INT3404E 20 - Image Processing: Homeworks 1

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1 Origin image

Figure 1: Origin image

2 Grayscale image

```python
def grayscale_image(image):
    # Get the image shape
    rows, cols, channels = image.shape
    # Create an empty array for the grayscale image with the same shape
    img_gray = np.zeros((rows, cols), dtype=np.uint8)  # Adjust dtype if needed
    # Iterate through each pixel and convert to grayscale
    for row in range(rows):
        for col in range(cols):
            # Get the pixel values for each channel
            r, g, b = image[row, col]

            # Apply the grayscale formula
            gray_value = 0.299 * r + 0.587 * g + 0.114 * b

            # Set the grayscale value for all channels in the new image
            img_gray[row, col] = gray_value

    return img_gray
```

Figure 2: Grayscale function

Figure 3: Grayscale image

3 Flipped grayscale image

```python
# Flip an image horizontally as function
def flip_image(image):
    """Flips an image horizontally using OpenCV."""
    return cv2.flip(image, 1)  # Use cv2.flip for horizontal flipping
```

Figure 4: Flip function

Figure 5: Flipped grayscale image

4 Rotated grayscale image

```python
# Rotate an image as function
def rotate_image(image, angle):
    """Rotates an image using OpenCV."""
    rows, cols = image.shape[:2]
    M = cv2.getRotationMatrix2D((cols / 2, rows / 2), angle, 1)
    return cv2.warpAffine(image, M, (cols, rows))  # Use cv2.warpAffine for rotation
```

Figure 6: Rotate function

Figure 7: Rotated grayscale image