Task 1-A program that binarizes an image.

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Date Of submission: 26-06-2025

Introduction:

In this report we are doing image binarization. In this particular process we are converting a grey scale image to two different thresholding i.e.,

1. Global Adaptive Thresholding
2. Local Adaptive Thresholding.

Methodology:

1.Global Adaptive Thresholding-

Global Adaptive Thresholding is a technique used to convert a grayscale image into a binary image (black and white) based on a *single threshold value* computed from the image itself. Let's break it down intuitively:

What It Does

Instead of using a fixed threshold (like 127 out of 255), global adaptive thresholding **calculates the best threshold** based on the image's content. It adapts to the image's pixel intensities by refining the threshold over several iterations.

2. Local Adaptive Thresholding-

Local Adaptive Thresholding is a technique used to binarize an image based on **local statistics**—meaning the threshold value is calculated for each pixel using its surrounding neighbourhood rather than using a global value.

Why Use Local Adaptive Thresholding?

It's especially useful when the image has:

- **Uneven lighting**
- **Shadows or gradients**
- **Variable background intensity**

Unlike global thresholding, this method adapts to brightness changes over small regions, preserving fine details better in diverse lighting conditions.

Algorithm:

1.Global Adaptive Thresholding-

- Initial threshold = mean image intensity
- Iterative refinement using class means μ1,μ2\mu_1, \mu_2μ1,μ2
- Converges when ΔT<ϵ\Delta T < \epsilon<ϵ

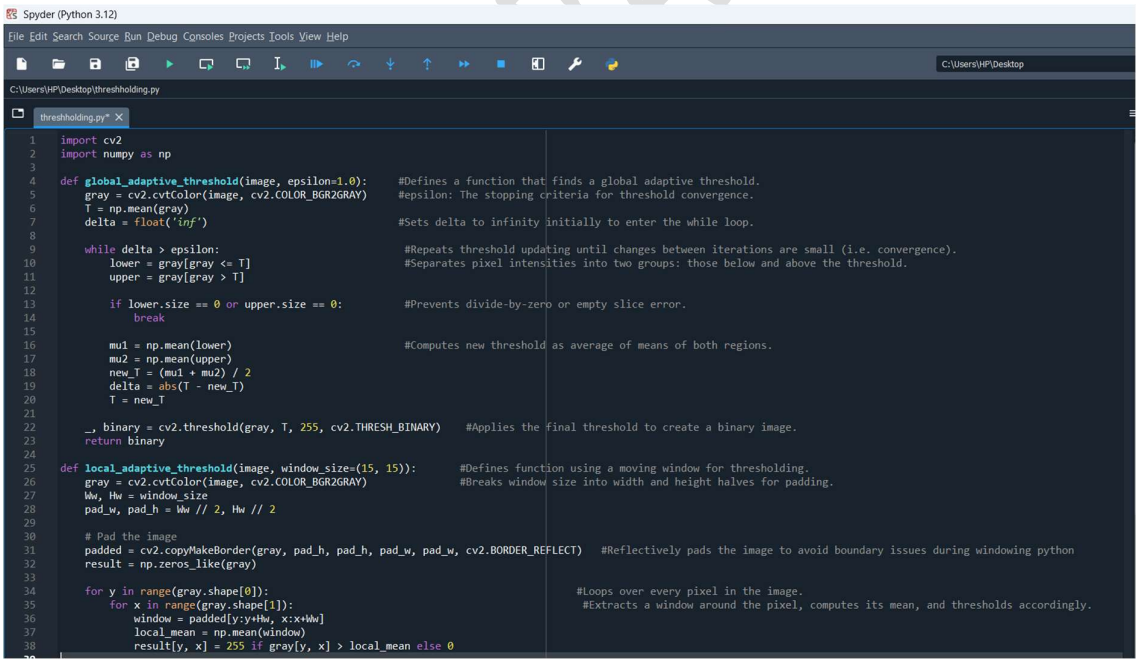
2. **Local Adaptive Thresholding**

- Window size Ww×HwW_w \times H_wWw×Hw
- Each pixel compared to the local mean
- Binarization is locally adaptive to lighting variations

Implementation:

- Platform: Python
- IDE: Spyder
- Input: Original image
- Output: Two binarized images
- Adjustable parameters: ϵ\epsilonϵ, window size Ww×HwW_w \times H_wWw×Hw

Code:



Code file:

threshholding.py

Actual Image Used:

Global Adaptive Threshold:

Local Adaptive Threshold:

Conclusion:

- Both techniques are useful.
- Local thresholding is more robust in real-world cases.

Reference Used:

Youtube : https://www.youtube.com/watch?v=I1dhyw-EjSw
AI Platform: Copilot
Lecture notes