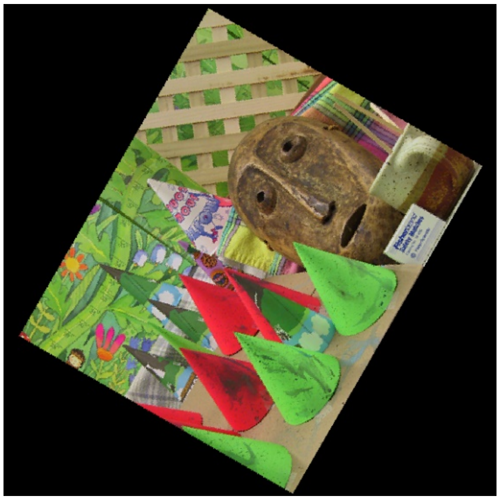
Image Rotation and Error Evaluation

Write a program that loads in an image and repeatedly rotates it by *x* degrees until the image has been rotated 360^{o} in total.



Your program should include the following:

- A parameter for the angle to rotate by at each step
- A function for multiplying two arbitrary nxm matrices (n and m should be dynamic)
- A rotation matrix of the format below. Each pixel in the image must be multiplied by R using the matrix multiplication function (prior bullet).

$$R = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$$

- An array variable for your image that is large enough for the entire image to be visible during all the intermediate rotations (when you've rotated 45^{o}, the corners of your image should not be clipped)
- Absolute color error calculation: Code to compute the absolute error between the colors of the original image's pixels and the colors of the image after it's been rotated 360^{o}
- Pixel displacement calculation: Code to compute the distance each pixel moves during rotation. This total value should be divided by:

  *(numPixelsInImage * numTimesImageWasRotated)*

You can use the OpenCV and Numpy libraries for opening, displaying, and saving images and to create empty arrays/images. You may also use the math library built into Python for sine, cosine, and PI calculations. You may not use any other built-in functions or libraries.

Submit your code and a report. Your report must be a PDF and contain the following:

- Summary of the assignment goals
- 3+ images showing your code at intermediate stages (image rotated *x* degrees) with captions saying what angle stepsize is being used and the total rotation of the image so far (i.e. Image rotated 60^o with steps of 20^o, 3 rotation operations applied so far.)
- A chart with the following information filled in:

Angle Step Size	***# Rotations***	***Absolute Color Error***	***Pixel Displacement***	***(# Rotations) * (Pixel Displacement)***
45^o	8			
60^o	6			
90^o	4			
120^o	3			
180^o	2			
360^o	1			

- Conclusions drawn from the completed chart
- Discussion of any issues encountered