Image And Video Processing

PARTH AGRAWAL
Roll No: [IIT2023506]

Problem Statement

The objective of this assignment is to perform basic image processing operations on two 180×180 grayscale images:

- **Img1:** Contains the student's first name.
- **Img2:** Contains the student's last name.

The following operations must be performed in MATLAB, **without using any predefined image processing functions**:

1. Complement of Img1
2. Complement of Img2
3. Union of Img1 and Img2
4. Intersection of Img1 and Img2

Prerequisites

- MATLAB (any version supporting matrix operations)
- Input images: `img1.png` and `img2.png` (both 180×180 px, grayscale)
- No use of predefined functions such as `imcomplement`, `imadd`, `imsubtract`, `max`, `min`, etc.
- Understanding of grayscale images (pixel values 0–255)

Explanation of Operations

1. Complement

The complement (negative) of a grayscale image inverts each pixel value. For 8-bit images, the operation is:

$$complement(x, y) = 255 - image(x, y)$$

This operation turns dark regions bright and vice versa.

2. Union

The union operation takes the **maximum** pixel value at each position from both images:

$$union(x, y) = \max(img1(x, y),\ img2(x, y))$$

This retains the brightest features from either image.

3. Intersection

The intersection operation takes the **minimum** pixel value at each position:

$$intersection(x, y) = \min(img1(x, y),\ img2(x, y))$$

This retains only the darkest features where both images overlap.

MATLAB Implementation (Algorithm)

```
for i = 1:180
    for j = 1:180
        complement1(i,j) = 255 - img1(i,j);
        complement2(i,j) = 255 - img2(i,j);
        if img1(i,j) > img2(i,j)
            union_img(i,j) = img1(i,j);
        else
            union_img(i,j) = img2(i,j);
        end
        if img1(i,j) < img2(i,j)
            intersect_img(i,j) = img1(i,j);
        else
            intersect_img(i,j) = img2(i,j);
        end
    end
end
```

Results

Description:

- **Img1:** Original image with first name (`PARTH`).
- **Complement Img1:** Negative of Img1; white regions become black and vice versa.
- **Img2:** Original image with last name (`AGARWAL`).
- **Complement Img2:** Negative of Img2; white regions become black and vice versa.
- **Union:** Brighter areas from both images are kept, so both names may be visible if they overlap.
- **Intersection:** Only overlapping dark regions from both images are visible, giving a merged effect.

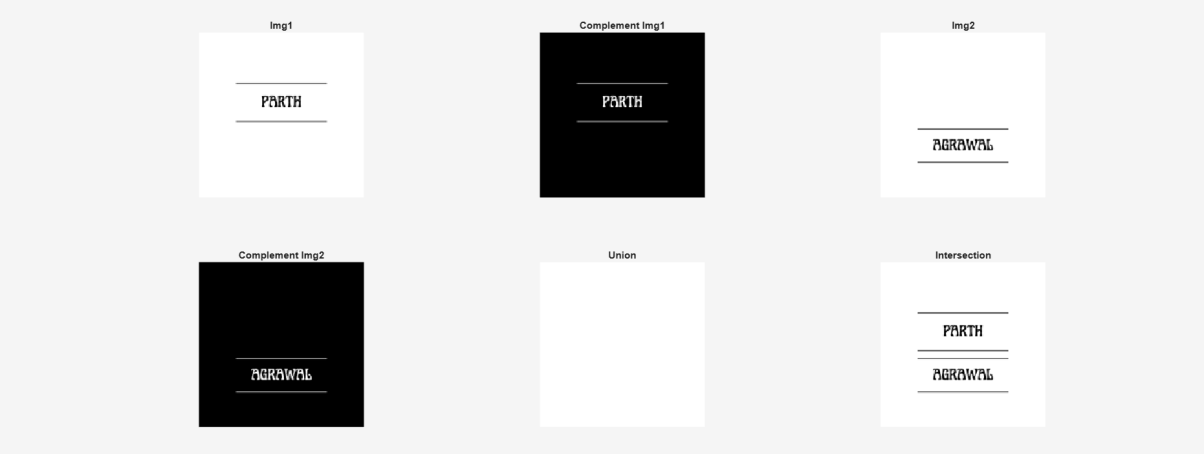

Figure 1: Outputs for all required operations: Img1, Complement Img1, Img2, Complement Img2, Union, Intersection

Observations and Conclusion

- The complement operation inverts the grayscale values of the images.
- The union operation highlights the brightest features from both images.
- The intersection operation emphasizes the darkest overlapping features.
- All operations were performed without predefined MATLAB image functions, confirming the understanding of basic image processing principles.