

Implementation of enhanced fractal texture analysis with layout descriptor for image segmentation

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ABSTRACT

Extraction of image features can be in various forms based on color, shape and the texture. The identification and segregation of the objects, a difficult task and more challenging because of many reasons like the variations in the background which is not stationary, illumination changes etc., This article aims at studying and analyzing feature extraction and object recognition. The hybrid approach that is formed by combining enhanced Fractal Texture Analysis with Layout descriptor is capable of meeting the issues in image segmentation. The help of designed shape and texture based Image segmentation does implementation. The image is pre-processed in this process in the beginning; a noise protected edge detector is used. At last, morphological gradient with both shape and texture gradient are applied. The experimental results depict the robustness of this method. The help of CV online object database that contains varied set of object images validates this approach.

1. Introduction

These days image processing is a noteworthy technique for different applications such as CV, face detection etc., [1]. The Image –based tracking techniques in the initialising for object tracking require an object identification method. However due to some factors like viewpoint, illumination changes, etc., come as hurdle in the process of detecting object. Also in certain issues, it led to partial occlusions. By this difficulty, the researchers focused in applying object segmentation method [2]. The object from the background can be separated with a conserved boundary through object segmentation method which provides different ultimate apps and has provoked in the field of computer vision and pattern recognition.[3-7] Consequently, it is necessitated the requirement to present applications including segmentation, image retrieval image captioning and object detection. Nevertheless, it has challenging issues in the object appearances that include significant, substantial variations from background clutter, occlusion, poses and scale changes. Generally, natural objects can be able to display smooth borders. There is correlation in the border smoothness of objects and visually seen objects. There is a requirement for multi-resolution smoothness due to the distortions such as downsampling which raise to harsh boundaries. In addition hard thresholding technique is utilized by data segmentation of the image this can be able to perform good at, but based on the threshold values the pixel set is divided into more than two sets. Also considering the over segmentation problem the similar neighbouring regions have to be merged with new regions based on the predefined merging criterion. [8,9]. Many researchers dedicated research on optimal approximation method, active contour and background subtraction. In view of these factors object detection from an image and tracking it is a difficult task.

Therefore, it is necessary to develop an algorithm, which can extract the object by using texture, shape, colour and a

descriptor for classification, tracking and object detection. Therefore, the hybrid approach, which is obtained by combining enhanced Fractal Texture Analysis with layout descriptor algorithm, can address all the above approaches to segment and detects the objects towards extracting the features. In this paper, shape and texture based image segmentation is proposed by combining enhanced Fractal Texture Analysis with layout descriptor. This is evaluated by comparison of results with existing segmentation techniques such as Active contour model, Marker-based watershed and Region based Geometric Active Contour.

2. Shape and Texture Based Image Segmentation

The methods like shape extracting, texture extracting and colour-based segmentation play vital role, used for the betterment of image segmentation. Shape is considered for surface of object, out or contour/boarder. The feature is utilized through image's outline for the segregation of objects from the background. By using region based and boundary-based shape, feature extraction techniques the shape feature can be recovered. Due to the matter of fact, the recognition of objects by humans can be done only by shape, the descriptor offer crucial information for detection processes. Fractal dimension seems to be advanced technique for the description of natural textures.

By using different techniques like texture segmentation region/boundary, based segmentation detection of texture can be done. For addressing the issues above a boundary/contour, based method is developed. This type of segmentation takes in account of implicit and explicit boundaries among the objects[10]. In Fractal Texture Analysis, the algorithm of extraction includes input image decomposition into a group of binary images in which the resulting regions of fractal dimensions are calculated so that the segmented texture patterns can be described [11]. After this, morphological gradient is used for removing noise which is basing on the geometric

shape feature. In this paper, the segmentation is performed by the combination of the Fractal Texture Analysis and layout descriptor. Later on gradient approach is utilised for removing unwanted noises.

3. Methodology

In this paper shape and texture-based image segmentation, which is a combination of enhanced Fractal Texture Analysis with layout descriptor is proposed for overcoming the issues mentioned. The colour images segmentation is much difficult for the computer visibility. It has some limitations such as slow computation, imprecision and losing the data. The boundary/contour complexity has been assessed by the approach. As a First step, the image has been preprocessed which eliminated the unwanted noise present and even takes care of small finite details with the help of Adaptive Switching Median Filter, subsequently enhancing the strength of edges found by a noise-protected edge detector. Later morphological gradient approach was applied which is the combination of shape and texture gradient extraction for extracting the image features. This is applied directly on the colour image, the colour qualities by this step are not lost which has an edge over traditional gray conversion process. On completion of the step feature, name shape has been extracted basing on descriptors like compactness, rectangularity, eccentricity and moment invariants from the preprocessed image.

The pictorial representation of proposed system architecture is shown in figure 1.

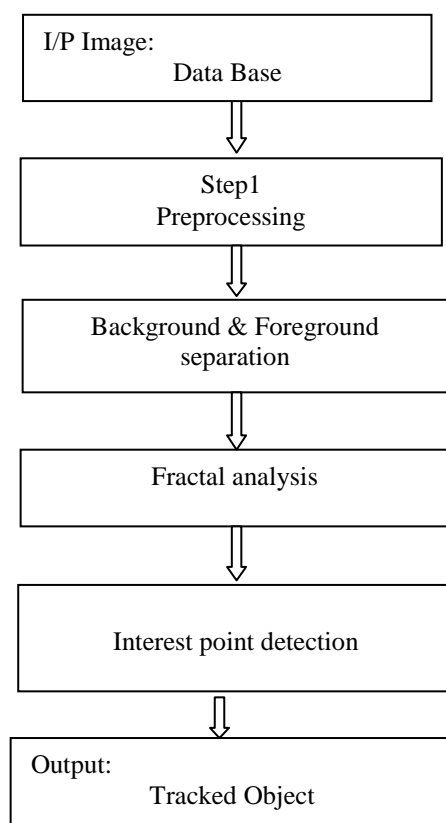


Fig1: System Architecture

The first step of image processing is the Pre-processing. The same has been employed for correcting some noise, which is appended to the image during acquisition of the image. In this paper, Adaptive Switching Median Filter has been applied for separating and identifying the interest objects from the background or other objects and the surroundings. The forefront comprises of objects of interest. In this research the Color Layout Descriptor (CLD) has been used which describes the feature of colour in an image in numeric quantity. This is dense and gives high-speed image retrieval with efficiency enhanced that denotes spatial dispersal of colors. Basing on this the characteristic, it can be used for various applications like visualisation, retrieval based on similarity and content filtering.

4. Experimental Evaluation

For experimental evaluation, CV online object database has been considered. This database contains various sets of object images. This database is accessible free of cost and is the one of the largest dataset that is having varieties of categories of the images viz., eyes, hand action, medical images etc. Images were selected such that they replicate varied dataset. At first the input image is taken from the CV online database. Initially, if the unwanted characteristic like any background noise is present it has to be removed. This process is carried in the preprocessing stage. Besides, the feature set comprises colour, shape and texture descriptors computed for each pixel of an image. Later, the info regarding the spatial arrangement of intensities or colour in image attained by the texture outputs. By this the texture portion of query is displayed. This has been carried out using Microsoft Visual Studio on 64-bit Intel Core i3 CPU laptop with 4 GB RAM and running at 2.0 GHz. Experimental implementation was done using Matlab R2016b of the authorised version. To check the performance of proposed technique used a database of 100 variable sized images spread across different categories. When the query image is received, the colour, shape and its texture quality are completely left out and this is evaluated against the ones contained in the present database. The 6-colour quality is tested by the similar 6-colour quality present in the colour table similarly for 4-texture quality. By the colour and texture quality are tested and that is saved in the database. The removed quality of input/query is then tested with the database image. This can be depicted in the below figures. The colour quality for image appears to similar mean feature extraction. But that varies in texture. As these are different, this is good point that have prominence while recovering similar images.



Fig2: Input Image

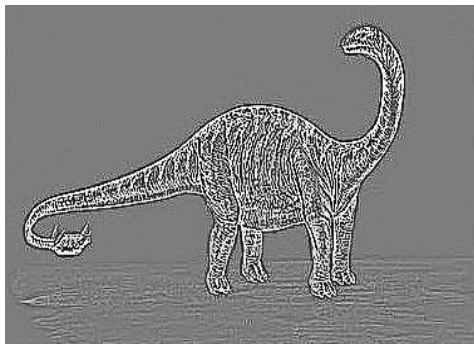


Fig3: Texture Extraction

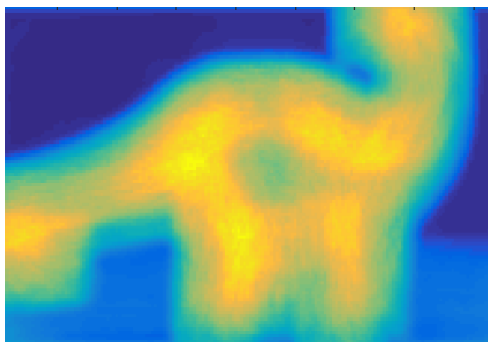


Fig4: Mean Feature Extraction

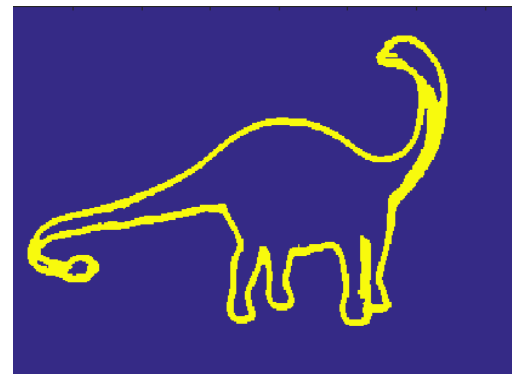


Fig5: Shape Extraction

The extracted objects are depicted in the below figure.



Fig6: Object Extraction/Output

In this way, the output is obtained using the enhanced method of Fractal Texture Analysis with Layout Descriptor.

In this research, the texture analysis which is based on fractal, used for measuring the intensity variation. This estimates the properties like regularity and smoothness. Later on, this was obtained with the texture descriptors as similar to edge, texture, texture and colour features, which are low sensitive towards illuminating the colour changes towards tracking the object.

The extracted shape feature is shown below

4.1 Results

The designed method's performance is evaluated by precision, recall and f-measure. Precision is the ratio between the number of relevant images retrieved to the total number of images retrieved. The capability to retrieve all the relevant images is denoted as a recall. This can be defined as the ratio between the databases all of the relevant images retrieved to the number of relevant images in the database. The most efficient image precision, retrieval measures and recall scores are evaluated by the combination into a single measure of performance or the F-score.

Table 1: Performance Evaluation

Method	F1-score	Precision	Recall
hit-or-miss transform [12]	0.27	0.4	0.21
stochastic approach [13]	0.16	0.12	0.24
morphological transforms[14]	0.32	0.35	0.30
path-based morphological operators[15]	0.5	0.56	0.54
RORPO[16]	0.73	0.73	0.73
Proposed method	0.95	0.90	0.91

Table 2: Processing Time

Method	Average processing time (in seconds)
Active contour model	15.7
Marker based watershed	0.15
Region based Geometric Active Contour	25.1
Proposed method	2.68

5. Discussion and Conclusion

The attained results were compared with previously available models like active contour, marker-based watershed, and region-based geometric active and contour mode in the design part[17]. In the experimental step this method is evaluated with the other state of art techniques. The experimental results of this approach are shown in above figure. Based on the results the obtained proposed method shows enhanced when compared to them because of the measure of F-measure (0.95), recall (0.91) and precision (0.90).

It can be interpreted that the improved performance of this approach is obtained by the application of morphological gradient technique, which provides improved detection and extraction. Furthermore, the use of noise-protected edge detector improved the detection of the edge portion of the object. The comparison results show that the proposed method is able to detect more precisely along with the significant reduction of noise in intense image sequences. Moreover, in terms of performance, the proposed method was better than the conventional methods.

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