



INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact factor: 6.078

(Volume 6, Issue 2)

Available online at: www.ijariit.com

Image de-noising and segmentation based on Fuzzy C-means clustering using Gaussian Noise

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ABSTRACT

Image sweetening technology is the most efficient essential technologies in the image process field. The aim of image sweetening is to boost the interpretability or perception of knowledge in pictures for human viewers or to supply 'better' Input for alternative machine-controlled image process techniques. Image Segmentation is one in every of the very important steps in the Image process for gathering data from the photographs. To check the effectiveness of noise in pictures, a noise like Gaussian noise measure added to the first image. The separate wave remodels (DWT) and Thomas Bayes Shrink soft thresholding is then applied for the removal of clamorous pixels and to smoothen the image. The planed technique is additional economical than the abstraction domain-based technique, is found to supply higher sweetening compared to alternative compressed domain-based mostly approaches. Within the end, the fuzzy-based mostly changed FCM bunch is performed on the de-noised pictures to provide clusters or segmented results.

Keywords— *Image Segmentation, discrete wavelet transform, Gaussian noise, Bayes Shrink soft thresholding, FCM clustering*

1. INTRODUCTION

The objects which are getting identified in an image might start with image processing techniques like noise removal, which extends by a small level feature extraction to locate lines, regions and possibly areas with certain textures [1].

The wise bit is to implement this collection of the shape as one object, examples include cars on the road, boxes on the conveyor belt or cancerous cells on a microscope slide. One of the reasons the problem is an AI problem is that an object appearance can be changed from different view and lighting. Second problem is the decision which involves which features

belong to which object and what are background or shadows etc. The visual system of human performs all these tasks most of the time without knowing but a machine requires skillful and logical programming and lots of processing power to match human performance [2]. Controlling data as an image will be done by using many techniques. An image is generally described as a 2-D array which contains brightness values, and it's mostly represented by patterns like print [3], slide, television screen, or movie screen. The image could be processed optically or digitally with the use of computer.

An image to process digitally, it's first required to attenuate the image to an array of numbers which will be controlled by the machine. A normal digitized image should be having 512×512 or approximately 250,000 pixels, even though much larger images are getting common. When the image is digitized, there are three basic operations which can be performed on it using the computer. For one single point operation, a pixel value within the output image is predicted on a 1-pixel value on every input image. For regional operations, various neighboring pixels in the input image with its own value produce the value of an output image pixel [4]. But in global operation, every input image pixel supply to an output image pixel value.

Perceiving the object classes in reality images is the main objective in computer vision. Hypothetically, this is tested as a result of its greater appearance variations of object instances which have a place with the same class [5]. Adding to the point bends that originate from a foundation perspective, scale, and mess variations and render highlights of even the very same object for example to be very different [6]. Further difficulties emerge from inner class likeness in which instances from different classes can show up very comparative. So also, the models for an object class must be serviceable enough to set up class changeability, yet discriminatively adequate to sift

through exact object instances in jumbled images. This paper tends to two objectives of acknowledgment are picture classification and object recognition. Toward these objectives, the main commitment right now a methodology for object class acknowledgment that utilizes edge data as it were. The curiosity of our methodology is that we show forms by very simple and normal shape simple of line portions and ovals, joined with a serviceable technique to get recognizing mixes. These discerning combinations are supportive in nature, where line segment representations straight contour and ellipse representation curved contour [7]. We choose an ellipse as it is the basic circular shapes, still is adequately flexible to model curved shapes [5]. These shape primitives contain various captivating properties. And, unlike contour fragment details, storage needs by these primitives are unconventional of object size and are adequately shown with four parameters for a line and five parameters for an ellipse.

1.1 Literature Review

Title: Incorporating Adaptive Local Information Into Fuzzy Clustering for Image Segmentation

Authors: Guoying Liu, et al

The algorithm used is based on extraction method. The limitation of this method is that SURF feature extraction is not good at handling viewpoint or perspective change and illumination change of an image.

Title: Image segmentation based on adaptive cluster prototype estimation.

Authors: Alan Wee-Chung Liew, et al

The algorithm used here are Object Categorization, Application Specific Constraints, Integrated Pre-filtering, Autonomous Harvesting. The annotations can lead to very misleading results on the precision recall curves, showing worse results than the actual accuracy of the trained object detector. It became clear that defining the actual objects to be found can be very challenging, even for domain experts.

Title: Detection of green and orange colour fruits in outdoor conditions for robotic applications

Authors: Bengi Öztürk, et al

The algorithm used here is k means clustering. Various preliminary partitions can produce in varied final clusters it doesn't combine properly with clusters within the first data of various size and different density.

2. EXISTING METHOD

2.1 K-Means Segmentation

K-means is an efficient way of solving clustering problems which use machine learning algorithms. The sequence follows an elementary and comfortable mode to categorize an apt data set done by a sealed number of clusters (presume k clusters) set a priori. The central concept is to denote k centroids for all clusters. The centroids must exist in intelligently due to dissimilar locations cause different output [8]. Thus, the superior option is to position them far away from each other. The next sequence is to take every point related to the required data points and link it to the closest centroid. If no points are left, the foremost sequence is through and an anterior unit is completed. In this case we want to re-evaluate k centroids as the bare center of the clusters coming from the earlier measure. Later we get these k newer centroids; different constricting needs are done connecting the identical data points and the latest centroid. A loop will be completed. Due to the iteration, we can identify that given k centroids alter position sequence past sequence until none are changed. Likewise, centroids cannot move further. Ultimately, the algorithmic program

focuses on reducing an aim function, in this case, a squared error function.

2.2 Hierarchical Segmentation

A gradable assortment of image segmentation could be an assortment of the many a picture segmentation of the equivalent image at varying levels of quality [9] during this the segmentations at deeper levels of detail are often eminent from lucid merges of positions at finer levels of detail. A special feature of ranked segmentation is that the ability to half boundaries for maintaining the total spatial resolution for each segmentation. During this ranked segmentation, the associate object of curiosity may be shown by several image segments in smother levels of feature within the segmentation hierarchy and may be integrated into encompassing areas at coarser positions of detail within the hierarchy. Once the segmentation hierarchy contains enough resolution, the desired object is shown as one phase at any intermediate level of segmentation detail [10].

2.3 Thresholding

The thresholding technique is the best technique for image segmentation. This method focuses on a clip-level to convert a gray-scale into a binary image. The all-important plan of the technique is to settle on the edge price. Several approved techniques area unit provided in the industry; of them is that the Otsu's methodology, most entropy methodology and additionally k-means agglomeration. Lately, techniques area unit created for pictures victimization thresholding X-raying (CT). The essential plan is that thresholding is completely different from Otsu's methodology that's the threshold area unit made from the radiographs instead of the reconstructed image.

2.4 KNN

Cluster analysis is an essential technology in data processing, maybe a productive technique of inspecting and locating fruitful info from information. Cluster algorithmic rule compass the info to categories and clusters in order that objects have a lot of similarity in distinction to at least one another among a cluster, still square measure terribly dissimilar to things in any clusters [11]. Dissimilarities square measure known supported the appointed values showing the objects. Many times, the way measures square measure used [12]. The foremost unremarkably used agglomeration error criterion is the squared-error criterion.

Aiming at the dependency to initial conditions and also the limitation of K-means algorithmic rule that applies the square-error criterion to live the standard of agglomeration, Associate in Nursing increased K-means algorithmic rule that's supported constructive strategies of once-clustering and multi-sampling to search out the productive rudimentary values of cluster centers.

3. PROPOSED SYSTEM

Image segmentation mistreatment fuzzy C-means agglomeration and de-noising Methodologies are given as follows;

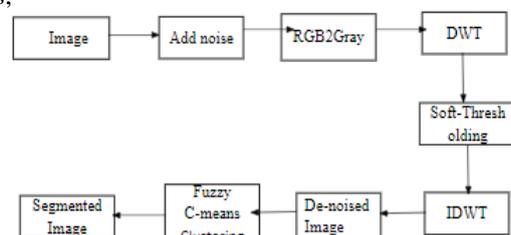


Fig. 1: Diagram of the planned system

3.1 Preprocessing

The preprocessing techniques are utilized in order to market the standard of input pictures and additionally facilitate to enhance the popularity performance of the algorithms.

- Grayscale Conversion
- Histogram Equalization

A filter is employed as a mask; the entire image is applied by the filter. Filters are usually used to take away the opaqueness and to get rid of the noise, and it's additionally used for edge detection functions. By mistreatment brandy Compass Masks following eight directions will be found.

- North
- North West
- West
- South West
- South
- South East
- East
- North East

First, the detected face is going to be allowable to divide into the native blocks that are completed to seek out the sting response by mistreatment brandy templates. Kirsch's template is used for detecting faces edge response for directional pattern analysis to extract texture features. It is an edge detector which is non-linear that finds the greatest edge strength in a few predetermined directions [13]. Any single kernel mask is taken by the operator and turned by forty-five-degree increments through all eight compass directions: N, NW, W, SW, S, SE, E, and NE. the utmost magnitude across all directions is that the edge magnitude of brandy that follows all the properties of a by-product mask then rotate it to hunt out the edges we will discover all the sides if pictures all told the directions By mistreatment brandy compass mask.

3.2 Fuzzy Logic

The definition of mathematical logic ought to lean as a generalization of classical logic. Lotfi Zadeh developed trendy mathematical logic within the mid-1960s to unravel the issues which provide the exactitude of knowledge, that have to be compelled to be done or in this the principles of reasoning area unit developed in an exceedingly} very generic thanks to building use of various classes. In symbolic logic or diffuse logic, there is a unit over 2 alternatives however a full set of truth values for logical propositions. The 2 truth values should not essentially add up to one looking on the sort of negation operator that's used. The association between symbolic logic and applied math is weak. Probabilistic ways that affect the general data area unit developed within the theorem framework; the justification of symbolic logic isn't needed whereas employing a probabilistic approach. During this chapter, we are going to be showing the strong link gift between mathematics, logic, and mathematics. Symbolic logic is corresponded by fuzzy mathematics and thus the linguistics of fuzzy operators is known by using a geometrical model.

The geometric mental image of symbolic logic offers the U.S.A. an idea to connect with neural the potential networks. Mathematical logic can also be used as an Associate in nursing interpretation model for the properties of neural networks, and for giving a further correct description of their performance [15]. At now the logical system is used in many types of merchandise of business and shopper natural science that a good system is sufficient and where the simplest management does not extremely arise.

3.3 Morphological method

The morphological image process is outlined as a set of either non-linear operations in relation with form or morphology of options in a picture. A morphological operation depends upon solely on the relative ordering of element values it doesn't rely on their numerical values, thanks to that they're suited to the process of binary pictures.

A morphological technique examines a picture with a little form or model that is named as a structuring component the structure of the part is placed at most of the locations of the image and it's equated with the close neighborhood of pixels [16]. Once morphological operation happens on a binary image, it creates a replacement binary image. The constituent in recently fashioned binary image features a non-zero worth provided that the take a look at is eminent at that location within the input image. The structuring of part maybe a minute binary image, which suggests a little matrix of pixels, is made with a worth of 1 or zero:

- The structuring part is outlined by the matrix dimensions.
- The structure of the part is outlined by the pattern of zeros and ones.
- Generally, the origin of the structuring part is one among its pixels, though the origin may be outside the structuring part.

3.4 Wavelet remodel primarily based Image De-noising

The rippling may be a cluster of orthonormal performs that is generated by dilation and transfer operation of scaling function performs and a rippling performs [17]. The rippling basis or performance will be localized in either frequency or area. Because of this the rippling remodels scans and analyzes the image info on each frequency and continuance. However, the localization of Fourier remodel will do solely in spatial domain. The rippling basis is outlined as follows;

$$\Psi_{(j,k)}(X) = 2^{j/2} \phi(2^j x - k) \quad (1)$$

The scaling function is defined as follows

$$\Psi_{(j,k)}(X) = 2^{j/2} \phi(2^j x - k) \quad (2)$$

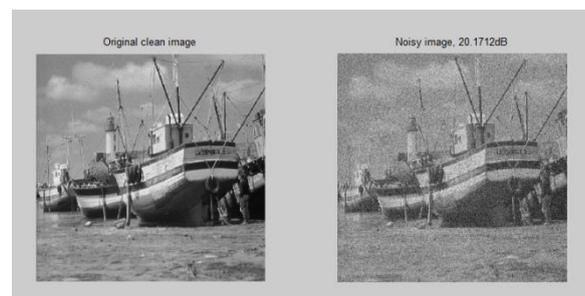


Fig. 2: Noisy and clean image

The image de-noising relying upon rippling is performed by rotten the corrupt image into the wavelet coefficients. Next, the rippling wave coefficients area unit changed on the premise of saturated or burdensome thresholding performs. At last, the inverse riffle rework is performed on a continuing constant that was modified to induce the reconstructed image [18]. The following is that the procedure for riffle based de-noising first; distinct riffle rework got to be applied to the hissing Image. The importance of riffle rework is to decompose the image data into the riffle coefficients.

- Second, thresholding performs got to be performed to the riffle coefficients parts. Thresholding is additionally either soft or taxing thresholding in line with the applying. The coefficients lesser pared to the brink worth ought to be removed and so the larger coefficients ought to be maintained.

- Third, inverse distinct rifle model ought to be applied on coefficients that were preserved and procure de-noised procure that's the reconstructed image.

4. CONCLUSION

Image segmentation is that the technique to recover the image to improve image with machine learning algorithms. Unsupervised learning discovers hidden intrinsic structures in data. Clustering is the commonly used unsupervised learning technique. It provides exploratory data inspection to find concealed patterns or structures in the images. Most algorithms used to perform clustering include k-means, Gaussian mixture models, self-originated maps, hidden Markov models, subtractive clustering and fuzzy c-means clustering. Future work we should use the combination and hybrid approach to get better performance accuracy for de-noising and segmentation.

5. ACKNOWLEDGEMENTS

The authors acknowledge the support from SRM Institute of Technology, Ramapuram, Chennai for providing and sustaining necessary domain insights and enabling a conducive learning environment.

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