

# COMPUTER VISION

## Assignment - 1

I20MA052 - Prashant Shrivastava

Question : Write a program in your preferred programming language to rotate an image by some random angle between 0 to 270. You can take greyscale image or color image.

Note: Do not use direct command to rotate an image. Use 2 x 2 or 3 x 3 transformation that is discussed in the class. Every student should have different image rotated by different angle. You have to comment your name and roll number in your code. Create a single pdf file that includes code and results (original image and rotated image mentioning the angle or rotation).

I have used the following 2x2 Transformation Matrix to carry out the rotation

$$M(\theta) = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}.$$

```
import numpy as np
import cv2, math, random
from IPython.display import Image
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```

```
# Loading a square image
img = cv2.imread("images/test_image2.png") # Reading the image in BGR
format
print(img.shape)
# 216x216 dimension | 3 (RGB) Channels
```

```
# important constants
```

```
HEIGHT, WIDTH = img.shape[:2]
CHANNELS = 3
```

```
IMG_CENTRE_X = WIDTH//2
IMG_CENTRE_Y = HEIGHT//2
IMG_DIAG = int(math.sqrt(HEIGHT**2 + WIDTH**2))
NEW_IMAGE_CENTRE = IMG_DIAG//2
```

```
TransformationMatrix = lambda x : np.array([math.cos(x), -math.sin(x),
math.sin(x), math.cos(x)]).reshape(2, 2)
# creating a lambda function that return a 2x2 transformation matrix that
will be used for rotation for any given input angle x, used for rotation
```

```
angleRotRadian = random.uniform(0, 270 * math.pi/180) # choose a random
rotation angle b/w 0 & 270 degrees (converted to radian)
rotated_img = np.zeros((IMG_DIAG, IMG_DIAG, 3))

for row_ind, row in enumerate(img):
    for col_ind, col in enumerate(row):
        new_indices = np.matmul(TransformationMatrix(angleRotRadian),
np.array([row_ind - IMG_CENTRE_Y, col_ind - IMG_CENTRE_X]).reshape(2, 1))
        new_hi = round((float(new_indices[0])) + IMG_CENTRE_Y)
        new_wid = round((float(new_indices[1])) + IMG_CENTRE_X)

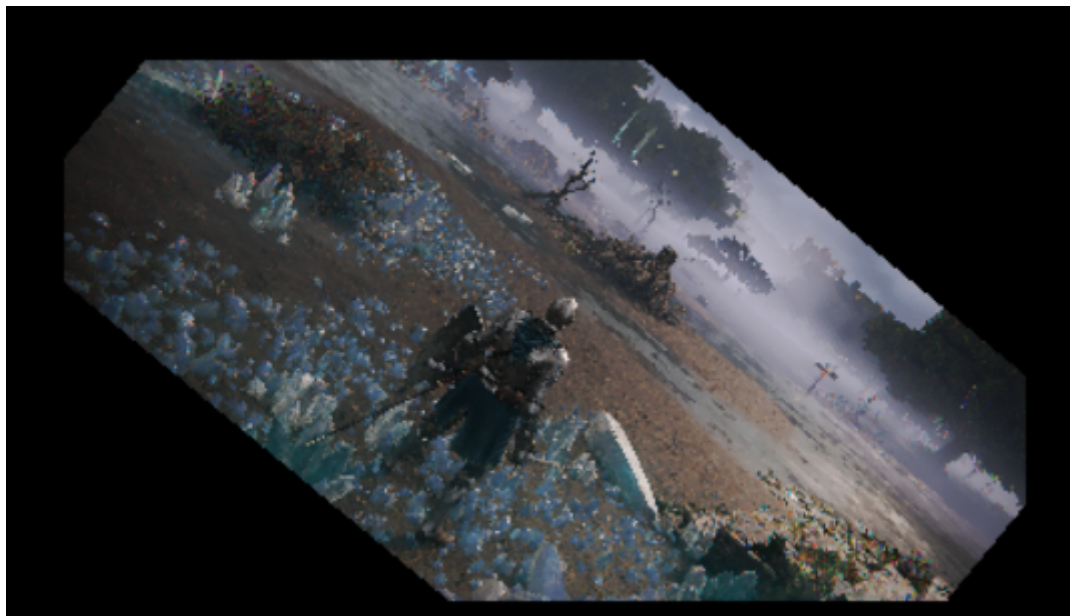
        if (new_wid ≥ 0 and new_hi ≥ 0) and (new_wid < WIDTH and new_hi <
HEIGHT):
            rotated_img[NEW_IMAGE_CENTRE + (row_ind-IMG_CENTRE_Y),
NEW_IMAGE_CENTRE + (col_ind-IMG_CENTRE_X)][:] = img[new_hi, new_wid][:]

cv2.imwrite("images/rotated.png", rotated_img)
print(f"Rotated image by : {math.degrees(angleRotRadian)} degrees")
Image("images/rotated.png")
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```

Image Before Rotation



Image After Rotation  
(Rotated image by : 39.57488452420214 degrees)



Complete Code can be found on my Github:

[https://github.com/GazPrash/ComputerVisionAssignments/blob/main/cv\\_assignment1.ipynb](https://github.com/GazPrash/ComputerVisionAssignments/blob/main/cv_assignment1.ipynb)