Image Segmentation

Session: 2020 – 2024

Group ID: 1

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Acknowledgments

We are grateful to Allah Almighty that He provided us with the strength and power to complete this project in time.

We are thankful to Sir Talha Waheed for the supervision, guidance, and care he provided throughout the project by enlightening us with the techniques to manage our work and efficiently meet the deliverables.

Fortunately enough we have had a good communication and collaboration amongst us which has brought us all to a parallel level of performance boosting our morale to keep on striving and working for the better.

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Abstract

The prime objective for the AI project was to implement the concept of image segmentation in AI and its uses in real world scenarios.Image segmentation plays an important role in a pre-processing phase of images having as objective a partition of the image into components or regions of interest for a more detailed analysis of one or more of these regions. Image segmentation may also be used as a pre-processing phase for a better image de-noising or de-blurring that will be done in a separate image processing phase.

1 Problem Statement

The division of an image into regions that separate different objects from each other, and from the background and further use it in different areas of real world scenarios

2 Introduction

2.1 Overview

Image segmentation is a sub-domain of computer vision and digital image processing which aims at grouping similar regions or segments of an image under their respective class labels. Since the entire process is digital, a representation of the analog image in the form of pixels is available, making the task of forming segments equivalent to that of grouping pixels. Image segmentation is an extension of image classification where, in addition to classification, we perform localization. Image segmentation thus is a superset of image classification with the model pinpointing where a corresponding object is present by outlining the object's boundary.

2.2 Background

All development is a long accumulation of technology, coupled with some external conditions to meet qualitative changes. We briefly summarized several periods of image segmentation: Before 2000, we used several methods in digital image processing: threshold segmentation, region segmentation, edge segmentation, texture features, clustering and so on. From 2000 to 2010, there are four main methods: graph theory, clustering, classification and combination of clustering and classification. By the end of 2017, we had divided hundreds of model structures. Of course, after studying the technology and principle, we find that the most successful image segmentation depth learning technology is based on a common pioneer: FCN (Fully Convolutional Network).

2.3 Motivation

Image segmentation is an important image processing, and it seems everywhere if we want to analyze what inside the image. For example, if we seek to find if there is a chair or person inside an indoor image, we may need image segmentation to separate objects and analyze each object individually to check what it is. Image segmentation usually serves as the pre-processing before image pattern recognition, image feature extraction and image compression. Researches of it started around 1970, while there is still no robust solution, so we want to find the reason and see what we can do to improve it. The main reason is that we found there are many kinds of existed image segmentation

techniques and methods, in order to gain enough background, we went through several surveys and decided to take deep view of image segmentation.

2.4 Objectives

As the process of image segmentation plays a crucial role in the development of software programs that use computer vision techniques, the applications of said process are very much widespread. To illustrate this point further, video surveillance systems use image segmentation to identify people, cars, street lights, and other miscellaneous objects within video recordings. Conversely, healthcare professionals rely on image segmentation when making use of medical imaging software, as these programs must be able to identify specific features within the human body. Furthermore, video redaction software programs that rely on facial recognition techniques also work in accordance with the process of image segmentation.Through the process of image segmentation, software engineers have been able to create machine learning algorithms that can detect everything from malignant tumors within an individual organ in the human body to a green traffic light on a busy street.

2.5 Scope

The importance of image segmentation is due to its extensive use in different fields of life. It covers every sector of life whether it is needed in medical sector or entertainment. Some of the key areas are stated below: Computer Vision - Computer vision is used in artificial systems to acquire information from images or video signals to then decide the outcome or next action to be taken.

Face Detection - This method helps in the analysis and matching of integral facial features to help with the detection and identification of faces.

Video Processing - Much like signal processing, video processing is an important part of digital systems. It is used in television sets, DVDs and video players to run and display visual data.

Remote Sensing - Remote sensing uses real-time wireless sensors to gather information about an object at a distance. This technique is used extensively by aircraft, satellites, and ships via ultrasound, Magnetic or even X-radiation methods.

Biomedical Analysis - Image processing has found multiple uses in the field of medicine with it being a major source of image diagnosis.

2.6 Methodology

In order to perform the segmentation on the image first we need to read the image from the local storage we done this using one of the library of the Computer Vision called

CV2.After reading the image we need to convert the 3D matrix into a 1D matrix and to perform this we converted the image into gray image and after that we have to make the group of the different objects depending on the values of the gray matrix but the problem is that the image matrix is not in the binary form so we converted the gray image into binary image using threshold value that's 35.After all these steps called pre-processing we performed the segmentation function that makes the groups of the object using recursion and assign different colors to different objects.

3 Visualization

3.1 Input Image

FIGURE 1: input image

First of all, we need to read image from the local storage and we read image using the CV2 library of the python.

3.2 Gray Image

FIGURE 2: gray image

In this step,+63+ +we need to convert the actual image into gray image so that the 3D matrix is converted into 1D matrix.Threshold value used in our function is 35.

3.3 Binary Image

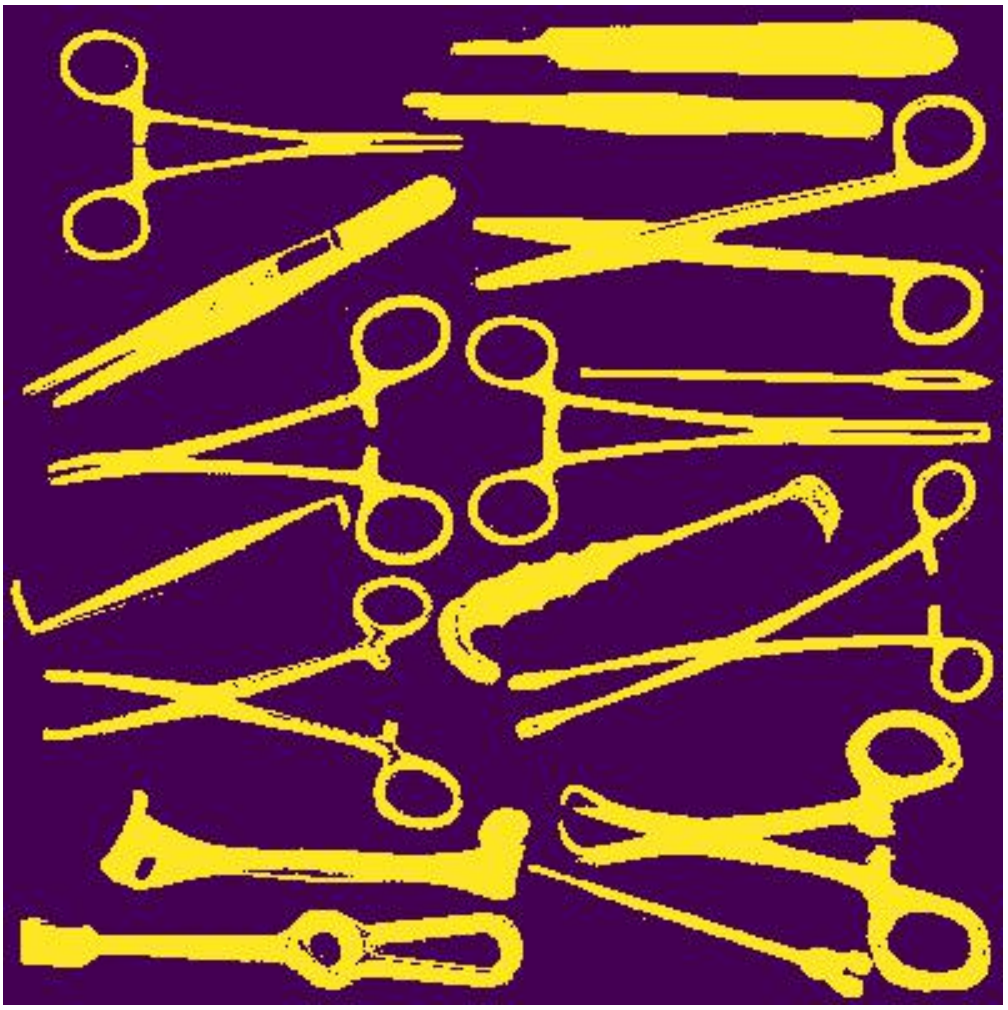

FIGURE 3: binary image

After converting into gar image, our system will convert the gray image to the binary image. the binary image means that the objects will be displayed with light color while the background will be displayed with black color.

3.4 Segmented Image

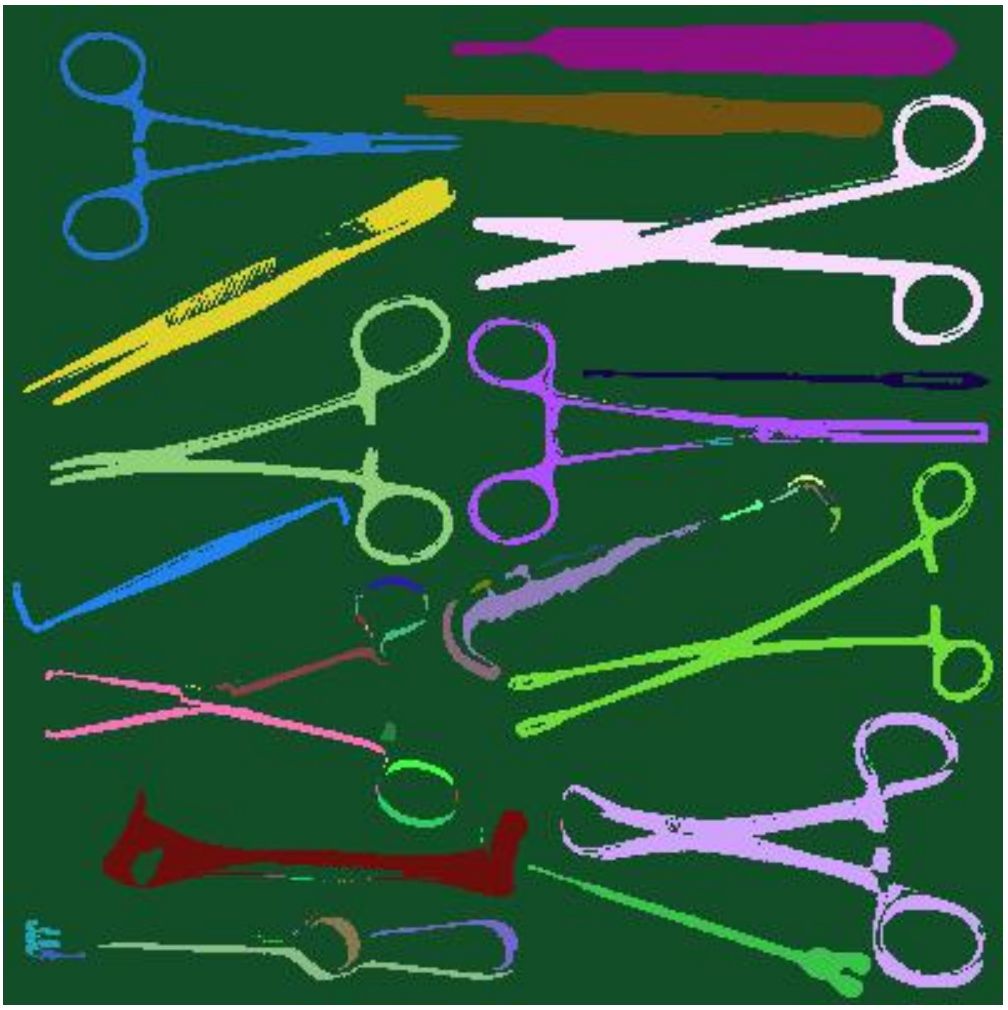

FIGURE 4: segmented image

At this stage, the binary image is converted into the segmented image. In the segmented image, all the objects of the image are seperated.

4 Literature Review

At present, the research of image segmentation theory is not perfect, and there are still many practical problems in applied research. Through comparing the advantages and disadvantages of the various image segmentation algorithms, the development of image segmentation techniques may present the following trends. The combination of multiple segmentation methods. Because of the diversity and uncertainty of the image, it is necessary to combine the multiple segmentation methods and make full use of the advantages of different algorithms on the basis of multi-feature fusion, so as to achieve better segmentation effect. In the parameter selection using machine learning algorithm for analysis, in order to improve the segmentation effect. Such as the threshold selection in threshold segmentation and the selection of K values in the K-means algorithm. CNN model is used to frame the ROI, and then segmented by non-machine learning segmentation method to improve the segmentation effect. It is believed that in the future research and exploration, there will be more image segmentation method to be further developed and more widely used.

5 Performance

In spite of significant advances in image segmentation techniques, evaluation of these methods thus far has been largely subjective. Typically, the effectiveness of a new algorithm is demonstrated only by the presentation of a few segmented images that are evaluated by some method, or it is otherwise left to subjective evaluation by the reader. We propose a new approach for evaluation of segmentation that takes into account not only the accuracy of the boundary localization of the created segments but also the under-segmentation and over-segmentation effects, regardless to the number of regions in each partition. In addition, it takes into account the way humans perceive visual information. This new metric can be applied both to automatically provide a ranking among different segmentation algorithms and to find an optimal set of input parameters of a given algorithm.

6 Limitations and Challenges

The methodology we used in solving our problem was based on recursion. As our system has limited recursion limit,hence it fails on pictures containing objects having large number of pixels. Nevertheless our solution works best for pictures containing objects having small number of pixels. If we talk about other solutions which are provided on the internet, they use libraries of python which differentiates our set of code as our solution uses simple if conditions in its working. The main challenge faced was the limit of recursion which exceeded everytime when pictures containing objects having

large number of pixels was used as input. Hence we decided to restrict our solution to pictures containing objects having smaller number of pixels.

7 References

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