

<b>EXP NO: 2</b>	<b>IMPLEMENT CONTRAST ADJUSTMENT OF AN IMAGE</b>
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**AIM:**

To adjust the contrast of an image using Python (OpenCV and NumPy) and observe the changes in pixel intensities.

**THEORY:**

Contrast refers to the difference in brightness between objects or regions within an image.

Adjusting contrast enhances image quality by making features more distinguishable:

- Increase contrast: Stretch pixel intensities away from the mean.
- Decrease contrast: Bring pixel intensities closer to the mean.

**MATHEMATICAL FORMULA:**

$$\text{new\_pixel} = \alpha \times (\text{pixel} - 128) + 128$$

$$\text{i.e., new\_pixel} = \alpha \times \text{pixel} + (128 - 128 \times \alpha)$$

**LET:**

$$\beta = 128 - 128 \times \alpha$$

so the formula becomes:

$$\text{new\_pixel} = \alpha \times \text{pixel} + \beta$$

**WHERE:**

- $\alpha > 1$ : Increases contrast.
- $0 < \alpha < 1$ : Decreases contrast.
- $\beta$ : Increases or decreases brightness

**LIBRARIES USED:**

- OpenCV for image loading, processing, and display.
- NumPy for numerical operations.

**ALGORITHM:**

1. Import required libraries.
2. Read the input image.
3. Adjust the contrast using the formula:  $\text{new\_pixel} = \alpha \times \text{pixel} + \beta$  with  $\beta=0$
4. Display the original and contrast-adjusted images.
5. Save the contrast-adjusted image.

**CODE:**

```
import cv2
import numpy as np
from google.colab.patches import cv2_imshow
from google.colab import files

uploaded = files.upload()

image = cv2.imread('/content/cv-img.jpg')

alpha = 1.8

beta = 128 - 128 * alpha

adjusted = cv2.convertScaleAbs(image, alpha=alpha, beta=beta)

if image.shape != adjusted.shape:
    adjusted = cv2.resize(adjusted, (image.shape[1], image.shape[0]))

combined = np.hstack((image, adjusted))

print("Original Image (Left) vs Contrast Adjusted Image (Right):")
cv2_imshow(combined)

cv2.imwrite('combined_result.jpg', combined)
```

**OUTPUT:****RESULT:**

The contrast of the image was successfully adjusted, enhancing the differences between bright and dark regions, and the resulting image displayed improved clarity and visual appeal.