relay):
    if condition:
        GPIO.setmode(GPIO.BCM)
        GPIO.setup(relay, GPIO.OUT)
    else:
        GPIO.cleanup()


def take_image():
    filename = "/home/pi/tmp/image.jpg"
    time.sleep(1)
    with PiCamera() as camera:
        camera.rotation = 180
        camera.capture(filename)
    image = Image.open(filename)
    image_array = np.array(image)
    return image_array


def segment_image(image_array):
    # Tentukan rentang warna yang ingin disegmentasi dalam format RGB
    color_ranges = [
        # Rentang warna minggu 2
        (np.array([16, 83, 1]), np.array([107, 133, 86])),
        (np.array([21, 61, 0]), np.array([64, 147, 56])),
        (np.array([112, 156, 0]), np.array([151, 205, 10])),
        (np.array([72, 90, 74]), np.array([89, 112, 87])),
        # Rentang warna minggu 3
        (np.array([28, 114, 29]), np.array([72, 182, 83])),
        (np.array([48, 193, 106]), np.array([80, 205, 161])),
        # Rentang warna minggu 4
        (np.array([92, 207, 47]), np.array([240, 247, 239])),
        (np.array([57, 145, 15]), np.array([157, 246, 116])),
        (np.array([12, 166, 102]), np.array([40, 226, 151])),
        (np.array([5, 113, 71]), np.array([34, 175, 126])),
        (np.array([0, 121, 73]), np.array([8, 144, 124])),
        (np.array([0, 110, 66]), np.array([14, 138, 69])),
        (np.array([1, 105, 58]), np.array([18, 118, 79])),
        (np.array([27, 237, 187]), np.array([142, 243, 233])),
        (np.array([0, 167, 132]), np.array([9, 193, 157])),
        (np.array([0, 87, 55]), np.array([3, 111, 71])),
        (np.array([0, 129, 108]), np.array([14, 199, 153]))    ]

     # Rentang warna yang ingin dihindari dalam format RGB
    avoid_ranges = [
        # Rentang warna minggu 2
        (np.array([3, 180, 186]), np.array([73, 215, 217])),
        (np.array([54, 112, 77]), np.array([70, 133, 99])),
        (np.array([57, 106, 81]), np.array([74, 125, 92])),
        (np.array([40, 92, 75]), np.array([74, 130, 101])),
        (np.array([23, 93, 79]), np.array([47, 104, 87])),
        (np.array([69, 112, 69]), np.array([82, 125, 81])),
        (np.array([30, 85, 80]), np.array([40, 90, 90])),
        (np.array([96, 128, 82]), np.array([116, 149, 93])),
        (np.array([62, 100, 76]), np.array([106, 138, 93])),
        (np.array([183, 234, 168]), np.array([191, 241, 186])),
        (np.array([110, 137, 79]), np.array([187, 212, 103])),
        (np.array([137, 154, 79]), np.array([197, 201, 130])),
```

```
        (np.array([103, 211, 197]), np.array([135, 241, 232])),
        (np.array([43, 87, 66]), np.array([78, 100, 78])),
        (np.array([18, 83, 79]), np.array([28, 90, 86])),
        (np.array([85, 87, 32]), np.array([95, 115, 66])),
        (np.array([20, 78, 71]), np.array([41, 93, 79])),
        (np.array([86, 129, 89]), np.array([115, 159, 101])),
        (np.array([121, 202, 158]), np.array([127, 214, 182])),
        (np.array([46, 83, 52]), np.array([111, 126, 65])),
        (np.array([31, 82, 64]), np.array([73, 115, 90])),
        (np.array([85, 87, 32]), np.array([95, 115, 66])),
        (np.array([20, 78, 71]), np.array([41, 93, 79])),
        (np.array([86, 129, 89]), np.array([115, 159, 101])),
        (np.array([121, 202, 158]), np.array([127, 214, 182])),
        (np.array([46, 83, 52]), np.array([111, 126, 65])),
        (np.array([31, 82, 64]), np.array([73, 115, 90])),
        (np.array([146, 222, 177]), np.array([198, 243, 233])),
        (np.array([70, 232, 231]), np.array([111, 245, 243])),
        (np.array([86, 124, 67]), np.array([117, 162, 93])),
        (np.array([9, 83, 72]), np.array([48, 106, 83])),
        # Rentang warna minggu 3
        (np.array([27, 66, 37]), np.array([40, 83, 53])),
        (np.array([20, 65, 45]), np.array([32, 81, 63])),
        (np.array([25, 67, 47]), np.array([52, 92, 65])),
        (np.array([240, 242, 239]), np.array([240, 242, 239]))

    ]

    # Membuat masker warna untuk rentang warna yang ingin dihindari
    avoid_color_mask = np.zeros(image_array.shape[:2], dtype=bool)
    for lower_color, upper_color in avoid_ranges:
        avoid_color_mask |= np.all((image_array >= lower_color) & (image_array
<= upper_color), axis=-1)
    # Membuat masker warna untuk rentang warna yang ingin disegmentasi
    color_mask = np.zeros(image_array.shape[:2], dtype=bool)
    for lower_color, upper_color in color_ranges:
        color_mask |= np.all((image_array >= lower_color) & (image_array <=
upper_color), axis=-1)
    # Menghilangkan area yang ingin dihindari dari masker warna hasil
segmentasi
    color_mask &= ~avoid_color_mask
    return color_mask
def classify_image(color_mask):
    pickled_model = pickle.load(open("/home/pi/mu_code/bayam_putih.pkl", "rb"))
    pickled_model.predict(color_mask)
    print(pickled_model)
while True:
    #take the image then segment it
    img_array = take_image()
    color_mask = segment_image(img_array)

    # after segment, classify it
    classify_image(color_mask)

time.sleep(2)
GPIO.cleanup()

```

Lampiran 7. Setup Aplikasi Monitoring Data Berbasis Desktop

App.py

```
1. from process.global_val import data_storage from process.threads import
setup_read_thread from utils.graph import all_graph_update, create_graph from
utils.label import create_label, all_label_update


class App:
    def __init__(self, root):
        root.title("Hydroponic Monitoring App")
        root.configure(bg="white")
        width = 800         height = 800         screenwidth =
root.winfo_screenwidth()
        screenheight = root.winfo_screenheight()
        alignstr = "%dx%d+%d+%d" % (width,
                                    height,
                                    (screenwidth - width) / 2,
                                    (screenheight - height) / 2)

        root.geometry(alignstr)
        root.resizable(width=True, height=True)

        root.read_thread = setup_read_thread(data_storage)

        label_1 = create_label(root, 0)
        ax_1, canvas_1 = create_graph(root, 1)

        label_2 = create_label(root, 2)
        ax_2, canvas_2 = create_graph(root, 3)

        label_3 = create_label(root, 4)
        ax_3, canvas_3 = create_graph(root, 5)

        label_4 = create_label(root, 6)
        ax_4, canvas_4 = create_graph(root, 7)

        labels = [label_1, label_2, label_3, label_4]
        texts = ["tds", "ph", "temp", "hum"]
        axes = [ax_1, ax_2, ax_3, ax_4]
        canvas_widgets = [canvas_1, canvas_2, canvas_3, canvas_4]

        all_label_update(root, labels, texts)
        all_graph_update(root, texts, axes, canvas_widgets)
2.
3.
```

graph.py

```
1. import matplotlib.pyplot as plt import numpy as np from
matplotlib.backends.backend_tkagg import FigureCanvasTkAgg

from database.api import get_data from process.global_val import data_storage


def plot_data(data, ax):
    """Create a visualization graph for the data"""     graph_data = data

    value = np.flipud(np.array(graph_data, dtype="float"))

    ax.plot(value)
    return ax


def all_graph_update(root, kinds, axes, canvas_widgets):
    """update the contents of the graph every 10 second"""     data =
get_data("get_all", data_storage)
    print(data)
    if data:
```

```
        for kind, ax, canvas in  zip(kinds, axes, canvas_widgets):
            if kind in data:
                ax.clear()
                plot_data(data[kind], ax)
                canvas.draw()
            else:
                print("No data kind: "+kind)
    else:
        print("No data acquired")

    root.after(10000, lambda: all_graph_update(
        root,          kinds,          axes,          canvas_widgets         )
    )


def create_graph(root, loc):
    """create a sample figure for graph"""     fig = plt.figure(figsize=(7.9, 1.6))
    ax = fig.add_subplot(111)
    canvas = FigureCanvasTkAgg(fig, root)
    canvas.get_tk_widget().grid(row=loc, column=0)
    canvas.draw()
    return ax, canvas
2.
3.
```

label.py

```
1. from tkinter import Label from tkinter.font import Font

from database.api import get_data from process.global_val import data_storage


def create_label(root, loc):
    """Create a new label to show the data"""     label = Label(root)
    ft = Font(family="Helvetica", size=20)
    label["font"] = ft     label["fg"] = "#333333"     label["justify"] = "center"
label["bg"] = "white"     label.grid(row=loc, column=0)
    return label


def all_label_update(root, labels, texts):
    """Update the label text"""     data = get_data("get_one", data_storage)
    if data:
        for label, text in zip(labels, texts):
            if text in data:
                label.configure(text=text.upper() + ": " + str(data[text]))
            else:
                print(f"No data for key: {text}")
    else:
        print("No data retrieved from queue.")

    root.after(1000, lambda: all_label_update(root, labels, texts))
2.
3.
```

api.py

```
1. import re


def process_data(data, data_storage):
    """processing the data achieved"""     data = data.decode().rstrip()
    data = re.match(r"(.*)-(.*)-(.*)-(.*)-(.*)", data)

    if data is not None:
        data = data.groups()

        data_json = {
            "tds": data[0],
            "ph": data[1],
            "temp": data[3],
```

```
            "hum": data[4]
        }

    data_storage.add_data_point(data_json)


def get_data(req, data_storage):
    """
    get the data from the api,
    get_one to get last input data,
    get_all to get last 10 data
    """     if req == "get_one":
        return data_storage.get_single_data()
    elif req == "get_all":
        return data_storage.get_all_data()
2.
3.
```

DataStorage.py

```
1. class DataStorage:
    def __init__(self):
        self.last_10_data_points = []

    def add_data_point(self, data_point):
        self.last_10_data_points.append(data_point)
        while len(self.last_10_data_points) > 10:
            self.last_10_data_points.pop(0)

    def get_all_data(self):
        try:
            result = {key: [d[key] for d in self.last_10_data_points] for key in
self.last_10_data_points[0]}
            return result         except IndexError as e:
            print(e)
            return {}

    def get_single_data(self):
        if self.last_10_data_points:
            return self.last_10_data_points[-1]
        return None  # or return a default value or raise an exception

    def get_data_by_index(self, index):
        if 0 <= index < len(self.last_10_data_points):
            return self.last_10_data_points[index]
        return None  # or return a default value or raise an exception
2.
3.
```

arduino_local.py

```
1. import socket from csv import writer from datetime import datetime

import paho.mqtt.publish as publish

from database.api import process_data from process.global_val import data_queue

MQTT_SERVER = "10.1.2.60" MQTT_PATH = "sensor"


def publish_single(payload):
    publish.single(
        topic=MQTT_PATH,
        payload=payload,
        hostname=MQTT_SERVER     )


def read_arduino(arduino_serial, data_storage):
    while True:
        data = arduino_serial.readline()
        if data:
```

```
            data_csv = [str(datetime.now()), data]

            try:
                publish_single(data)
            except socket.timeout as e:
                print("Socket operation timed out!")

            with open("tmp/data_hidroponik.csv", "a") as file:
                writer_obj = writer(file)
                writer_obj.writerow(data_csv)

            for _ in range(4):
                processed_data = process_data(data, data_storage)
                data_queue.put(processed_data)
2.
3.
```

global_val.py

```
1. from database.DataStorage import DataStorage

import queue import serial

data_queue = queue.Queue()
ser = serial.Serial("/dev/ttyUSB0", baudrate=115200)
data_storage = DataStorage()
2.
3.
```

threads.py

```
1. import threading

from process.arduino_local import read_arduino from process.global_val import ser


def setup_read_thread(data_storage):
    read_thread = threading.Thread(
        target=read_arduino,
        args=(ser, data_storage)
    )
    read_thread.daemon = True  # Close the thread when the application closes
    read_thread.start()
    return read_thread
2.
3.
```

main.py

```
1. from ui.App import App from tkinter import Tk

# Press the green button in the gutter to run the script.
root = Tk()
app = App(root)

if __name__ == '__main__':
    root.mainloop()

# See PyCharm help at https://www.jetbrains.com/help/pycharm/
2.
3.
```

Lampiran 8. Bash Script untuk Pengambilan Data Resource Usage

```
#!/bin/bash

# Set the start time
start_time=$(date +%s)

while true; do
    current_time=$(date +%H:%M:%S)
    elapsed_time=$(( $(date +%s) - start_time ))

    # Check if 30 minutes have passed
    if [ "$elapsed_time" -ge 1800 ]; then
        break
    fi

    cpu_usage=$(top -b -n1 | awk '/^%Cpu/{print $2}')
    memory_usage=$(free | awk '/Mem/{printf "%.2f", $3/$2*100}')

    echo "$current_time CPU: $cpu_usage%  Memory: $memory_usage%"
    sleep 1
done

```

Lampiran 9. Python Script untuk Pengambilan Gambar Tanaman

```
from picamera import PiCamera
import time
import datetime
import time
import os
camera = PiCamera()
start_time = datetime.time(7, 0)  # 7:00 AM
end_time = datetime.time(18, 0)  # 6:00 PM
log_file = '/home/pi/camerapi/error_log.txt'
def job():
    print("condition1")
    now = datetime.datetime.now()
    camera.rotation = 180
    filename = '/home/pi/camerapi/{}.jpg'.format(now.strftime('%Y-%m-%d_%H:%M:%>
    # Wait for 1 second before capturing the image
    time.sleep(1)
    # Capture the image
    camera.capture(filename)
    # Wait for 1 second before checking the time again
    time.sleep(1)
    print("condition2")
    while True:
        try:
            cmd = "rclone copy /home/pi/camerapi FauzulIchwan:/Sampel_TA"
            os.system(cmd)
        except exception as e:
            continue
        break
    print("ok")
while True:
    job()
    time.sleep(3600)

```