INT3404E 20 - Image Processing: Homeworks 2

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1 Mã nguồn exercise 1

```python
# Load an image from file as function
def load_image(image_path: str) -> np.ndarray:
    """
    Load an image from file, using OpenCV
    """
    return cv2.imread(image_path)[:, :, ::-1]
```

Listing 1: Hàm tải hình ảnh

```python
# Display an image as function
def display_image(image: np.ndarray, title: str="Image"):
    """
    Display an image using matplotlib. Rembember to use plt.show() to display the image
    """
    plt.imshow(image)
    plt.title(title)
    plt.show()
```

Listing 2: Hàm hiển thị hình ảnh

```python
# Grayscale an image as function
def grayscale_image(image: np.ndarray) -> np.ndarray:
    """
    Convert an image to grayscale. Convert the original image to a grayscale image. In a
        grayscale image, the pixel value of the
    3 channels will be the same for a particular X, Y coordinate. The equation for the pixel
        value
    [1] is given by:
        p = 0.299R + 0.587G + 0.114B
    Where the R, G, B are the values for each of the corresponding channels. We will do this by
    creating an array called img_gray with the same shape as img
    """
    gray_img = 0.299 * image[:, :, 0:1] + 0.587 * image[:, :, 1:2] + 0.114 * image[:, :, 2:3]
    return np.broadcast_to(gray_img.astype(image.dtype), image.shape)
```

Listing 3: Hàm tạo ảnh xám (từ ảnh RGB)

```python
# Save an image as function
def save_image(image: np.ndarray, output_path: str):
    """
    Save an image to file using OpenCV
    """
    cv2.imwrite(output_path, image)
```

Listing 4: Hàm lưu ảnh

```python
# Flip an image as function
def flip_image(image: np.ndarray) -> np.ndarray:
    """
    Flip an image horizontally using OpenCV
    """
    return image[:, ::-1, :]
```

Listing 5: Hàm lật ảnh theo chiều ngang

```python
# rotate an image as function
def rotate_image(image: np.ndarray, angle: float) -> np.ndarray:
    """
    Rotate an image using OpenCV. The angle is in degrees
    """
    height, width = image.shape[:2]
    rotation_matrix = cv2.getRotationMatrix2D((width / 2, height / 2), angle, 1.)
    rotated_img = cv2.warpAffine(image, rotation_matrix, (width, height))
    return rotated_img
```

Listing 6: Hàm quay ảnh theo một góc

2 Kết quả exercise 1

2.1 Ảnh gốc

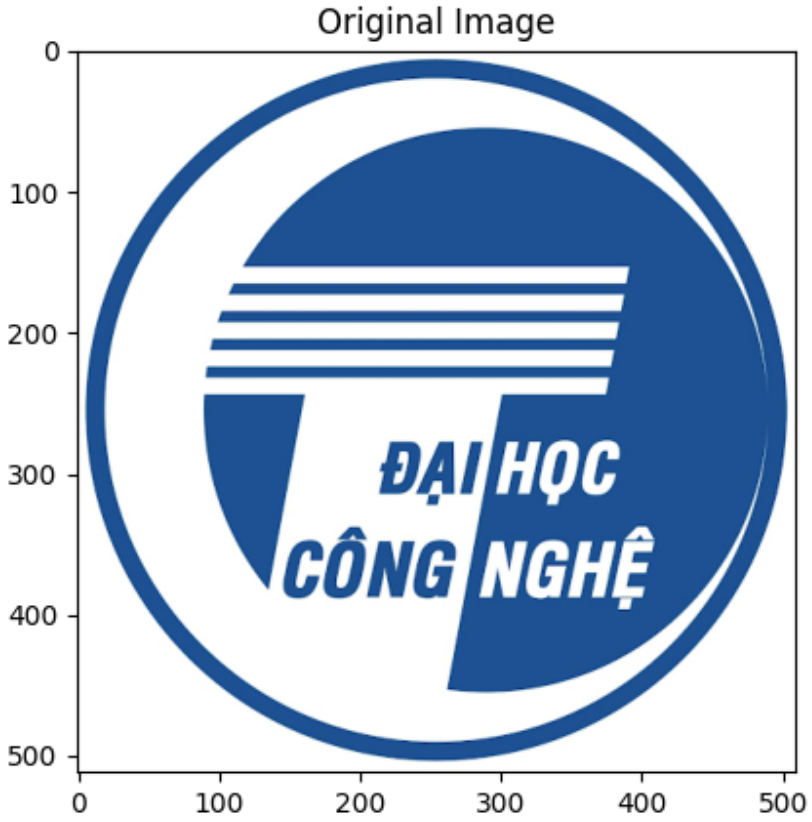

Figure 1: Original Image

2.2 Ảnh xám (grayscale)

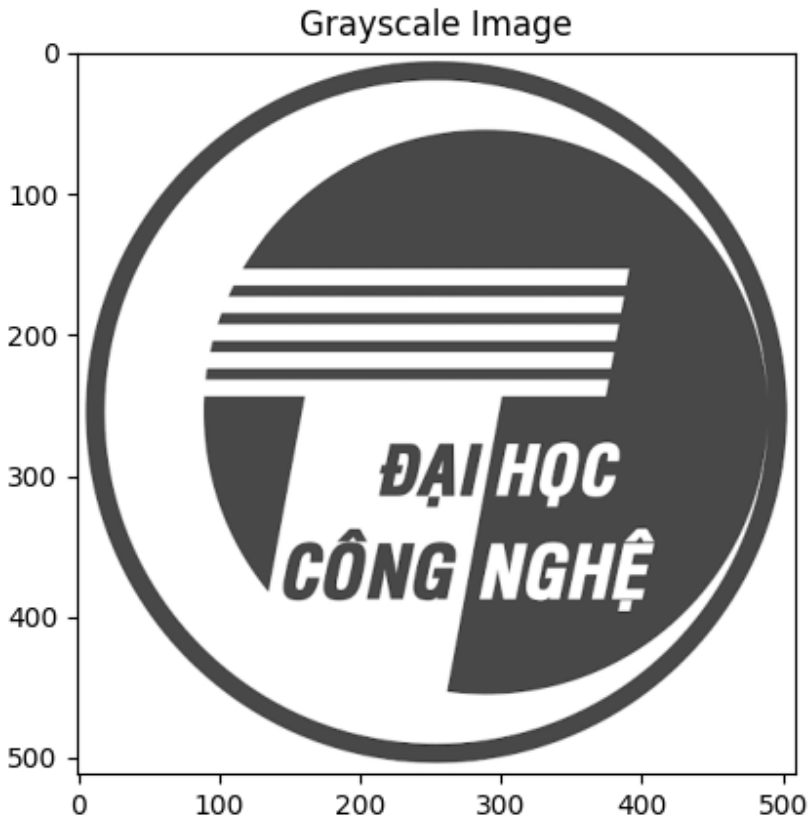

Figure 2: Grayscale Image

2.3 Ảnh xám lật theo chiều ngang

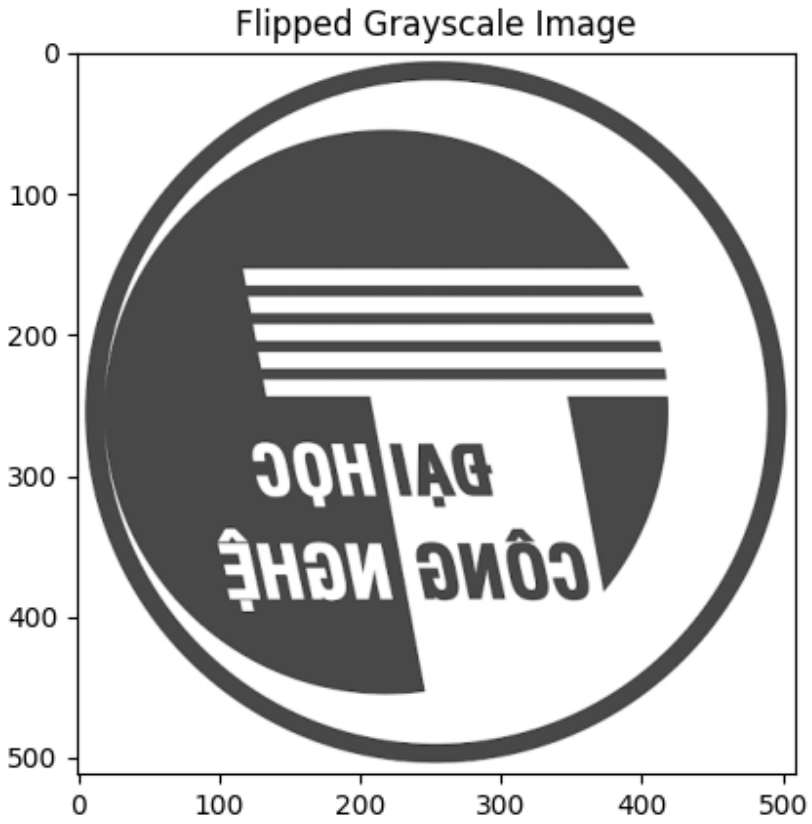

Figure 3: Flipped Grayscale Image

2.4 Ảnh xám quay một góc 45 độ ngược chiều kim đồng hồ

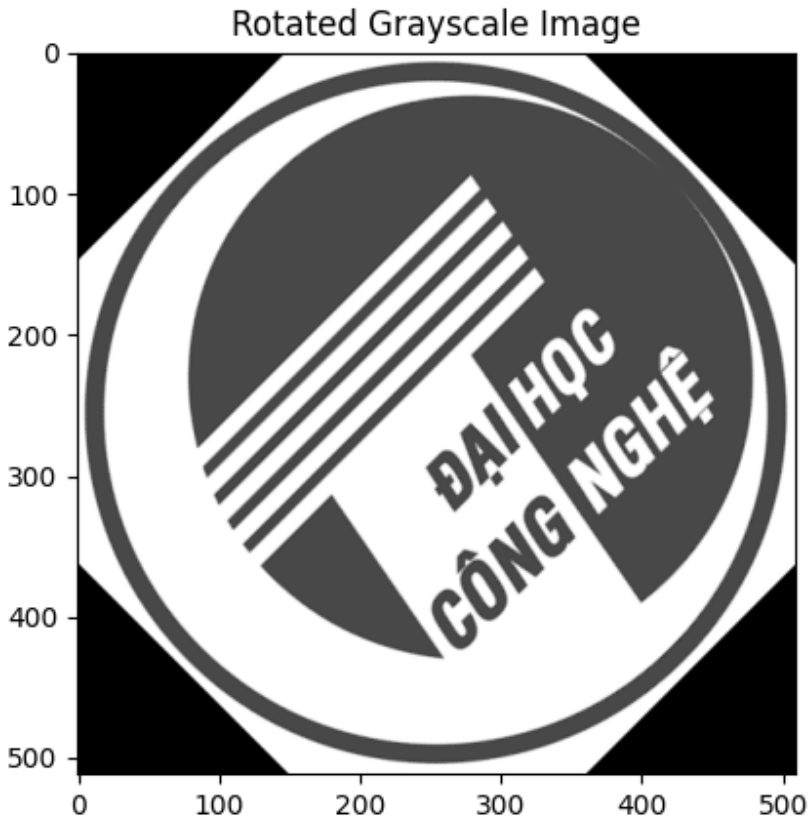

Figure 4: Rotated Grayscale Image