ISSN XXXX XXXX © 2018 IJESC

Research Article Volume 8 Issue No.4

An Enhanced MRF Model for Arbitrary Shaped Occluded Objects Segmentation

Shubham Sharma[1], Vyom Kulshreshtha[2], Dr. Pankaj Sharma[3]
M.Tech Student[1], Assistant Professor[2], Professor[3]
Department of Computer Science & Engineering
Sachdeva Institute of Technology, Uttar Pradesh Technical University, Lucknow, India

Abstract:
The object segmentation is very valuable in many practical problems like tumor detection, abstraction of shapes of cell, nuclei, and bacteria in medical imaging. There is moreover a prevalent application in metallurgy for determining the grain size, modularity and coating thickness in industrial machine vision. In the present work we are pointing the objects in the arbitrary shapes in several domains and specifically deal with pull out the objects, their shape parameters which are occluded, which is a interesting open problem so far.

Keywords: Image Processing, Image Segmentation, Image Segmentation Techniques, Edge-Based Segmentation,

1. INTRODUCTION

1.1 Image Processing

Digital image processing is a latest subject in computer history. When we work with computer vision, Image processing is the general issue in today's era. In itself it is a broad view to be considered [1].

Applications

1. Satellite imagery
2. Wire photo standards conversion
3. Medical
4. Imaging
5. Videophone
6 .character recognition and
7. Photo enhancement [2]

1.2 Image Segmentation

Image segmentation is an important technology for image processing. There are lots of applications whether on synthesis of the objects or computer graphic images require precise segmentation. Segmentation divides an image into distinct regions containing each pixel with similar attributes [3].

1.3 Image Segmentation Techniques

Segmentation can be classified as follows:

1) Region Based

2) Edge Based

3) Threshold

4) Feature Based Clustering

5) Model Based

The classification is specified in Figure 1 [5]

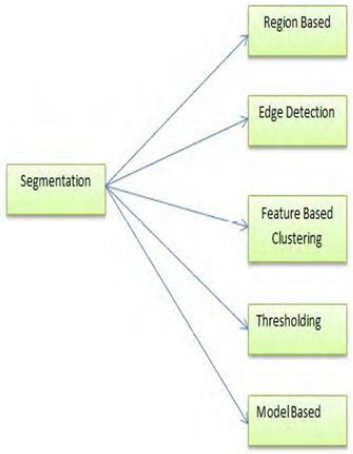

Figure.1. Various types of segmentation [5]

1.3.1 Edge-Based Segmentation

Edge finding methods modify pictures to edge pictures benefitting from the progressions of grey tones in the pictures. Edges are the sign of lack of continuity, and ending. As a result of this revolution, edge image is obtained without encountering any changes in physical qualities of the main image. Objects made of numerous parts of different color levels. In an image with different grey levels, despite an evident change in the grey levels of the object, the shape of the image can be distinguished in Figure 2 [6].

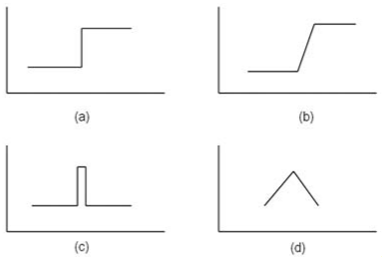

Figure.2. Edges types (a) Step Edge (b) Ramp Edge (c) Line Edge (d) Roof Edge [6]

1.3.1.1 Soft Computing Approaches
Three different soft computing techniques to edge detection for image segmentation are most frequently used. These are

(1) **Fuzzy based Approach**
There are different possibilities for development of fuzzy logic based edge detections. One method is to define a membership function signifying the degree of edginess in each neighborhood. This approach can only be defined as a exact fuzzy approach if fuzzy concepts are additionally used to modify the membership values.

(2) **Genetic Algorithm based approach**
A genetic algorithm made up of three foremost operations: selection, crossover, and mutation. The selection estimates each individual and keeps only the fittest ones in the population. In addition to those fittest individuals, some less fit ones could be elected according to a small probability.

(3) **Neural Network based Approach**
Neural networks are produced by several elements that are connected by links with variable weights. Artificial neural networks (ANN) are widely useful for pattern recognition. Their processing potential and nonlinear characteristics are applied for clustering. Self-organization of Kohonen Feature Map (SOFM) network is a powerful tool for clustering

1.3.2 Region Based Method
This strategy works on the standard of homogeneity by accepting the way that the neighboring pixels inside a region possess similar characteristics and are dissimilar to the pixels in other areas. The objective of region based segmentation is to produce a homogeneous region which is bigger in size and results in very few parts in the image. The regions though treated as homogeneous in nature but there is condition to note any considerable changes in the characteristic of the neighboring pixels. Region based methods are basically divided as
1. Region growing methods
2. Region split and merges methods [7].

1.3.3Markov Random Field
A Markov Random Field (MRF) has the organization of an undirected graph G, where all edges of E are undirected (e.g., Fig. 3(a)), and holds the following local autonomy assumptions (referred to as local Markov property) which entail that a node is independent of any other node given all its neighbors [8].

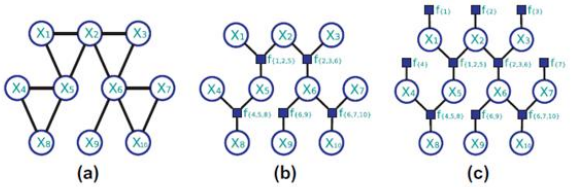

Figure.3. Examples of Markov Random Fields and factor graphs. Given that the Markov Random Field in (a) can be described by the two factor graphs (b) and (c). Nonetheless, the factor graph in (c) includes factors corresponding to non-maximal cliques, whereas the one in (b) contains only factors consequent to maximal cliques [11]

2.RELATED WORK

The research work performed in this area by diverse researchers is presented as follows:
SujataSaini et al. in 2014 [1] Image segmentation is a vital step for image processing, and it is used everywhere if we want to analyze internal part of the image. Picture division gives the important objects of the picture. This paper represents the various image segmentation methods that could be used in the segmentation algorithm. Every time we work with the image, first step is to segment the image so as to remove its complexity. The segmentation of images is the first thing for understanding the images. It is used in the Image processing applications like Computer vision, etc. this paper, two categories are mentioned: Edge and region based Segmentation, which furthermore includes their respective techniques.

Ashraf A. Aly et al. in 2011 [2] Assessing the previous study is an essential part of advances segmentation technique for the image analysis techniques. The objective of this paper is to present a review of digital image segmentation techniques. The troubles of digital image segmentation illustrate great challenges for computer vision. The broad range of the problems of computer vision may make good use of image segmentation. In this paper different methods for segmentation techniques are evaluated. We discuss the tendency of each algorithm with their approaches, advantages and disadvantages. This study is helpful for determining the accurate use of the image segmentation methods and for upgrading their accuracy and performance and also for the main objective, which designing new algorithms**.**

ShanazAman et al in 2015 [3] image segmentation is the procedure of dividing a picture into different types of regions and in classes of specific geometric shape. It can said that each class has normal distribution with specific variance and mean, so the picture called as Gaussian Mixture Model. In this paper, first study h related with the Gaussian-based HMRF (hidden Markov random field) model and its EM algorithm. At that point we sum it up to - concealed Markov irregular field in light of Gaussian blend display.In MATLAB R20013a this algorithm is executed. And also apply this algorithm to color image segmentation problems.

R.Yogamangalam et al. in 2013[4] new technologies are appearing in the field of Image processing, especially in the domain of segmentation in day-to-day life. Speedy portrayal on the absolute most regular division systems like thresholding, Edge detection, Clustering, Model based etc., defining its advantages as well as the drawbacks presented in this paper. Few of them techniques are suitable for noisy images. Among them Markov Random Field (MRF) is the most grounded strategy for commotion cancelation in pictures though the least complex method for division is thresholding.

N. Senthilkumaran et al. in 2009 [5] Soft Computing is an emerging field that consists of compatible elements of fuzzy logic, evolutionary computation and neural computing. Soft computing techniques have found broad applications. One of the most important methods for image segmentation is edge detection. Image segmentation is the course of partitioning a digital image into sets of pixels or multiple regions. Edge is a fringe among two homogeneous area. Edge detection elaborate the process of identifying and locating sharp asymmetry in an image. This paper concentrated on the analysis of hypothesis of edge finding for picture division using Fuzzy logic based soft computing approach, Neural Network and Genetic Algorithm**.**

A. M. Khan et al. in 2013 [6] Image segmentation is the basic and essential step to inspect images and extract data from

them. It is the field which is widely researched and still facing various problems for the researchers. This paper tries to put light on the methods used to segment an image. This paper stresses on the aim behind the basic methods used. Image segmentation can be mainly categorized as semi-interactive method and fully automatic approach. The algorithms developed in one of these approaches. Image segmentation is a essential step as it exactly effects the total success to understand the image.

Quan Wang in 2012 [7] the (HMRF) hidden Markov random field model and its (EM) expectation-maximization algorithm implemented using MATLAB toolbox namedHMRF-EM-image for 2D image segmentation using the HMRF-EM framework in this paper. Author conclude that HMRF-EM-image toolbox is an implementation of the hidden Markov random field and its EM algorithm. This toolkit is well commented and easy to reconfigure. Author suggested in this paper that The HMRF model is mainly used to refine the direct segmentation output of some other algorithms. To get better segmentation results on more complicated images, some higher-level features should be used to construct y irrespective of just pixel intensities, and some more advanced algorithm should be used to generate the initial labels.

Yong Xia et al. in 2006 [8] the problem of conventional feature-based texture segmentation methods usually suffer from the intrinsically less inaccuracy, which is largely caused by the Over simplified assumption that each textured sub image used to estimate a feature is homogeneous. An adaptive segmentation algorithm based on the coupled Markov random field (CMRF) model is suggested in this paper. The CMRF demonstrate has two commonly subordinate segments: one models the practical picture to calculate features, and the other models the labeling to achieve segmentation. When calculating the feature of each pixel, the homogeneity of the sub image is ensured by using only the pixels currently labeled as the same pattern. With the gained features, the labeling is obtained through solving a maximum a posteriori problem. By using the intermediate segmentation result, the accuracy of feature extraction is much improved. With the refined feature set, the segmentation result also gets better. Comparative experiments have proved the success of the proposed approach. Also author suggested that in the proposed CMRF model though the work focuses on the MRF-based features, the proposed idea of simultaneously refining features and labels may provide some inspiration to other feature-based texture segmentation approaches. Also authors suggest the feature used in this paper has its limitation to model textures with strong edges/directionality or large-scale primitives, Additional future work are to explore different texture features to segment various images.

3. PROPOSED WORK

Object Extraction implies discovering districts in the picture area possessed by a characterize question or protests. Object Extraction often require high position knowledge about the shape of the objects sought in arrange to deal with high noise, cluttered backgrounds, or occlusions. Therefore, most way to extraction have, to vary degrees and in different ways, incorporated prior knowledge about the edit of the objects sought. Precociously approaches were full generic, essentially encouraging smoothness of object boundaries. Object Extraction have many important applications, for example the extraction of cells from light microscope images in biology, or the origin of densely packed tree crowns in remote sensing images. In the current work we are targeting the objects in the arbitrary shapes in various domains and specifically deal with extracting the objects, their shape parameters which are occluded, which is a challenging open problem so far.

4. RESULTS AND ANALYSIS

This chapter focuses on result and its analysis based on the MRF Model in image segmentation using MATLAB. To compare the performance of MRF and Enhanced MRF, peak signal to noise ratio (PSNR) is used as performance metric. To see the results of Enhanced MRF, first of all run MATLAB

Enhance MRF

Step 1:- Run the GUI file

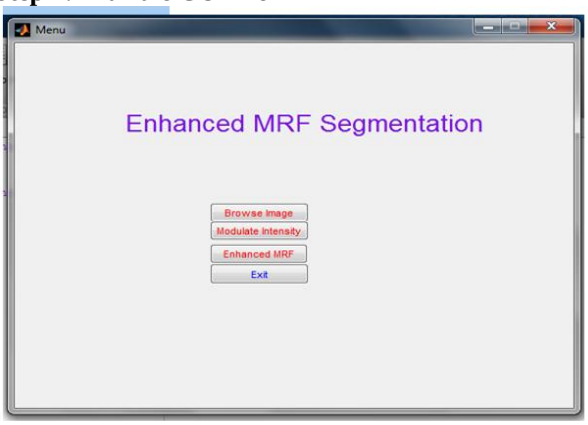

Figure.4.1: Graphical User Interface

Step 2:- Browse Image and Choose Modulate Intensity

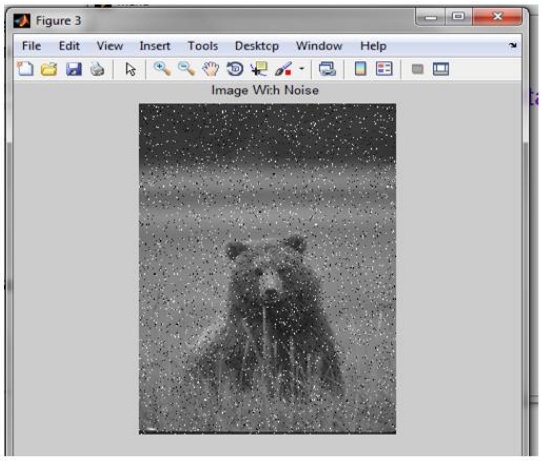

Figure.4.2: Image with Noise

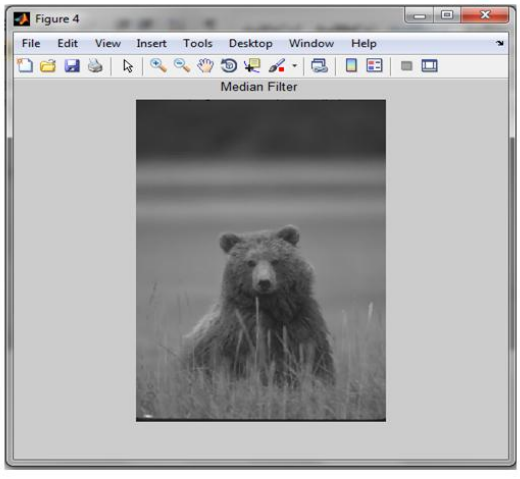

Figure .4.3: Image Noise Removal

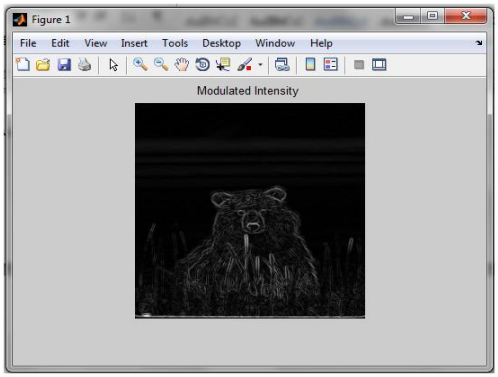

Figure 4.4: Modulated Intensity

Step 3:- Choose Enhance MRF

Step 4:- Calculate the PSNR (Peak Signal-to-Noise Ratio (PSNR)

```
Iteration No. 7
  Inner iteration: 1
  Inner iteration: 2
  Inner iteration: 3
  Inner iteration: 4
  Inner iteration: 5
  Inner iteration: 6
  Inner iteration: 7
  Inner iteration: 8
  Inner iteration: 9
  Inner iteration: 10

PSNRMedian =

   23.7159
```

Figure ;4.5: PSNR of Enhanced MRF

The enhanced MRF image quality is improved as shown in figure

Step 5:- Final output

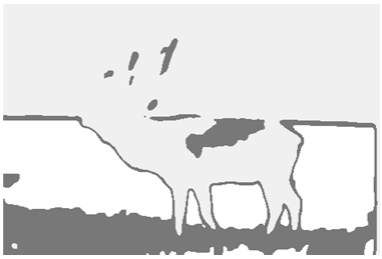

Figure 4.6: Output of Enhanced MRF

Table 4.1 Output of MRF & Enhanced MRF

Table 4.2 PSNR of MRF and Enhanced MRF

Image Name	MRF	Enhance MRF
Animal	4.2655	23.7159
Temple	5.1970	24.7558
Plane	4.8471	19.2557
Bus	4.6558	21.4194
Mountain	4.5483	16.1750

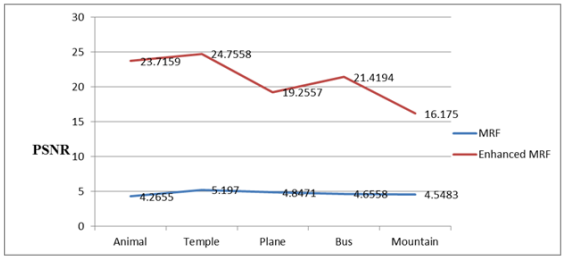

Figure .4.7. MRF vs. Enhanced MRF PSNR

5. CONCLUSION AND FUTURE SCOPE

Image segmentation is important step for image processing and it is used everywhere when the internal part of the image is to be analyzed. To remove the complexity of image segmentation process is required. Present work represents different segmentation methods. Different researchers suggested many points about segmentation techniques that are: Single method or technique would not provide better results. Segmentation can be applied to any type of image. Comparing to other methods thresholding is the simplest fast method. Segmentation technique of the image could be used as per the required application or the usage as image is segmented on the basis of different features. Segmentation techniques are categorized on the basis of detection of discontinuity and similarity of the image. Also Markov random field impose strong spatial constraints on the segmented regions, while segmentation based on clustering only considers pixels intensities, therefore HMRF segmentation results are much smoother than the results of direct K-means clustering. In coming work, we will effort on the weakness of parameters used in MRF. Also, we will ensure more theoretical analyses on our projected technique to advance our proposed segmentation approach. To get better segmentation results on more complicated images, some higher-level features should be used instead of just pixel intensities, and some more innovative algorithm should be used to yield the initial labels.

6. REFERENCES

[1]. SujataSaini and KomalArora, ”A Study Analysis on the Different Image Segmentation Techniques”,volume4, Number 14 (2014).

[2]. Ashraf A. Aly, Safaai Bin Deris, NazarZaki, ” RESEARCH REVIEW FOR DIGITAL IMAGE SEGMENT ATION TECHNIQUES”, IJCSIT, Vol 3, No 5, Oct 2011.

[3]. ShanazAman, FarhatAfreen , HarapriyaSahoo , Chandana Patel, RajanJha, AshimSauravSahoo, ”IMPLEMENTING GMM-BASED HIDDEN MARKOV RANDOM FIELD FOR COLOUR IMAGE SEGMENTATION”, April, 2015.

[4]. R.Yogamangalam, B.Karthikeyan," Segmentation Techniques Comparison in Image Processing",IJET,Vol 5, No 1, Feb-Mar 2013.

[5]. N.Senthilkumaran and R. Rajesh, "Edge Detection Techniques for Image Segmentation – A Survey of Soft Computing Approaches", International Journal of Recent Trends in Engineering, Vol. 1, No. 2, May 2009.

[6]. A. M. Khan, Ravi. S, "Image Segmentation Methods: A Comparative Study",IJSCE, Volume-3, Issue-4, September 2013.

[7]. Quan Wang, "HMRF-EM-image: Implementation of the Hidden Markov Random Field Model and its Expectation-Maximization Algorithm", December, 2012.

[8]. Yong Xia, Dagan Feng, Rongchun Zhao,"Adaptive Segmentation of Textured Images by Using the Coupled Markov Random Field Model", VOL. 15, NO. 11, NOVEMBER 2006.