Assignment 3

Due date: May 5, 2024

1 Image Compression - Huffman Coding

Question 1:
Use Huffman coding to reduce the code of the provided input image (Huffman.png) and answer the following questions.

1. Identify and count all unique pixel values (symbols) in the image. (5 points).
2. For each unique pixel, calculate the total number of times it appears in the image. (5 points)
3. Compute the probability of occurrence for each distinct pixel in the image. (5 points)
4. Apply Huffman coding to calculate the source reductions. Write the process and the resulting Huffman codes. (20 points)
5. Based on Huffman coding, assign new codes to each distinct pixel (symbol). (15 points)
6. Calculate the average number of bits per symbol used in the encoded image. (5 points)
7. Calculate the total storage size (in KB) required for the image after applying Huffman coding. (5 points)
8. Calculate the compression rate (C) achieved with Huffman coding. This (5 points)
9. Compute the percentage decrease (R) in size from the original image to the compressed format. (5 points)

Note: MATLAB code is required for parts 1 and 2 of Question 1. Additionally, please provide tables that include all mathematical calculations for steps 1 through 9, as shown in Lecture 22.

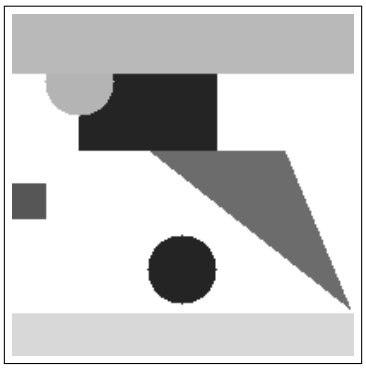


Figure 1: Input Image

2 Text Enhancement

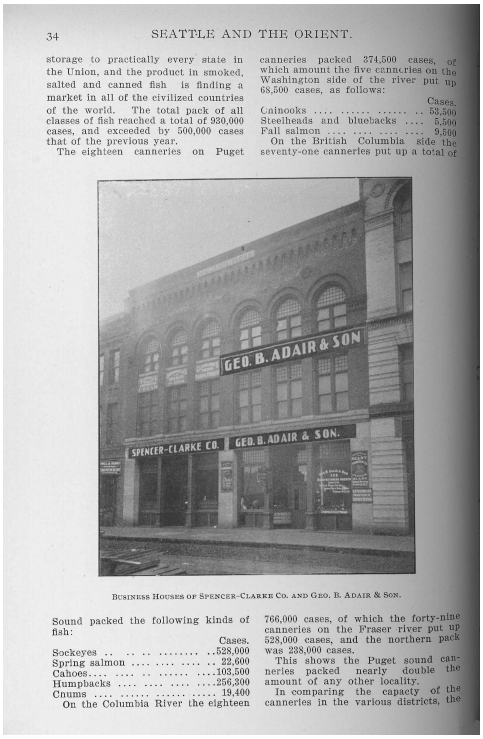
Question 2:
Develop a MATLAB script to process two scanned images of papers named "Seattle 1" and "Seattle 2". The script should perform the following steps:

1. Convert both images to binary format using Otsu's method. Save the histograms for both the original and the binary images, resulting in a total of four histogram images. Additionally, perform global thresholding on the original images and save these output images. (7 points)

2. Implement a local thresholding method that specifically enhances text and white space while excluding images. Assign binary values (0 for text, 1 for non-text areas). Use the formula for the threshold T=localMean × thresholdFactor where localMean is the average intensity calculated over a small local window. The window size should vary from 15 to 45 pixels. (18 points)

3. Apply morphological operations to the images from step 2 to correct and reconnect any broken letters in the text. (5 points)

   Note: Submit all processed images and the complete MATLAB code for each sub question.



(a) Seattle 1

(b) Seattle 2