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IMAGE SEGMENTATION AND EDGE DETECTION

NEURO-FUZZY LOGIC SYSTEM

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Abstract- *Image Segmentation* is the process of disintegrating a digital image into many segments (sets of modules, also known as super-pixels). The goal of segmentation is to clarify and change the presentation of an image into something that is comparatively more meaningful and easier to understand. Image segmentation is generally used to pinpoint objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation nowadays used to process of selecting module to every pixel in an image such that pixels with the same module share defined characteristics.In other words, Image Segmentation is the technique of distinguishing an image into meaningful parts, or objects.[6] It also results in a highly segmented image, where each object or entity is labeled in a different way that simplify the description or process of the original image and it can be interpreted by the system that handles the image. In general, the classification of an image's pixels as belonging to one of the "objects" (i.e., classes) composing the image is generally based upon some similar feature(s), to some pattern. In order to find features which can lead to a successful types, assumptions about the image are usually required. This is however due to the fact that the best results are generated by segmentation algorithms "tailored" for defined applications however,generally they operate poorly upon applications other than assigned. The maximum of total segmentation algorithms assumesgenerally 2 levels, or "object and background" related segmentations. Whereas such a result is considerate for some of the 'classical' image processing [11].The neural Networks is an areaof Artificial Intelligence (AI) which find data structures and algorithms for the learning and the codification of data.Many of the chores that humans generally perform naturally fast arethe realization of a familiar face, proves to be a very difficult task for a computer when typical programming methods are used generally. By executingthe Neural Network techniques a function can be learned by examples, and create an internal algorithm of rules to modulatethe different inputs, such as recognising the images [1][27].

I. INTRODUCTION

IMAGE segmentation is considered as a technique of disintegrating an image into the meaningful parts, or modules. It generally results in a modulated image, where each of the object is generally defined in a way which simplifies the description of the original image such that it can be scanned by the system that handles the image. In general, the arrangement of an image's pixels as belonging to one of the "objects" (i.e., classes) constructing the image is based on some common feature(s), or similar to some of the patterns. In order to regulate the features that can lead to successful arrangements,some assumptions about the image are usually required by the system. It is due to the fact that the best outputs are determined by the segmentation algorithms "tailored" for some precise applications (but which operate poorly uponthe applications other than the one are designed for). The superiority of the segmented algorithms deducegenerally two levels, or "object and background" segmentation. While, such an output is considered to be similar for some of the 'traditional' image processing related applications such as the automatic image scrutinyof documents or industrial roles, it is not gratifying for applications handle with more mosaic scenario, where those multiple objects have to be detected by the system. In the presented paper, it has been deduced that a system can be capable of operatingat multilevel segmentation of images in an automatic/autonomously way.[6][7]We have not assumed a single assumption about the image (type, features, contents, stochastic model, etc.). Such an "universal" algorithm is most dedicated for applications that are assumed to work with different (and possibly initially unknown) types of

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the images (e.g., searching for images on the Internet or in the photo archive of a magazine) [28]. The deduced system can be willingly employed, "as is," or as a basic building block by a more disillusioned image segmentation algorithm (that consolidates additional "knowledge" into different parts of the system). The deduced neuro-fuzzy segmentation system is self-organizing. It is consisted of a multilayer perceptron (MLP)-like a network that generally dictates the image segmentation by flexible thresholding of the input image using some modules automatically pre-selected by a fuzzy clustering technique [11]. Deduced architecture is feedforward system, but contrary to the traditionalMLP system, the learning is also autonomous. Whereas, the output status is considered fixedof the network as a fuzzy set. Fuzzy entropy is usually used as an amplitude of the error of the segmentation system as this magnitude handles only one aspect of the quality of the segmentation and because no gratifying quality measures were deduced in the literature, the results are analyzed normally by the visual inspection and comparison of outputs obtained by some of the other algorithms. One of the main roadblocks towards full automation of the segmentation system is the problem of mechanically choosing the true number of labels [24]. This parameter, of main importance to most modulating methods, is usually very hard to arbitrateautomatically, and in most codes it is left as a parameter which has to be provided by the user. Some of the methods of engaging cluster validity measures to solve this problem were verified together and some preliminary outputs are also enclosed in this paper.

II. OBJECTIVE

The basic objective of the paper is to imitate the human vision processing system which is highly hefty and noise impractical and hence can be defined even when information is infirm prescribed or defective/partial. The image segmentation problems can also be advanced as either classification or aggregate problems (depending upon the application in hand), both of which are the 'natural' applications of current NNs. In inclusion, NN-based algorithms have also been refined to solve some of the image segmentation problem by imitating the different ongoing approaches (like relaxation, edge detection, and so on etc.). The several NN image processing models have been here designed, of most interest to this research being those which are also auto-robust.

III. NEURO-FUZZY APPROACHES TO IMAGE SEGMENTATION

A. Fuzzy Logic Approach to Image Segmentation

Fuzzy image processing is the assortment of all the advanced that understand, represent and process some of the images, their segments and features as fuzzy sets [15]. Traditional approaches of pattern assignment also involves aggregatetraining samples with correlating clusters to the given divisions. Building classifiers also involves capturing some of the similarity index among the training patterns and their assigning modules for some of the group of similar patterns. The capturing of the similarity among patterns also becomes complex when a training pattern points to more than one class, which also resultsthat classes are overlapping in nature [29]. Thus we can say fuzzy uncertainty appears in form of similarity and the overlap of the system. As due to the lack of details, 2 input patterns can appear similar whereas the class labels may not be same. The intricacy and the boundations of previous mechanisms are mainly due to the dragging of an effective way of defining their limits among various clusters. This one of the problem generally becomes more intractable when total number of features that are used for distinguishingalso increases [1][2][3].

B. Neural Network Approaches to Image Segmentation

The neural Networks are considered to be propitiously being used in number of sectors often in connection with the use of other Artificial Intelligence approaches. A regular application used for NN is known to be image recognition [1]. A network that can also define different definitive images can be applied in several of the areas: Quality assertion, by classifying a metal welding as whether is holds the quality standard. The medical diagnostics, by segregating x-ray pictures for tumor diagnosis[14] can also be used. The detective tools, by the codingof fingerprints to a database of suspects is also used. A well known application using the image recognition of the Optical Character Recognition (OCR) tools that is generally used to be available with the definitive scanning software for the home computer. Scansoft has had great profit in combining the NN with a rule-based system to correctly detect both of the characters and words, to get a high level of the efficiency. All the network topologies and algorithms used have their own advantages and disadvantages. When it originate to understanding

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of the spoken language the best found answers use a combination of NN for phoneme recognition and the expert system for Natural language processing system, whereas, neither AI technique can generally be modified to solve the problem in whole. Another one of the renowned application used for NN is Customer Relationship Management (CRM) system. Many companies here have the same rate as electronic data storage system thathas become commonplace for the built up of large customer databases. By using this Neural Networks for data mining in given databases, patterns however manifold canalso be identified for some of the various types of customers, thus giving valuable customer information to the company[30]. One of the example is the airline reservation system known as AMT2 which also can assume sales of tickets in relation to the destination, time of the year and the ticket price. The NN system was well suited for the purpose as the system can be modifiedregularly / continuously with the actual sales happening. In relation to modern trends inthe Management strategies CRM has also reached a high order as due to the proposals of a successful CRM system summation value to the business in terms of not only the better assumption of customer requirements but also the deducing which customers would be using the most important for the company.[27]

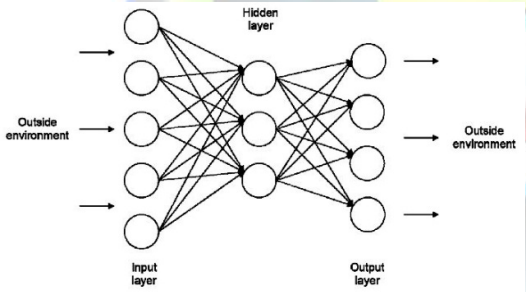

Figure 1. The structure of the Neural Network used.

IV. METHODOLOGY

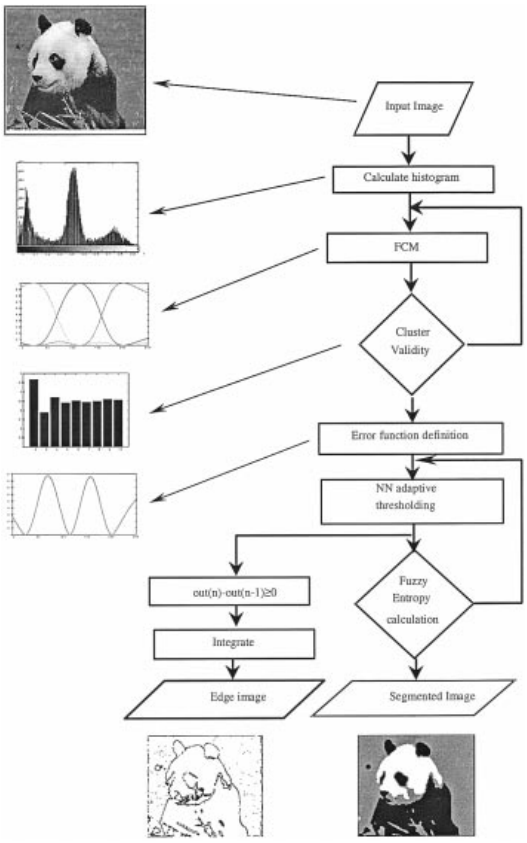

Figure 2. The Flowchart of the Image Segmentation system.

The working of pattern codifier is considered to search the structure used. This search generally becomes complexas the presence of uncertainties correlated with the structure are their [1]. Thus, the system of whole pattern distribution process includes manipulation of the some information supplied by the instances. The instances including information about the process operating them is used and the extracted features also reflect this information. The structures presenting features determines the information in a defined manner such that the relationship among the variables in the distribution process can also be detected[3]. Finally, in the last step, a search process perceives the information from the structure. Now, if a new pattern is confronted, the machine detects the structure in which the input pattern belongs, and based on the structure the pattern is codified. [5] proposed a work, in this work, a framework of feature distribution scheme is proposed for object matching. In this approach, information is

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distributed in such a way that each individual node maintains only a small amount of information about the objects seen by the network. Nevertheless, this amount is sufficient to efficiently route queries through the network without any degradation of the matching performance. Digital image processing approaches have been investigated to reconstruct a high resolution image from aliased low resolution images. The accurate registrations between low resolution images are very important to the reconstruction of a high resolution image. The proposed feature distribution scheme results in far lower network traffic load. To achieve the maximum performance as with the full distribution of feature vectors, a set of requirements regarding abstraction, storage space, similarity metric and convergence has been proposed to implement this work in C++ and QT. Therefore, once the structure is detected, the machine is capable of dealing with new situations to some extent. The issue of choosing the features to be excerpted should be monitored by the following concerns:

1. The features should also importthe enough information about the given image and which should also not depend upon any of the domain-specific knowledge for their excerption given.

2. They should be easy to gauge in the order for the approach to be expedient for a comparatively wide image collection process. They should also divulge well with the human emotive characteristics since users will finally determine the propriety of the retrieved images. On the other hand, two steps have to be taken and considered in rank to address any of the segmentation problem:

Step 1: Exemplify the segmentation problem, with a mathematical notion of the homogeneity or the similarity among image-regions which need to be recognized.

Step 2: An economical algorithm used for partitioning or clustering also has to be copied particularly to carry some of the earlier step out in a computationally potent manner [15]. The problems of image segmentation also become more unclear and disapproving when it also comes to dealing with some of the noisy images. The fuzziness of the image information arising out of the admixture of the different components which has also been handled with some of the soft computing paradigms. The numerous articles used and many surveys on the gray/monochrome image segmentation techniques have to be used published in this regard [17]. A formal definition of the segmentation of an image can also be termed as in. The segmentation of image I is a partition P of I into a set of M regions {Rm, m=1, 2…M} such that[19],

$$1.\quad \bigcup_{m=1}^{M} R_m = I \text{ with } R_m \cap R_n = \Phi,$$

$$m \neq n, 1 \leq m, n \leq M$$

$$2.\quad H(R_m) = true \; \forall \; m, 1 \leq m, n \leq M$$

$$3.\quad H(R_m \cap R_n) = false \; \forall \; R_m \text{ and } R_n$$

$$adjacent, 1 \leq m, n \leq M$$

Here H can bethe signifyof homogeneity. An area is homogeneous if we say all its pixels gratify the homogeneity predicate the defined over one or more the pixel attributes such as intensity, texture or color. On the other hand, a region is affixed and if a bridged path exists between two pixels within the area.

V. ALGORITHM[15][17][19]

- Step 1. Scan a noisy image as input.
- Step 2. Detect the Region of Interests of the image by different thresholding values.
- Step 3. Exclude the image information in terms of pixel attributes and threshold magnitudes for further use.
- Step 4. Develop the different membership envelops of the input image.
- Step 5. Generate fuzzy rules placed on the numerical data retrieved from the input image corrupted by noise. The fuzzy code generation consists following steps:
- Discern Input and Output spaces into fuzzy areas
- Generate fuzzy rules from retrieved data
- Outline the threshold values obtained from different techniques in the corresponding fuzzy areas
- Write a combined fuzzy rule base Determine a graph on the basis of this combined fuzzy rule base.
- Step 6. Proximate the value obtained in Step 5.
- Step 7. Frame-Up the image constructed thus.

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VI. EDGE DETECTION

The edge representation of an image significantly reduces the quantity of data to be processed, yet it retains essential information regarding the shapes of objects in the scene. This explanation of an image is easy to incorporate into a large amount of object recognition algorithms used in computer vision along with other image processing applications. The major property of edge detection technique is its ability to extract the exact edge line with good orientation as well as more literature about edge detection has been available in past three decades. On the other hand, there is not yet any common performance directory to judge the performance of edge detection techniques.[32] The performance of an edge detection techniques are always judged personally and separately dependent to its application. Edge detection is a fundamental tool for image segmentation. Edge detection methods transform original images into edge images benefits from the changes of grey tones in the image. In image processing especially in computer vision, the edge detection treats the localization of crucial variations of a gray level image and the observation of the physical and geometrical properties of objects of the scenario.[31] It is an initial process that detects and outlines of an object and boundaries among objects and the background in the image. Edge detection is the most common approach for detecting significant discontinuities in discrete values. Edges are confined changes in the image intensity. Edges technically occur on the boundary between two regions. The prime features can be excluded from the edges of an image. Edge detection has main feature for image analysis. These features are used by advanced computer vision algorithms. Edge detection is used for object detection which set-out various applications like medical image processing, biometrics etc. Edge detection is an mobile area of research as it promotes higher level image analysis.[33] There are three various types of discontinuities in the grey level like point, line and edges. Spatial visor can be used to notice all the three types of discontinuities in an image.

VII. RESULT AND CONCLUSION

The prime features and advantages of this access are, It gives us a general technique to merge measured numerical information into a familiar framework-a combined fuzzy rule base that theoretically gratify both numerical and linguistic information.[4] It is an easy and genuine single pass buildup procedure and hence is vacant of any time consuming iterative training as it happens in a studying neural network or in a neurofuzzy approach. There is a lot of rights in choosing the membership domains in the given design. In fact, this happens to be one of the important challenges 4.[3] This can be displayed as very general model free integrated fuzzy system for a large range of image processing problems where ―model free means no mathematical model is needed for the problem; ―integrated means the systems integrates all the recorded threshold values that are combined with the systems for finding ROIs and that can support to design adaptive fuzzy regions; and, ―Fuzzy‖ denotes the fuzziness introduced into the system by linguistic fuzzy rules, fuzziness of data, etc. There are two conditions used in assessing the quality of images. They are subjective principle and objective principle.[9] The subjective principle depends on human being' individual judgment and interpretation. Naturally, it is masked with the possibility of inconsistency and lacks repeatability, it is also time consuming and economical. One of the classic ways of subjective measurement is called Mean Opinion Score (MOS), it is very arid, expensive and could not be practical in real time. It has five scales ranging from deterioration is not noticeable (best) to deterioration is extremely objectionable (worst).[8] On the other hand, the objective principle available depends on the output of computing some of the following statistical error based methods dependent on pixels variation. Overall image mean absolute error (MAE), overall image mean square error (MSE), signal-to-noise ratio (SNR), or peak signal-to-noise ratio (PSNR) figure this list. The smaller the MAE (or MSE) or the larger the SNR (or PSNR) is, the higher is the quality of the signal. It is quick and repeatable. There is no extensive theory on image segmentation yet that may be extensively applicable in all types of images. This is because image segmentation is abstract in nature and endures from uncertainty. All the ongoing image segmentation approaches are, in the prime, ad hoc. They are strongly application particular. In other words, there are no general algorithms vis-à-vis color voids that are uniformly fine for all color images. An image segmentation problem is fundamentally one of

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psychophysical approach and it is important to supplement any mathematical solutions by a correct knowledge about the image. The fuzzy set theory has drawn more and more attention in the area of image processing because of its intrinsic capability of handling undetermined.[11] Fuzzy set theory gives us with a perfect tool, which can display the uncertainties arising in image segmentation and can shape the relevant cognitive activity of the human beings.[13][15] Fuzzy operators, properties, mathematics, inference rules have originated more and more applications in image segmentation. Despite the computational cost, fuzzy approaches execute comparable to or better than their firm counterparts.[19] The most essential advantage of a fuzzy methodology lies in that the fuzzy membership function gives a natural means to shape the uncertainty established in an image case. Subsequently, fuzzy segmentation outputs can be applied in feature extraction and object recognition phases of image processing and further computer vision. Fuzzy approach also gives a promising means for color image segmentation.[20][22]

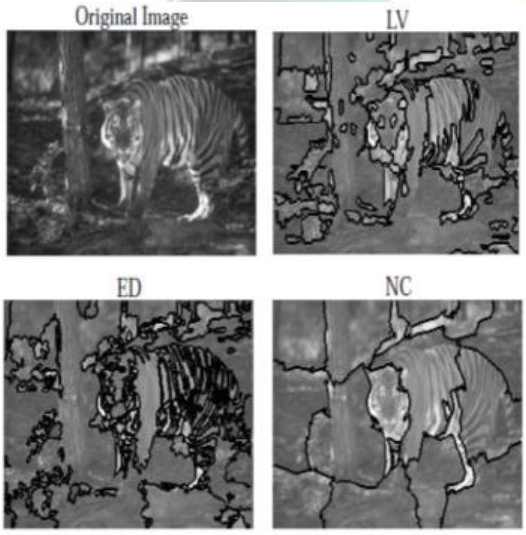

Figure 3.Edge Detection (LV) Local Variation (ED) Edge Segmented Mean Shift (NC) Normalised Cut

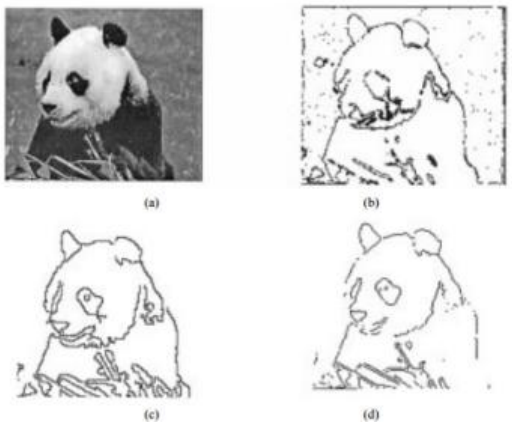

Figure 4. Edge Detection Outputs. (a) Original image (b) Segmented (c) Filtered (d) Result

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