

## Normalization with Moments

**Exercise 21 Programming Task:** For this exercise, download the image *momented.jpg* from the website.

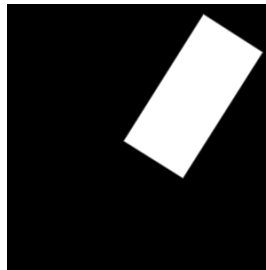


Figure 1: *momented.jpg*

- Implement a Python function to compute the geometric moments  $m_{00}$ ,  $m_{01}$ ,  $m_{10}$ ,  $m_{11}$ ,  $m_{02}$ ,  $m_{20}$ ,  $m_{12}$ ,  $m_{21}$ ,  $m_{03}$  and  $m_{30}$ . The function should expect a binary image and return an array with the computed moments. Use numpy's functions to keep the code short, efficient and without redundancies. How functions are defined in Python can be found here: <https://docs.python.org/3/tutorial/controlflow.html#defining-functions>
- Also implement a function for computing the central moments  $\mu_{00}$ ,  $\mu_{01}$ ,  $\mu_{10}$ ,  $\mu_{11}$ ,  $\mu_{02}$ ,  $\mu_{20}$ ,  $\mu_{12}$ ,  $\mu_{21}$ ,  $\mu_{03}$  and  $\mu_{30}$ .
- Rotate and center *momented.jpg* using the moments as shown in the figure below. This should also be a function which takes a mask and returns the result.

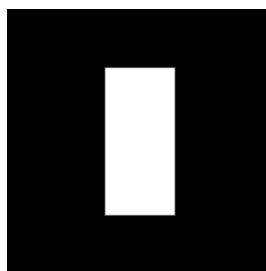


Figure 2: unmomented