1-11

Counting Object in Images by Using Cellular Neural Networks

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1. Introduction

In this study, as a new approch for image processing, we propose a new algorithm using Cellular Neural Networks (CNN) to count the number of objects in an input image. This algorithm creates spatially uniform spots in the image and uses it to count the number of objects.

2. Proposed Method

The proposed algorithm is shown in Fig. 1. The algorithm creates the spots throughout the image, leaving only the spots in the objects. We count the number of object by the proportion of that spots. The letter between parenthetic in Fig. 1 correspond to the letter between parenthetic in Fig. 2.

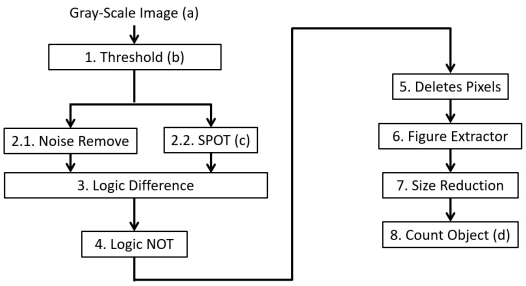

Figure 1: The proposed algorithm.

Each step of the proposed algorithm is as follows.

Step1: Threshold

The input image is binarized by switching between the Black Filler template and the White Filler template.

Step2.1: Noise Remove

Noise are removed using the Small Object Remover template for the binarized image in step 1.

Step2.2: SPOT

The spot is created using the SPOT template for the binarized image in step 1.

Step3: Logic Difference

The Logic Difference template is used to subtract the images in step 2.1 and step 2.2. This step is done to remove background spots.

Step4: Logic NOT

The image in step 3 is inverted for the rest of the process.

Step5: Deletes Pixels

1-pixel or 2-pixel objects in the image in step 4 are removed using switching between State Value template and Small Object Remover template.

Step6: Figure Extractor

Isolated pixels from the step 5 are removed using the Deletes Isolated White Pixels template.

Step7: Size Reduction

The size of the remaining spots in step 6 are reducted using switching between State Value template and Black Filler template. The step is done to shape the remaining spots.

Step8: Count Object

The image in step 7 are compared with the pitch black image. The number of objects are counted with differences above the threshold.

3. Simulation Results

In this section, we show the simulation results of the propossed algorithm counting objects in image.

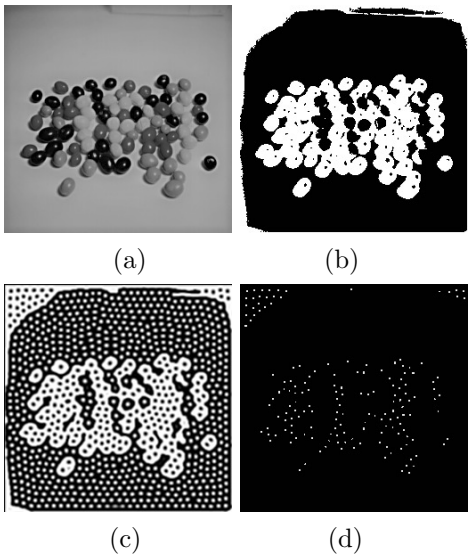

Figure 2: Simulation results. (a) Input image. (b) Simulation result of Threshold. (c) Simulation result up to SPOT. (d) Output image.

Figure 2 (a) shows the image containing objects. Figure 2 (b) shows the binarized image. Figure 2 (c) shows to create spots in a black area having spatial uniformity and black spots in a white area having spatial uniformity only in areas wider than a certain size. Figure 2 (d) shows the output image. The number of objects is 82 in Fig 2 (a). However, from Fig. 2 (b), the number of binarized objects is 61. In contrast, from Fig. 2 (d), the number of spot is 137. As the results, we confirmed that number of objects can be known by spots inside the object.

4. Conclusions

In this study, the accuracy of the proposed algorithm is reduced due to more binarization than necessary. We confirmed that the accuracy of the proposed algorithm varies with the accuracy of the binarization. Therefore, in the future, it is necessary to improve the accuracy of the proposed algorithm by enhancing binarization.