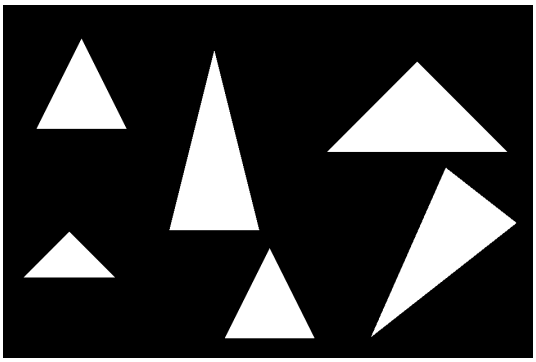
ECE4580 FA23 - Prof. Jones – HW 5

Due Thursday, November 30, 2023 – 11:59 PM via Canvas

For this assignment you will use the image "triangles.png", available in the images folder on Canvas. It looks like this:



1. Load the image from your Google Drive; convert to grayscale if necessary by averaging the color planes.
2. Use Otsu's method to find a suitable threshold to binarize the image; print the threshold value out to the console and create the binary image.
3. Use the connected components method to produce a labeled image, and print out (at least) the following features for each object: label, bounding box extrema, area and centroid.
4. Compute the central moments, normalized moments and Hu's moments.
5. Print out a table of the requested features and Hu's moments, like the following (your formatting can vary from this) Note that the numbers in this example are NOT realistic:

	label	bbox-0	bbox-1	bbox-2	bbox-3	area	centroid-0	centroid-1	H1	H2	H3	H4	H5	H6	H7
0	1	531	826	799	373	60412	757.4548953	359.0982936	0.556027	0.984517	0.483856	0.188507	0.115041	0.254272	0.598623
1	2	918	379	420	438	71566	177.5207219	73.28832964	0.379544	0.885596	0.528943	0.174448	0.750671	0.681035	0.575854
2	3	617	698	841	626	43283	959.9723554	853.0533528	0.402544	0.310351	0.085082	0.965242	0.563148	0.835949	0.415193
3	4	696	442	876	25	249	109.7969314	979.4293051	0.0108	0.501675	0.175391	0.665704	0.388061	0.917062	0.746016
4	5	623	189	531	41	96646	900.4250289	992.2642275	0.06673	0.876629	0.667421	0.88621	0.753653	0.121506	0.567209
5	6	694	604	169	482	99323	469.5443862	879.9886191	0.334021	0.898436	0.071162	0.415466	0.956567	0.431466	0.530732

   You can use Python, Excel or anything you wish to create this table from the output of your program.
6. Compute a *distance matrix* for the Hu's moments vectors. This is a matrix where each entry d_{ij} is the vector distance between the Hu's moments vector for object i and object j. Hint: your matrix should have zeroes along the diagonal (for obvious reasons).
7. Print out the matrix and explain what you see. Relate the contents of the matrix to the objects that they pertain to.

Note: you can use any methods of numpy, skimage, scipy and pandas in this assignment.

SUBMISSION:

For your submission, paste all of your code, the feature table requested above, the distance matrix and your discussions into a single well-organized Word (or pdf) file. Paste code as plain text (no dark-mode or screenshots). Also submit your final Python notebook (as an ipynb file). Submit two separate files: your Word or pdf submission and your CoLab notebook. Submit your files using Canvas. Do NOT put your files into a zip file for submission; submit them as separate files.