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An MRF Model for Extracting Multiple Arbitrary Shaped Occluded objects

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ABSTRACT

The object classification is useful in many practical problems like tumor detection, extraction of shapes of cell, nuclei, and bacteria in medical imaging. There is also a wide application in metallurgy for measuring the grain size, coating thickness, modularity, and in industrial machine vision. 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.MRF is adopted because it provides the good, flexible, stochastic image models. MRF image models are so much versatile that it can be applied in the areas of Image Processing

Keywords: **Image Processing, Image Segmentation,Image Segmentation Technique,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]. In digital image processing, we use computer algorithms to achieve image processing. Actually digital image processing has several advantages on the analog image processing; first it gives a high number of algorithms to be used with the input data, second we can evade some processing problems such as creating noise and signal distortion during signal processing. In 2000s, fast computers became presented for signal processing and digital image processing has become the popular form of image processing. Due to of that, signal image processing became versatile method, and also cheapest [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]. Efficient image segmentation is one of the most vital tasks in automatic image processing. Image segmentation has been interpreted differently for various applications. For example, in machine vision applications, it is viewed as a bridge among low level and high level vision subsystems, in medical assuming as a tool to delineate anatomical structure and other regions of interest whose a priori knowledge is normally available and in statistical analysis, it is posed as a stochastic evaluation problem, with assumed prior distributions on image structure, which is widely used in remote sensing. In remote sensing, it is frequently viewed as an aid to landscape change detection and land use/cover classification. A fore mentioned examples state that image segmentation is present in every kind of image analysis. This constitutes a plethora of literature on the image segmentation [4].

1.3 Image Segmentation Technique:

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 Fig 1 [5]

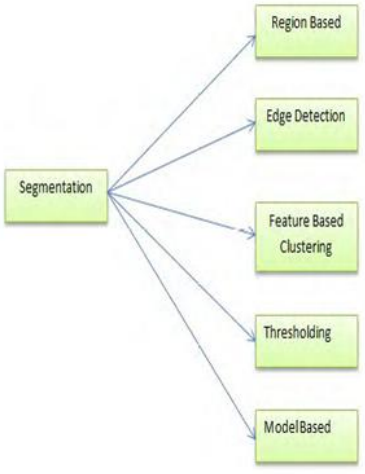


Fig 1.Various types of segmentation [5]

1.3.1 Edge-Based Segmentation:
Edge detection techniques transform images to edge images profiting from the changes of grey tones in the images. 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 3 [6].

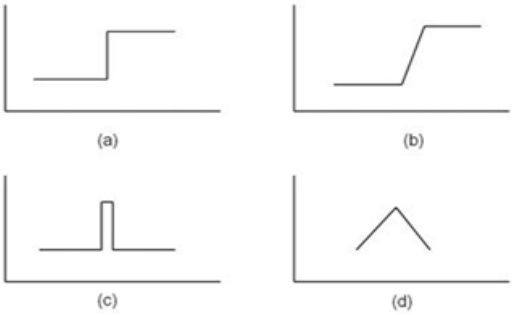


Fig. 3. Type of Edges (a) Step Edge (b) Ramp Edge (c) Line Edge (d) Roof Edge [6]

1.3.2Region Based Method:-
This method works on the principle of homogeneity by assuming the fact 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 merge methods [7].

1.4 Digital Image Segmentation Methods with Advantages and Disadvantages: [2]

Method	Advantage	Disadvantage
Inverse dynamics method	• Data are very good. • Animation is of high quality. • Using a nonlinear optimizer.	• Many different EMG patterns can produce the same kinematic output
Active contour method	• Use active contour models • Preserves global line shapes efficiently	• Should find strong image gradients to drive the contour. • Lacking accuracy with weak image boundaries and image noise
Watersheds Method	• Based on Mathematical Morphology • Helps to improve the capture range	• Over segmentation
Novel edge-based method	• Algorithm based on an energy minimization procedure.	• depends on the assumption that the deformation and movement of the tracked object is small between the frames.
Topological alignments method	• Improve the filtration efficiency. Using linkage clustering.	• Complicated.
Pattern Recognition method	• Pattern recognition fields used to perform the segmentation. • The method used to model relationships between inputs and outputs.	• Restrictions on shape parameters. • Complicated

2. RELATED WORK

The research work performed in this area by different 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. Image segmentation provides the significant objects of the image. 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. Then we generalize it to - hidden Markov random field based on Gaussian mixture model. In MATLAB R20013a this algorithm is executed. And also apply this algorithm to color image segmentation problems.

V. Dey et al. in 2010 [4] as the research on image segmentation progresses, it has become important to categorize the research results and readers are provided with an overview of the existing segmentation techniques in each category. Different image segmentation methods applied on optical remote sensing images are investigated in this paper. Papers are selected on the basis which includes sources from image processing journals, books, dissertations and thesis out of more than 3000 journals, books. The conceptual details of the techniques are explained and for simplicity mathematical details are avoided. Broad and detailed classifications of examined segmentation techniques are provided. The state of research on each category is provided with image properties used by them and emphasis on developed technologies. The categories mentioned are not always commonly independent. Hence, their interdependence is also stated. Sofinal conclusions summarizing frequently used techniques and their complexities in application.

R.Yogamangalam et al. in 2013[5]new technologies are appearing in the field of Image processing, especially in the domain of segmentation in day-to-day life. Quick description on some of the most common segmentation techniques 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 strongest method of noise cancellation in images whereas the simplest technique for segmentation is thresholding.

N. Senthilkumaran et al. in 2009[6]]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 boundary between two homogeneous regions. Edge detection defines the process of identifying and locating sharp asymmetry in an image. This paper stresses on the survey of theory of edge detection for image segmentation using Fuzzy logic based soft computing approach, Neural Network and Genetic Algorithm**.**

A. M. Khan et al. in 2013 [7] 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.

Sandhya et al. in 2015 [8] Segmentation is having its significance in various object identification and selection applications. On accurate feature selection or segmentation the accuracy of these applications depends. In this paper, in a generalized way a study to the segmentation approach is presented. Here the segmentation approaches are classified as edge based, threshold based and region based segmentation. The paper also explored most effective clustering approach used for segmentation. Different types and aspects of clustering approaches are explained here. The paper is presented as a study to define the importance of segmentation approaches.

SmritiPathak et al. in 2016 [9] in computer vision, to get a perfect display, Processing of image takes several stages. It involves processing an image in to the elementary components in order to expand statistical data. Every single one Image Processing operation mainly focuses at a better recognition of object under consideration. The main point behind is to find suitable local feature that can be noticeable from other objects and also from the background. Previous researches shown many efficient techniques to make effortless and better noticeable image or data. This paper throw light an overview of their efficient work in the appropriate field in order to understand their feasibility and realization.

Manikannan et al. in 2015 [10] in recently innovative technologies are coming out trends in the field of Image processing. A comparative study in region based and model based segmentation of image is the most unreliable functions in image processing and analysis. Segmentation is the technique to Simplify and/or to change the view of any image either region based and model based segmentation into that image that is more meaningful and easy to analyze. Region based segmentation is used to find out objects and boundaries in images. image segmentation consequences influence all the coming processes of analysis of image such as object description and illustration, characteristic dimension, This paper gives a outline about the various techniques of segmentation used in image processing techniques such as region based, Model based, Edge based, clustering etc. giving its advantages as well as drawbacks.

Quan Wang in 2012 [11] the hidden Markov random field (HMRF) model and its expectation-maximization (EM) 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 usedto 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

3. PROPOSED WORK

3.1 Problem Formulation

Occlusion can provide a strong cue for object segmentationand "pop-out", but determine an object's occlusion boundaries using appearance alone is a hard problem in itself.Multi-layer binary Markov random field (MRF) model assigns large probability to object configurations in the image domain consisting of an unknown number of possibly touching or overlapping near-circular objects of almost a given size.The layers interact via a correct for the overlap of regions in different layers, and this inter-layer interaction is crucial, specifically when a likelihood term is added. In its absence, the maximum probability configuration would just be the same in all layers and equal to that found using the Markov Random Field model. The result is that rather than the regions similar to two overlapping objects necessarily merging into a single region; it may be energetically favorable for the two regions similar to the two separate objects to appear in different layers. The multi-layer MRF GOC model enables the define and modeling of object configurations consisting of an *a priori* unknown number of almost circular objects of roughly the same size, which may touch.

3.2 Proposed Work

The object classification is useful in many practical problems like tumour detection, extraction of shapes of cell, nuclei, and bacteria in medical imaging. There is also a wide application in metallurgy for measuring the grain size, coating thickness, modularity, and in industrial machine vision. 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.

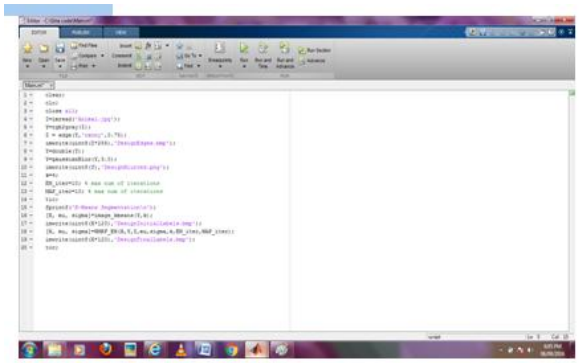
4. RESULTS AND ANALYSIS

To compare the performance of MRF and Enhance MRF, consider the performance metrics of energy consumed, data transmitted and image quality.

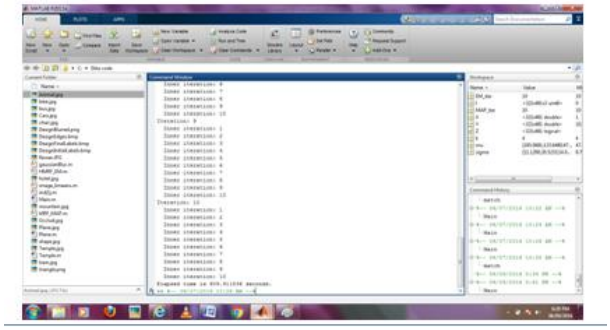
To see the results of Enhance MRF, first of all run MATLAB WINDOW as shown in figure 5.1 below:-

MRF Example Animal:

Step 1:- Run the main file



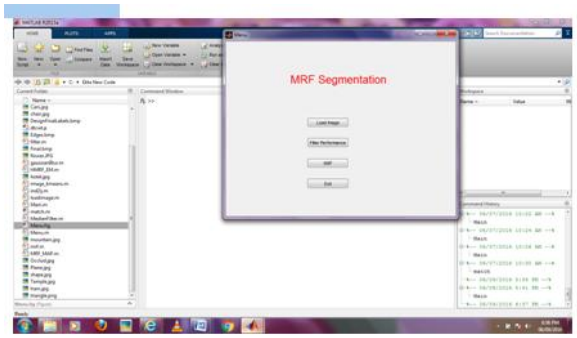
Step 2:- Script run



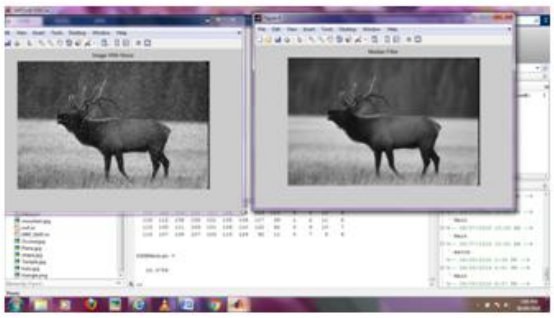
Step 3:- MRF run on the MATLAB and display image in folder design final label

Enhance MRF:-

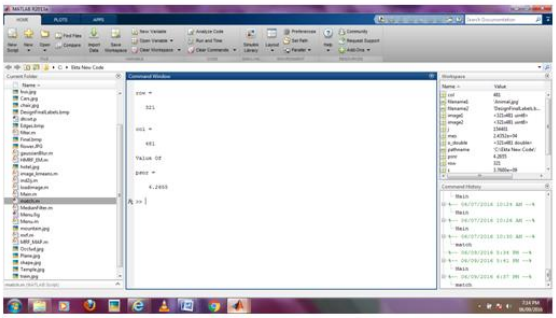
Step 1:- Run the menu file



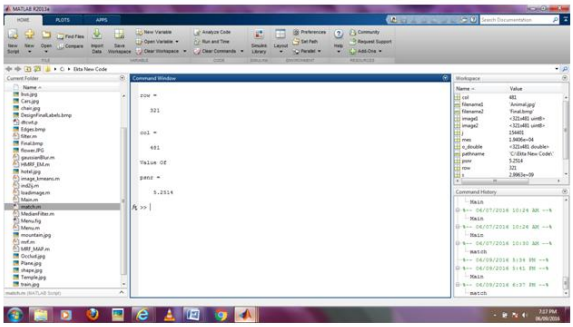
Step 2:- load image and filter the image



Step 3:- choose Enhance MRF at end of the loop after that match file run and compare with original and segmented image calculate the PSNR (Peak Signal-to-Noise Ratio (PSNR)

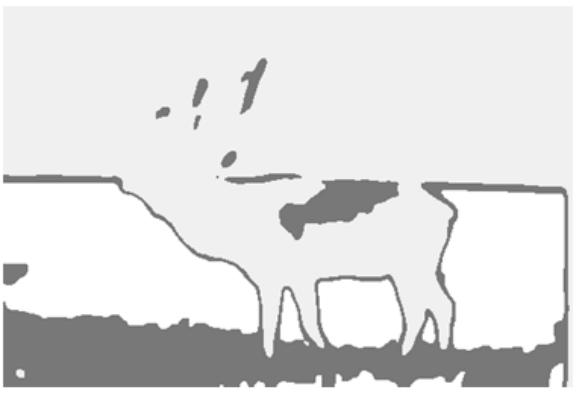


Step 4:- compare with original image and enhance MRF image show in the final folder



The enhance MRF is image quality is improve

Step 5:- Final output



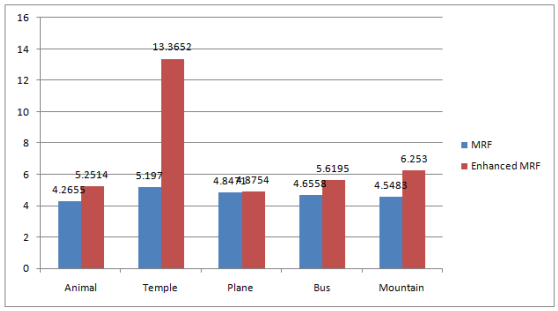
Performance Comparison with MRF and Enhance MRF

Image Name	MRF	Enhance MRF
Animal	4.2655	5.2514
Temple	5.1970	13.3652
Plane	4.8471	4.8754
Bus	4.6558	5.6195
Mountain	4.5483	6.2530

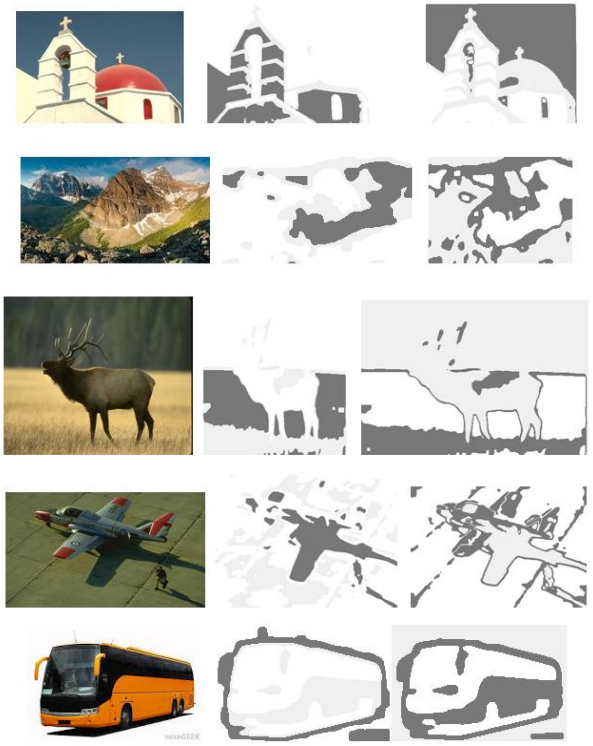
This table show compare between the MRF and Enhance MRF and calculate the value

After that,

Graph:-



Original image **MRF** **Enhance MRF**



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. This paper represents different segmentation methods. Different papers 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.

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