AMERICAN UNIVERSITY OF ARMENIA
College of Science and Engineering
CS 260 / CS 371 Image Processing

Project 2 – Symbols Boxes in a Text Line in Stone Inscriptions

Preliminary Submission Deadline: Wednesday, **December 17 2025**, at 16:00 in
Submission Format: In-person, hard copy**,** in room# 313W
Submission Content: The hard copy of the table from **step 12**

Final Submission Deadline: Thursday, **December 18 2025**, no later than 22:00 **SHARP**
Submission Format: Electronic, upload the deliverables in \Lines2 and \Symbols sub-folders of the Google shared folder

Textbook: W. Burger, M. J. Burge. "Digital Image Processing: An Algorithmic Introduction using Java", 2nd ed., 2016
Reading: Chapter 5, Chapter 6, Chapter 8, Chapter 9, Chapter 10, Chapter 18, Chapter 19.

The shapes of Armenian letters are based on vertical strokes. Based on this observation, implement and test a pipeline outlined below. Implement the steps as ImageJ plug-ins or menu commands, and save them using the ImageJ macro recorder. In addition to the recorded macro(s), submit the code of all implemented plug-ins. Other image processing and programming environments may be used only for testing purposes.

#	Description	Submission
0	Create in the shared Google drive a subfolder **\Lines2**. If needed, revisit Project 1 collect the revisited deliverables in tis subfolder. The original subfolder **\Lines2** must not be changed.	
1	Use the same images as in Project 1. Crop the text lines manually or, ideally, based on the results of Project 1. Apply the subsequent steps to different cropped text line images.	The cropped image files of individual text lines together with the coordinates and dimensions of the cropping boxes
2	Enhance the contrast of the carved symbols in the text line by trying different combinations of **Image → Adjust → Brightness/Contrast… → Auto**, **Process → Sharpen**, **Process → Filters → Gaussian Blur…** (radius 1.00), **Cut_After_Max** command (the last Quiz). Find **Cut_After_Max.java** plugin uploaded in Moodle.	Histogram of the original cropped images and histograms after each applied command
3	Apply Fourier Transform to the cropped image of enhanced contrast from **step 2**.	The image of thee FFT result

4	Enhance the contrast of the FFT result from **step 3** using the same **Image → Adjust → Brightness/Contrast… → Auto** command.	The image of the enhanced FFT result
5	Extract the brightest pixels from the enhanced FFT image from **step 4** by running **Image → Adjust → Threshold…** command.	The filtered binarized FFT image
6	In the binarized FFT image from **step 5** detect average periods between the strokes and / or symbols manually or, ideally, using **Analyze Particles…** command. Preprocess the FFT image as needed.	The detected period(s)
7	Identify the most prominent stroke in the enhanced cropped image from **step 2**. For example, compute the vertical projection and locate the maximum point.	The x coordinate of the most prominent stroke
8	Binarize the image of the text line and draw boxes of equal width detected in **step 6** both sides from the stroke detected in **step 7**.	The image of the binarized text line with the drawn boxes
9	Select a binary image of the Armenian alphabet, skeletonize it and compute Hu's invariant moments for each letter (chapter 10, section 10.6.4).	The skeletonized image and the 7-component vector of Hu's invariant moments for each letter
10	Compute Hu's invariant moments of binary regions in individual and / or two or more adjacent cells from **step 8**.	7-component vector of Hu's invariant moments for each computed cell
11	Use the results of **step 9** and **step 10** to estimate / classify a symbol in each cell.	Classification of the symbols
12	Implement (fully or partially) the **steps 1 – 8** as a macro and construct a table to indicate which step succeeded and which one failed for each processed text line.	The constructed table – electronically and in hard copy

Submission Conditions:

1. This is an individual assignment. Identical or similar submissions / files / results / reports / diagrams etc. will be disqualified – both the source(s) and receiver(s) will collect 0 point.
2. Group work will be accepted only if all group members are explicitly indicated in the submission. The individual contribution of each group member must also be explicitly stated, including all reasons of forming the group.
3. The submission deadline is rigidly strict. Submit even an unfinished work to get points and feedback. Late submissions will be disqualified and collect 0 point.
4. Not only precise solutions, but also free-format descriptions of ideas, difficulties, algorithms, simplifications, assumptions, etc. may be submitted.
5. You are welcome to use external sources, but all of them must be explicitly acknowledged and the links / references provided.