Abstract

Binary image segmentation is a technique that enables an image to be divided into several related portions. In this research, the iterative, Otsu, multiple, adaptive and global algorithms were reviewed to evaluate the importance of the techniques and challenges that limit their usage.

The study utilized the Carl Friedrich Gauss equation to suppress the impact of noisy pixels. The matrix generated was converted into integers to generate a histogram. An arbitrary pixel is selected from the histogram as a threshold to partition the image into two classes. The threshold that generates the minimum variance from the classes is then multiplied by the optimization constant which ranges from 0.1 to 1, and the computed value is used for the segmentation process.

An improved Otsu Algorithm based on the Carl’s Friedrich Gauss equation was evaluated with
the Otsu, multiple, adaptive, and global algorithms. The signal to noise ratio that defines the sensitivity of a segmentation algorithm, and the running time that specifies the quantum of time required by an algorithm to execute were used as the metrics of performance. The experiments conducted using MATLAB and the Berkeley Image Segmentation Dataset was as follows:

The first experiment consisted of five noise free images. In the experiment, the adaptive obtained the highest sensitivity rating of 8.890dB. This was followed by this studies proposed Twum-Acquah algorithm at 5.623dB. The worst performance was recorded in the global at 2.367dB.

In the second experiment that consisted of noisy images, the proposed Twum-Acquah algorithm obtained the highest performance rating of 4.444dB, while the Adaptive which was at the bottom of the evaluation scored 0.851dB.

In terms of the running time, the fastest algorithms were observed in the global, Otsu and the multiple with a rating of 1.103, 1.264 and 1.392 seconds respectively, while the slowest was recorded in the Adaptive at 129.479 seconds.

References

Binary Image Segmentation through the Carl Friedrich Gauss Equation


Index Terms

Computer Science Image Processing

Keywords

Twum-Acquah algorithm, Carl Friedrich Gauss equation, thresholding techniques.