Assignment 03 : Segmentation of a Textured Image

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I. Abstract

The aim of this study was to explore advanced segmentation techniques for textured images, focusing on isolating an object (a fish) from its background. The challenge arises due to similar textures and colors between the object and background, rendering traditional binarization ineffective. By employing texture filtering and morphological operations, we achieved precise segmentation.

Key Words : image segmentation, texture analysis, morphological operations, binarization, MATLAB.

II. Introduction

Image segmentation is a critical task in computer vision, enabling the separation of objects of interest from their surroundings. This process becomes particularly challenging when the object and background share similar textures and colors. Traditional segmentation methods, such as binarization, often fail in such scenarios. In this report, we explore an advanced segmentation approach that leverages texture filtering and morphological operations to accurately segment a textured image of a fish.

III. Methodology

The segmentation process involved several sequential steps. The image **"flatfish.jpg"** was first loaded into MATLAB and converted to grayscale to simplify processing.

To enhance texture details, the ***rangefilt*** function was applied with a 3x3 neighborhood, followed by rescaling the pixel values to the range [0, 1] using the rescale function.

Noise was reduced using a 7x7 median filter. The filtered image was then ***binarized*** to separate the fish from the background, and the binary image was complemented using the ***imcomplement*** function to ensure the fish appeared white on a black background.

Border noise was removed with the ***imclearborder*** function, and small objects with fewer than 50 pixels were eliminated using ***bwareaopen***.

Morphological closing, performed with a spherical structuring element of radius 6, connected disjoint structures and filled gaps.

Finally, the ***imfill*** function was applied to fill remaining holes, yielding the final segmented image.

IV. Results

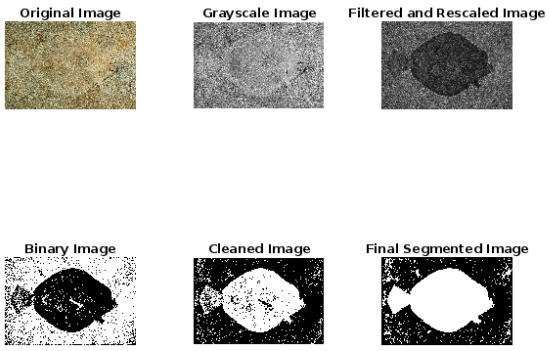

Figure 1. Segmentation results of the textured image.

— The segmentation process successfully isolated the fish from a textured background as presented in the figure [1].
— Starting with an original image where the fish and background were indistinguishable, the grayscale conversion highlighted intensity differences.
— Texture filtering further enhanced local variations, aiding in object differentiation.
— Binarization and complementation distinctly separated the fish, presenting it as white against a black background.
— Subsequent cleaning operations removed border noise and small artifacts, while morphological closing and hole filling refined the segmentation by connecting disjoint regions and eliminating gaps.
— The final result was a smooth and complete segmented image accurately isolating the fish.

V. Discussion

The results demonstrate that the segmentation technique successfully isolated the fish from a textured background where traditional binarization methods would fail. Texture filtering using rangefilt effectively highlighted the object's

boundaries. Morphological operations proved essential in refining the segmentation by connecting disjoint regions and removing noise.

One limitation observed was the reliance on parameter tuning, such as the radius of the structuring element and the threshold for binarization. Future work could focus on automating these parameters using adaptive methods. Additionally, extending this approach to other textured images would validate its generalizability.

VI. Conclusion

This study demonstrates the efficacy of advanced segmentation techniques in processing textured images. By combining texture filtering, binarization, and morphological operations, we achieved precise object isolation. This methodology can be adapted for various computer vision applications involving complex backgrounds and objects.

VII. Appendix

Please note that not all the results (figures) and code have been included in this report. For a complete view of the code and detailed results, please refer to my GitHub repository : GitHub Repository Link.