

Assignment - 04

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Thresholding in Digital Image Processing

Introduction

Thresholding is a basic image segmentation method that classifies pixels based on their intensity values. It compares each pixel against one or more thresholds and assigns a new value accordingly.

1. Step Function (Binary Thresholding)

$$f(x, y) = \begin{cases} 0, & I(x, y) \leq 127 \\ 1, & I(x, y) \geq 128 \end{cases}$$

Pixels below 128 become black, pixels above or equal become white.

2. Function 2 (Three-Level Thresholding)

$$f(x, y) = \begin{cases} 1.02I(x, y), & 0 \leq I(x, y) < 128 \\ 0, & 128 \leq I(x, y) < 196 \\ 1.0, & I(x, y) \geq 196 \end{cases}$$

Dark pixels slightly brightened, mid-range set to gray, high intensities set to white.

3. Function 3 (Three-Level with Offset)

$$f(x, y) = \begin{cases} 0, & I(x, y) \leq 50 \\ 1.05I(x, y) + 5, & 50 < I(x, y) \leq 196 \\ 0.75, & I(x, y) > 196 \end{cases}$$

Very dark pixels set to black, mid-range brightened with offset, high intensities fixed to gray.

Function Diagrams

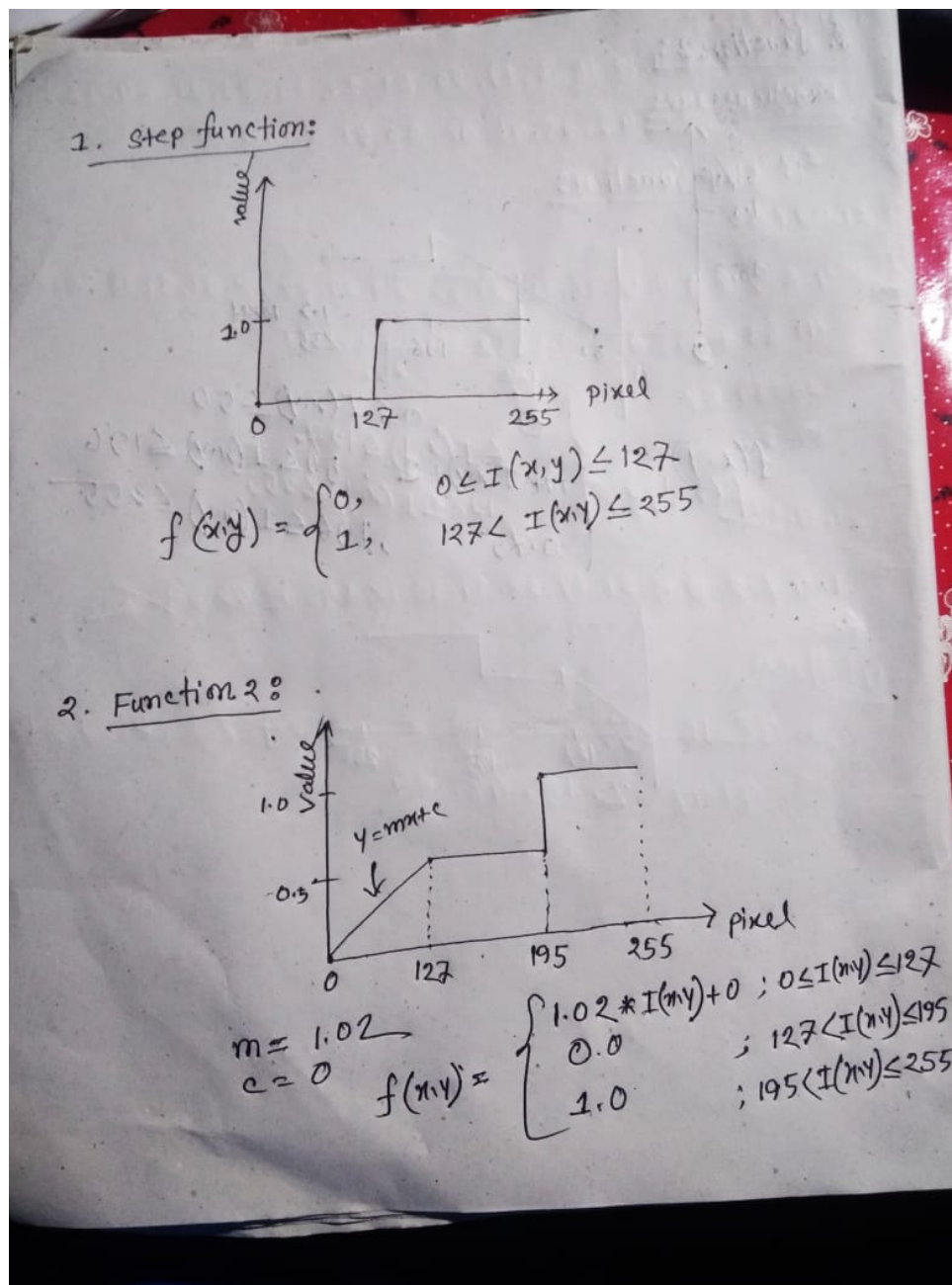


Figure 1: Step function and Function 2 diagram

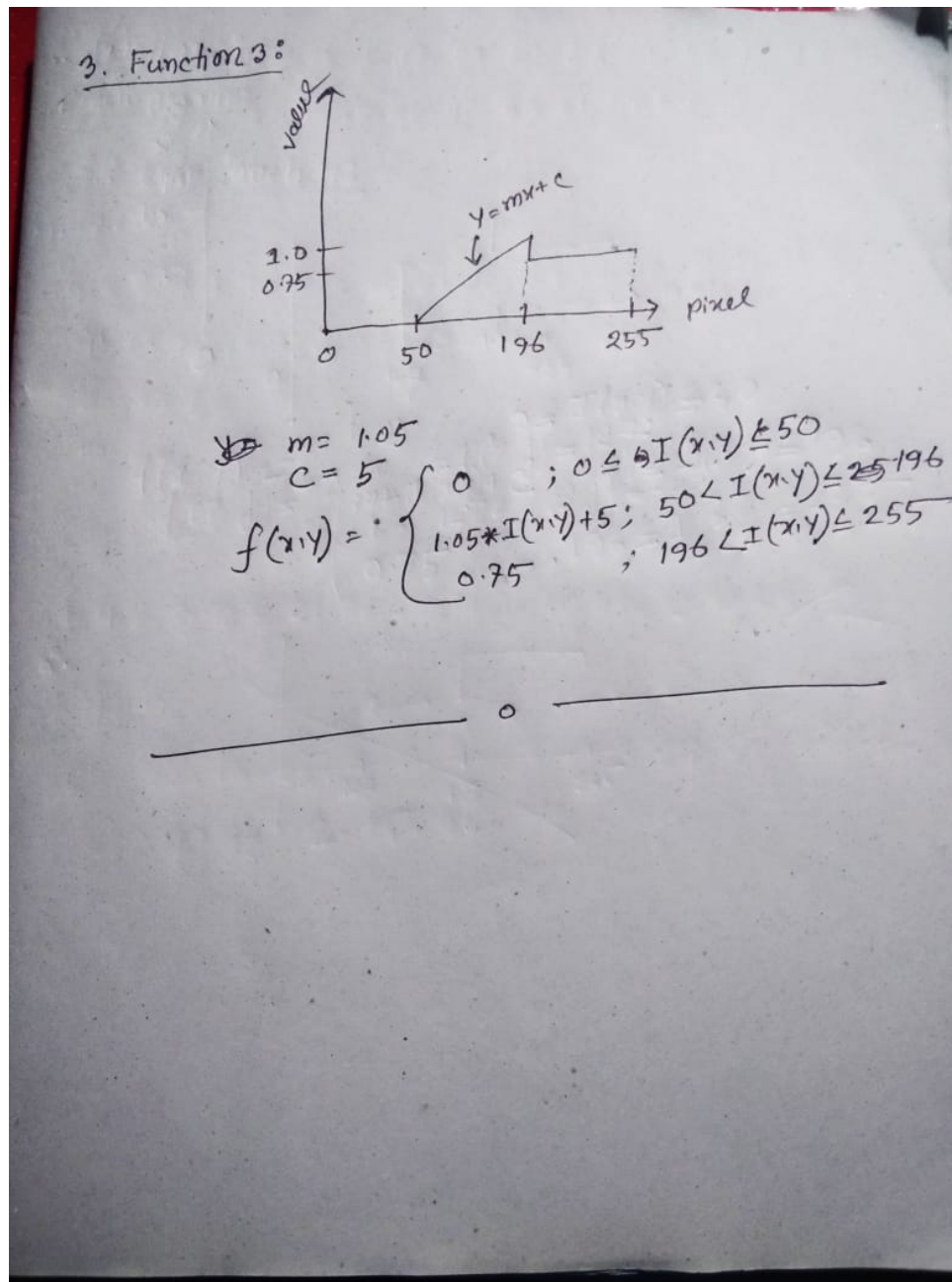


Figure 2: Function 3 diagram

Python Implementation

The implementation of these three functions is available in the following GitHub repository:

<https://github.com/Al-Amin134/Digital-Image-Processing/blob/main/Thresholding/thresho>

Output

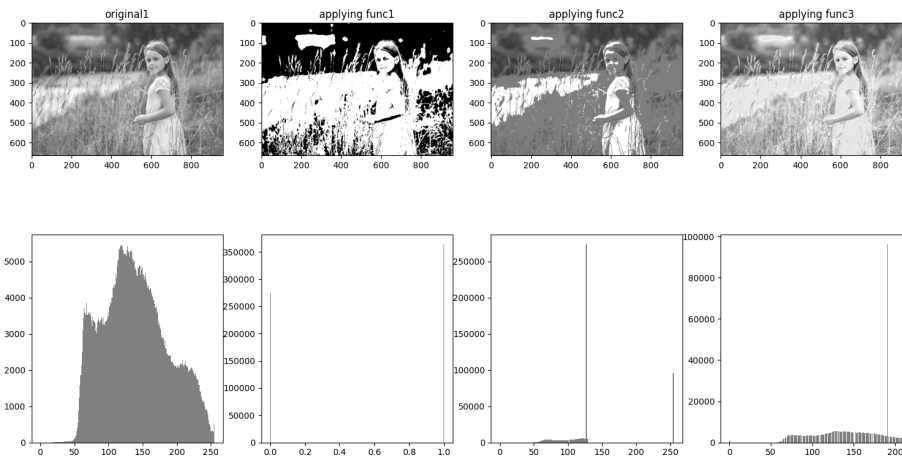


Figure 3: Output images and histograms after applying thresholding functions