TEAM AMRIT

Problem 1 - Satellite Image Brightness Normalizer

Team ID - 1

Team Members:

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PROBLEM EXPLANATION

Satellite images often vary in brightness due to different lighting or weather conditions. Normalizing brightness makes images consistent, allowing better analysis and decision-making in various fields.

Objectives and Task:

- Normalize the brightness of 10 grayscale satellite images (PNG format, 256x256 pixels).
- Adjust each image’s average intensity to match a given global average (e.g., 127.5).
- Each image’s final average intensity must be within ±1 of the global average.
- Ensure consistent brightness across all images without degrading image quality.

SOLUTION APPROACH

Extract Files

Unzip satellite_images.zip to access 10 grayscale PNGs (image1.png to image10.png).

Read Images

Load each image using OpenCV and convert to grayscale NumPy arrays.

Compute Global Average

Flatten all 10 images into a single array and calculate the mean pixel intensity.

Normalize Each Image

- Compute current image average.
- Calculate scaling factor = global_avg / current_avg.
- Scale all pixels, clip to range [0, 255].

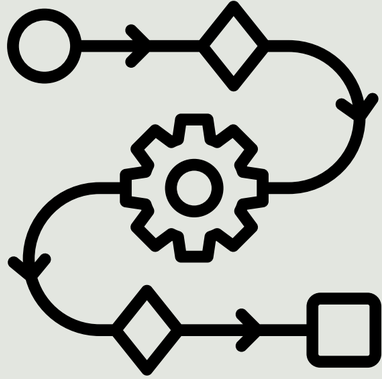
Save Output

Save each image as normalized_imageX.png using PIL.

Validation

Ensure each output image’s average intensity is within ±1 of the global average

WORK FLOW



Step 1

Row code testing on the sample test cases

Step 2

Getting smaple output on row code

Step 3

Matches the results and save aoutput file

Step 4

Verify our outcome image files against there expected image files.

Step 5

Enhance the code readibility, scalability, and modularity.

TOOLS AND PROGRAMMING LANGUAGES

Programming Languages:

We used Python due to its simplicity and strong support for image processing.

Tools:

1. **OpenCv -** To read and Write the images.
2. **NumPy -** To perform the operation on the images.
3. **zipfile -** To extract the images from zip file
4. **git and GitHub -** To clone the dataset and to push the code

IMPLEMENTATION

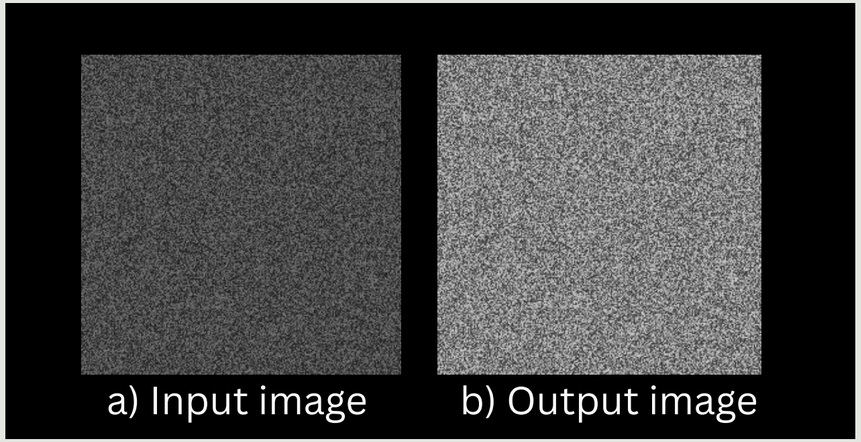
```python
# Normalizing the images and checking whether absolute(diff. bet. each img mean and global_avg ) is <= 1
def NormImages_Output(global_avg, images_load_grayscale, image_indices, missing_images):

    # Step - 1 Converting Images to normalized_Images
    normalized_images = []
    for img in images_load_grayscale:
        current_avg = img.mean()

        factor = global_avg /current_avg

        normalized = img * factor

        normalized = np.clip(normalized,0,255)

        normalized = normalized.astype(np.uint8)

        normalized_images.append(normalized)
```

Normalized each image by calculating the current and global average of intensity and the normalized factor, which is the ratio of global_avg to current_avg.

```python
# Converting Images to GrayScALE using cv2.IMREAD_GRAYSCALE and Calculating Global AVg for each image array
def GlobalAverage():
    images_load_grayscale = []                          # store the image grayscale data
    image_indices = []                                  # Store the Image number which is Available
    missing_input_img = []                              # Store the Misssing Image Number

    for i in range(1,11):
        img = cv.imread(f"test cases/sample_input/image{i}.png", cv.IMREAD_GRAYSCALE)
        """   To read the image file .....
        change the path for hidden test case according to your location
        """

        if img is not None:
            images_load_grayscale.append(img)
            image_indices.append(i)                     # track the present image number AS index
        else:
            missing_input_img.append(i)                 # track the missing image number As index


    all_pixels = np.concatenate([img.flatten() for img in images_load_grayscale])

    global_avg = np.mean(all_pixels)
    return global_avg, images_load_grayscale, image_indices, missing_input_img
```

In the above code we have implimented the error handling by keeping track on the missing and non-missing images.

RESULTS



The input image is normalized to by adjusting the brightness

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS  SEARCH ERROR

(myvenv) PS S:\Shivanjal\Hackathons\KVGC Hackathons\problem 1> python main.py
Missing Images: []
GLobal Average = 130.20
image1.png: avg=129.71 (within ±1 of 130.20)
image2.png: avg=129.73 (within ±1 of 130.20)
image3.png: avg=129.71 (within ±1 of 130.20)
image4.png: avg=129.70 (within ±1 of 130.20)
image5.png: avg=129.69 (within ±1 of 130.20)
image6.png: avg=129.69 (within ±1 of 130.20)
image7.png: avg=129.69 (within ±1 of 130.20)
image8.png: avg=129.70 (within ±1 of 130.20)
image9.png: avg=129.71 (within ±1 of 130.20)
image10.png: avg=129.67 (within ±1 of 130.20)
Score for Sample Test Case = 10
```

The average intensity of each output image is within a (-1, 1) of the global average.

TEAM CONTRIBUTION

Ganesh Mali - Programming using pil python library, Documentation

Ramchandra Potadar- Programming using open-cv python library, PPT Making

Sandip Sargar - Analyzing Algorithm, Documentation, PPT Making

REFERENCES

- **OpenCV Library:** https://opencv.org
- **Zipping in Python:** https://docs.python.org/3/library/zipfile.html
- **Numpy Library:** https://numpy.org
- **GitHub Dataset:** https://github.com/arshad-muhammad/kvgce-hackwise

Thank You..