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Graphics and Vision

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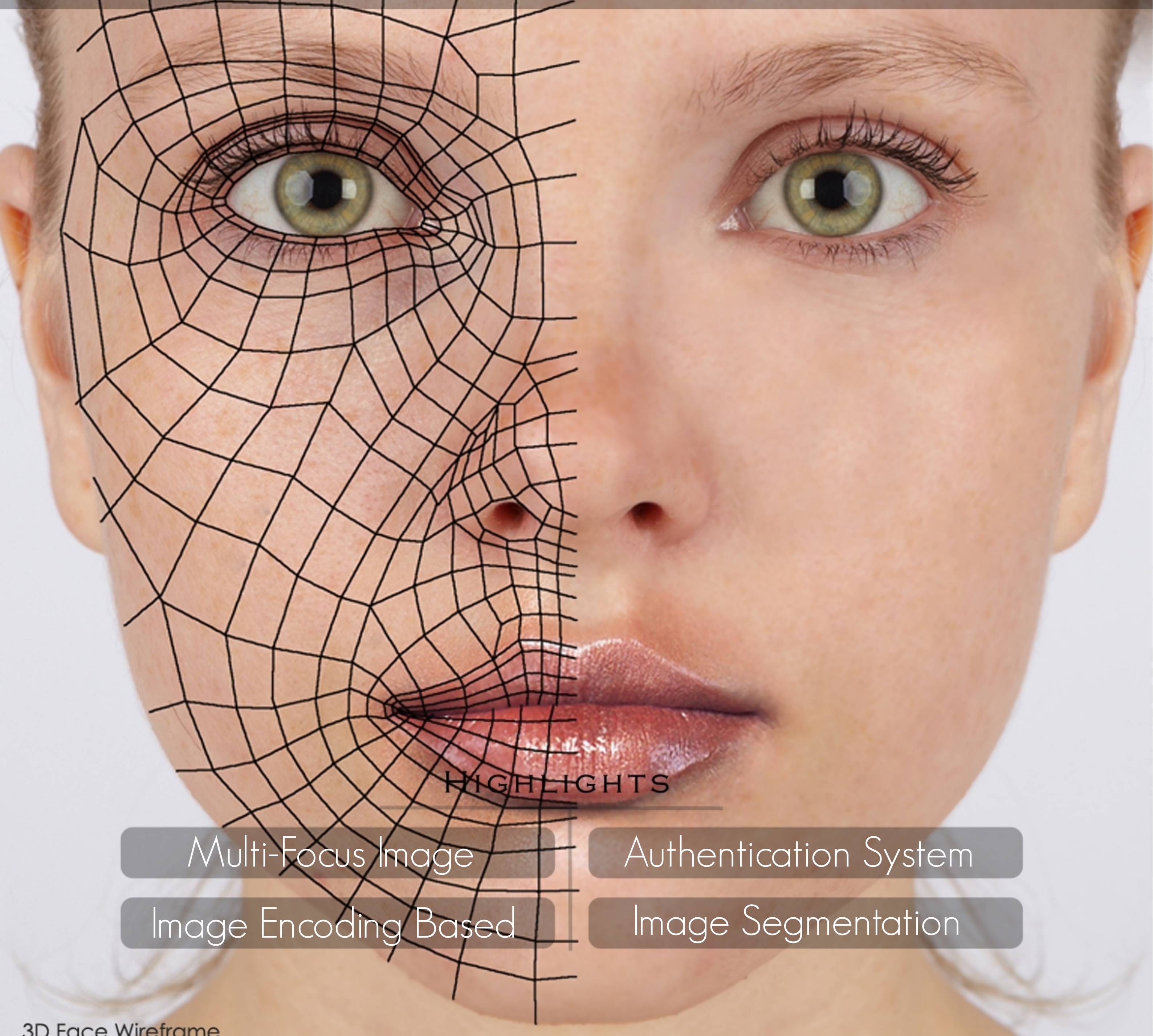

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HIGHLIGHTS

Multi-Focus Image

Authentication System

Image Encoding Based

Image Segmentation

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Uncertainty Analysis for Spatial Image Extractions in the Context of Ontology and Fuzzy C-Means Algorithm

By Md.Sarwar Kamal, Sonia Farhana Nimmy & Linkon Chowdhury
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Abstract - This paper emphasis on spatial feature extractions and selection techniques adopted in content based image retrieval that uses the visual content of a still image to search for similar images in large scale image databases, according to a user's interest. The content based image retrieval problem is motivated by the need to search the exponentially increasing space of image databases efficiently and effectively. It is also possible to classify the remotely sensed image to represent the specific feature of the target images. In this research we first imposed the Fuzzy C-means algorithm to our sample image and observed its value. After getting the experimental result from Fuzzy C-means we have had designed Ontological Matching algorithm which aftereffect better than the previous one. We have had espy that our Ontological Matching algorithm is twenty (20%) percent better than Fuzzy C-means algorithm.

Keywords : Ontological Matching Algorithm, Fuzzy C-means algorithm, Spatial Feature Extractions, feature selection, Fuzzy Logic.

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UNCERTAINTY ANALYSIS FOR SPATIAL IMAGE EXTRACTIONS IN THE CONTEXT OF ONTOLOGY AND FUZZY C-MEANS ALGORITHM

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Uncertainty Analysis for Spatial Image Extractions in the Context of Ontology and Fuzzy C-Means Algorithm

Md.Sarwar Kamal [α], Sonia Farhana Nimmy [σ] & Linkon Chowdhury [ρ]

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Keywords : Ontological Matching Algorithm, Fuzzy C-means algorithm, Spatial Feature Extractions, feature selection, Fuzzy Logic.

I. Introduction

The increase in computing power and electronic storage capacity has lead to an exponential increase of digital content available to users in the form of images which form the bases of many applications [1]. Consequently, the search for the relevant information in the large space of image databases has become more challenging. How to manage appropriate extracted outcome is still difficult problem and it is a proper field to make experiment. A typical image retrieval system includes feature extraction usually in conjunction with feature selection [2]. We can depict any image as a collection of color, texture and shape features. While several image retrieval systems rely on only one feature for the extraction of relevant images, but exact collection of relevant features can yield better retrieval performance [3]. The process of determining the combination of features that is most representative of a particular query image is called feature selection.

In case of analyzing real-world maps, the images shown there may not distinctly identify accurate and comprehensible information; rather lots of knowledge may be embedded in the domain in a hidden and unexplored form.

a) Fuzzy Logic

The logic which works with approximation instead of exact and constant value is called fuzzy logic. The logic has been used from long back to solve various problem domains. The working value of fuzzy logic can be any value in between 0 and 1.Although the fuzzy logic is relatively young theory, the areas of applications are very wide: process control, management and decision making, operations research, economies and, for this paper the most important, pattern recognition and classification. An idea to solve the problem of image classification in fuzzy logic manner as well as comparison of the results of supervised and fuzzy classification was the main motivation of this work.

II. Fuzzy C-Means Algorithm

Fuzzy C-means Algorithm capitalizes image segmentation under consideration of pixels values. It bring the pixels into multiple classes under the value of membership function. Fuzzy C-means Algorithm is formulated as the minimization of the following objective function:

$$\mathrm{J}_m(U,\mathbf{V}) = \sum_{i=1}^{c}\sum_{k=1}^{n} u_{ik}^m D_{ik}^2 \qquad (1)$$

Where, $U \in M_{fcn}$, $V = (v_1, v_2, \ldots, v_c)$, $v_i \in R^p$ is the i^{th} prototype m>1 is the fuzzifier and

$$D_{ik}^2 = \left\|\mathbf{x}_i - \mathbf{v}_k\right\|^2$$

The objective is to find that U and V which minimize J_m

The Steps fro FCM Algorithm:

1. Choose: $1 < c < n$, $1 < m < \propto$, $\in$ = tolerance, max iteration = N
2. Calculation of membership values as according to the equation (2)

$$u_{ij} = \left[\sum_{k=1}^{c}\left(\frac{D_{ij}}{D_{ik}}\right)^{\frac{2}{m-1}}\right]^{-1} \forall i, j \qquad (2)$$

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3. Computer the centroids values according to the equation (3)

$$\mathbf{v}_i = \left(\frac{\sum_{k=1}^{n} u_{ik}^m \mathbf{x}_k}{\sum_{k=1}^{n} u_{ik}^m} \right) \forall i \qquad (3)$$

4. Selection of new multiplier fields.
5. Repeat the step 2 until the algorithm has converged.

III. Fuzzy Matching

Let us consider the fuzzy matching for the mixing images on the input images [10]. .The degree to which the input target images satisfy the conditions of fuzzy rules and conditions .Suppose IMAGE X is defined by rules R1 and IMAGES Y is defined by rules R2.In this case the matching degree will be represented by as follows:

Matching Degree (IMAGE X,R1)=μ(IMAGE X)

Matching Degree (IMAGE Y,R2) =μ (IMAGE Y)

Where μ is the fuzzy membership function.

The fuzzy matching determines the actual outcome for fuzzy optimization which is accomplished here by fuzzy matrix. Here is a graphical view of fuzzy matching degree for IMAGE Y as follows:

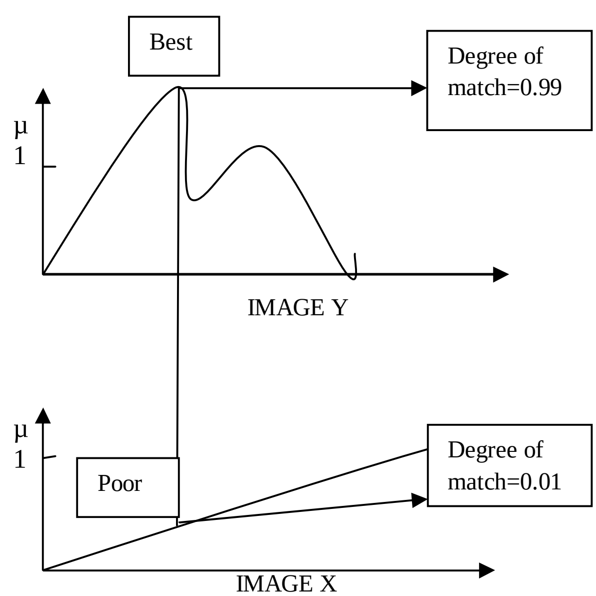


Fig. 1: The matching degree of fuzzy images

IV. Classification Procedure

In our previous work we have done the classification by projecting the maximum classifier without NULL classifier is used. We implied a normal distribution and evaluate the variance and correlation of spectral response during the classification of the unknown pixel.

Here we have had fixed the partitioning as follows:

Let we have a data set $X = \{x_1, x_2, \ldots, x_n\} \subset R^p$ and A classification of X is a c × n matrix $U = [U_1U_2 \ldots U_n] = [u_{ik}]$, where U_n denotes the k-th column of U. We have found three classifications efficient and suitable for our research activity. The labeled vectors for these classifications are:

1. $N_{pc} = \{\, y \in R^c : y_i \in [0\ 1]\ \forall i,\ y_i > 0\ \exists i \}$ Possibility Label
2. $N_{fc} = \{y \in N_{pc} : \Sigma y_i = 1\}$ Fuzzy Label
3. $N_{hc} = \{y \in N_{fc} : y_i \in \{0, 1\}\ \forall i \}$ Hard Label

The Fuzzy classification =

$$M_{fcn} = \{ U \in M_{pcn} : \mathbf{U}_k \in N_{fc} \forall k \}$$

V. Ontology and Knowledge Base

According to Ehrig (2007), ontology contains core ontology, logical mappings, a knowledge base, and a lexicon [3]. Core ontology, S, is defined as a tuple of five sets: concepts, concept hierarchy or taxonomy, properties, property hierarchy, and concept to property function.

$$S = (C, \leq_C R, \sigma, \leq R)$$

where **C** and **R** are two disjoint sets called concepts" and relations" respectively. A relation is also known as a property of a concept. A function represented by σ(r) =< dom(r); ran(r) > where r € R, domain is dom(r) and range is ran(r). A partial order ≤R represents on R, called relation hierarchy, where $r_1 \leq_R r_2$ iff dom $(r_1) \leq_C$ dom (r_2) and ran $(r_1) \leq_C$ ran (r_2). The notation $\leq_C$ represents a partial order on C, called concept hierarchy or taxonomy". In a taxonomy, if $c_1 <_C c_2$ for c_1; $c_2 €_C$, then c_1 is a sub concept of c_2, and c_2 is a super concept of c_1. If $c1 <_C c_2$ and there is no $c_3 €_C$ with $c1 <_C c_3 <_C c_2$, then c1 is a direct sub concept of c_2, and c_2 is a direct super concept of c_1 denoted by $c_1 \prec c_2$. The core ontology formalizes the intentional aspects of a domain. The extensional aspects are provided by knowledge bases, which contain asserts about instances of the concepts and relations. A knowledge base is a structure KB = (C,R, I, ‎ٱC, ,ٱR) consisting of

_ two disjoint sets C and R as defined before,

_ a set I whose elements are called instance identifiers (or instance for short),

_ a function C : C→ Ə(I) called concept instantiation,

_ A function { R: R → Ə(I2) with (r) ⊆ $ٱ_C$ (dom(r)) × $ٱ_C$ (ran(r)), for all r ε R. The function R is called relation instantiation.

VI. Ontological Instance Matching Algorithom

The operational block of the instance matching integrates ontology alignment, retrieves semantic link clouds of an instance in ontology and measures the terminological and structural similarities to produce matched instance pairs. Pseudo code of the Instance Matching algorithm

Algo. InstanceMatch (ABox ab1, ABox ab2, Alignment A)
for each insi element of ab1
cloudi=makeCloud(insi,ab1)
for each insj element of ab2
cloudj=makeCloud(insj,ab2)
if $\forall$a(c1; c2) elements of A|c1 elements of Block(ins1:type) ^
c2 elements of Block(ins2:type)
if Simstruct(cloudi; cloudj) $\geq \delta$
imatch=imatch$\bigcup$makeAlign(insi; insj)

VII. Experiments With Real-World Data

For the procedures of image classification was used to gather images from "Google Earth" on the Bangladesh region (Chittagong zone).). It uses this as a case study for implementing feature extraction. The collected images contain some common features such as roads, water, field, agriculture, buildings. The features will be separated based on the pixel intensity value selected for the individual features. It has been chosen as an application area because number of spatial features can be extracted from the map images of Forestry complex.

This image contains three channels recorded in three bands: the first band for green, the second for red and the third for blue. In the figure below, we present a fragment of this image and some statistics for the whole image.

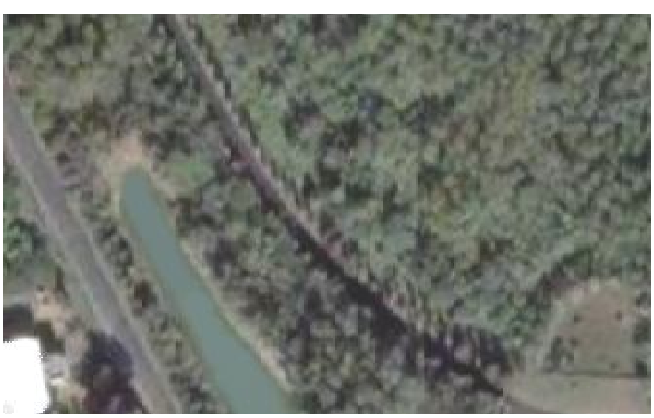
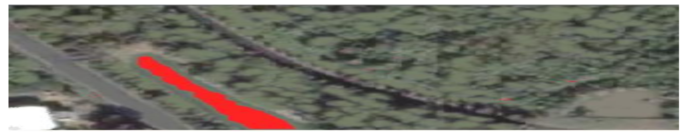


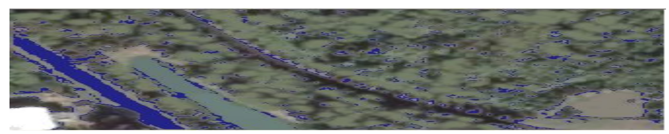
Figure 2 : Forestry Complex Area

After performing thresholding [5] based on color intensities defined for each and every feature, the features are higlighted with individual colors. Therefore, the highlighted feature area is clearly distinguished from the background. The thresholding process finally extract number of spatial features from the particular region such as road, water, field, building and forest.



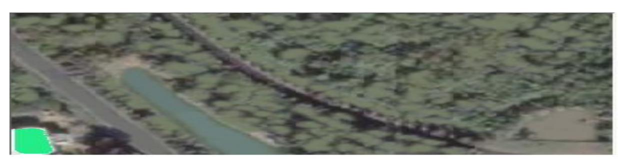
(a)Water

(b)Field



(c) Road

(d) Forest

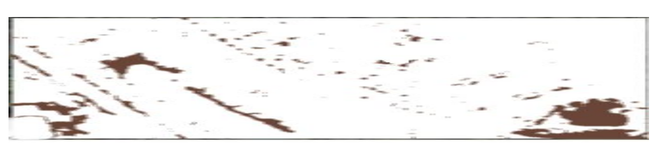


(e) Building

Figure 4: Extracted Features from Forestry Area Image

The extracted features are further threshold for separating them from the background. This has been done by setting the background to all white form, thus displaying the particular feature is.

(a)Water



(b) Field

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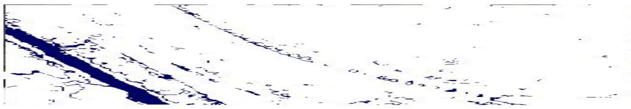

(c) Road

(d) Forest

(e) Building

Figure 5: Separated Features from Forestry Area Image

VIII. Fuzzy Matrix Optimization

Comparing between two given matrix and finding out the optimum values between them.

Steps To Solve the Problem:

1. Taking values of first matrix as input into the first array from a file for iterative comparisons.
2. Taking values of second matrix as input into the second Array from a file for iterative comparisons.
3. The values of both arrays will be compared than.

IX. Pseudo Code for Optimization Process

```
Fuzzy optimization (x.finput1 [], y.finput2 [])
for the value i,j where i ≠ j
float matrixone[][] = new float[][];
float matrix two[][] = new float[][];
iteration up to the i=n and j=n
{matrix one[k][i]=finput.nextInt();
matrix two[k][j]=finput.nextInt();
(matrixone[m][n]>=matrixtwo[m][n])
System.out.print(" "+matrixone[m][n]);}
```

X. Result Evaluations for Fuzzy Cmeans Classification

One way of the result evaluation was through the accuracy assessment. The classification results are compared to the raw image data and the report is created. This process is done during the random sample selection. The idea of the accuracy assessment is: point is highlighted in the sample list and observation [9] was done where it is located on the image.

The following table shows the mean and standard deviation for the classified classes:

Channel	Mean	Standard
water (from 50 samples)		
Green	73.53	12.32
Red	52.47	9.53
Blue	67.64	14.71
Forest (from 75 samples)		
Green	143.12	22.12
Red	58.77	18.12
Blue	44.12	17.11
Agriculture (from 50 samples)		
Green	122.77	15.50
Red	62.47	13.53
Blue	65.45	17.31
Buildings (from 50 samples)		
Green	52.23	13.21
Red	39.12	8.56
Blue	44.12	10.11
Road (from 75 samples)		
Green	83.35	16.00
Red	29.37	9.12
Blue	41.12	12.19

Creation of the membership functions for the output variables is done in the similar manner. Since this is Sugeno-type inference, constant type of output variable fits the best to the given set of outputs (land classes). When the variables have been named and the membership functions have appropriate shapes and names, everything is ready for writing down the rules.

Class	Output variable
water	1
Forest	2
Agriculture	3
Buildings	4
Roads	5

Based on the descriptions of the input (green, red and blue channels) and output variables (water, agriculture, forest, buildings, and roads), the rule statements can be constructed:

Rules for image classification procedure in verbose format are as follows:

IF (GREEN is a1) AND (RED is a1) AND (NIR is a1) THEN (class is water)

IF (GREEN is a2) AND (RED is a2) AND (NIR is a2) THEN (class is agriculture)

IF (GREEN is a3) AND (RED is a3) AND (NIR is a3)THEN (class is forest)

IF (GREEN is a4) AND (RED is a4) AND (NIR is a4)THEN (class is buildings)

IF (GREEN is a5) AND (RED is a5) AND (NIR is a5)THEN (class is roads)

XI. Result Evaluations for Ontological Classification

Ontological classification is different that fuzzy classification. The idea of the accuracy assessment is: point is highlighted in the sample list and observation was done where it is located on the image.

The following table shows the mean and standard deviation for the classified classes :

Channel	Mean	Standard
water (from 50 samples)		
Green	63.11	22.12
Red	32.01	18.31
Blue	47.58	24.14
Forest (from 75 samples)		
Green	120.54	32.31
Red	43.35	27.02
Blue	33.19	25.33
Agriculture (from 50 samples)		
Green	92.12	19.31
Red	98.58	35.64
Blue	69.11	21.65
Buildings (from 50 samples)		
Green	71.55	25.35
Red	96.25	21.98
Blue	48.56	20.28
Road (from 75 samples)		
Green	89.32	19.22
Red	64.10	5.63
Blue	49.54	18.16

XII. Accuracy Assessments by Fuzzy Cmeans Classification

Idea for accuracy assessment of fuzzy C-Means classification results comes from the manner the maximum likelihood accuracy assessment was performed: select random sample areas with known classes and then let fuzzy logic 'say' what these samples are. With 100 random selected samples, results were as following:

Correctly classified samples: 72
Misclassified: 28
Accuracy: 72%

XIII. Accuracy Assessments by Ontological Classification

Idea for accuracy assessment of ontological classification results comes from the manner the maximum likelihood accuracy assessment was performed: select random sample areas with known classes and then let fuzzy logic 'say' what these samples are. With 100 random selected samples, results were as following:

Correctly classified samples: 92
Misclassified: 08
Accuracy: 92%

The both experiments and observations clearly showed that Fuzzy Logic classification is better than ontological knowledge base classification for Histo for Spatial Feature Extractions.

XIV. Discussion and Conclusion

This paper aimed for extracting the spatial features for providing a fundamental abstraction for modeling the structure of maps representing various raster images. The central part of this paper is an established procedure that is carried out for spatial Historical Heritages classification. As the work continues, it tries to implement every part of the procedure so as to establish its effectiveness and efficiency. It involved the use of supervised learning, assigning membership functions and discovery of pattern feature phases for successfully classifying an image. In the knowledge base, it must be well known whether selected sample forest area or water area.

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An Active Contour for Range Image Segmentation

By Khaldi Amine & Merouani Hayet Farida
Badji Mokhtar University Sidi Amar, Annaba

Abstract - In this paper a new classification of range image segmentation method is proposed according to the criterion of homogeneity which obeys the segmentation, then, a deformable model-type active contour “Snake” is applied to segment range images.

Keywords : Image segmentation, Active contour, Snake, Range image.

GJCST-E Classification: I.4.6

AN ACTIVE CONTOUR FOR RANGE IMAGE SEGMENTATION

Strictly as per the compliance and regulations of:

An Active Contour for Range Image Segmentation

Khaldi Amine [α] & Merouani Hayet Farida [σ]

Abstract - **In this paper a new classification of range image segmentation method is proposed according to the criterion of homogeneity which obeys the segmentation, then, a deformable model-type active contour "Snake" is applied to segment range images.**

Keywords : Image segmentation, Active contour, Snake, Range image.

I. Introduction

Many researchers have studied the range image segmentation in the 80's mainly, then, this area has been neglected at the expense of intensity images due to their easy acquisition (acquiring a range image requiring a laser) and they are much more prevalent that the range images. During the past decade, with the influx of 3D geometric representations and their complex geometric representations a different interest was focused on range images, 3D image segmentation can go through a projection of the 2D image for segment it as a range image. So much work on the range images were presented and improvements have been made but not using the deformable model. Range image segmentation algorithms can be broadly classified into two categories: edge-based and region-based segmentation. Region-based approaches group pixels into connected regions based on homogeneity measures, while boundaries between regions are located by edge detection methods. Both techniques have their strengths and drawbacks. Edge detection is mostly criticized for its tendency to produce disconnected boundaries. The challenge is to extract the boundary elements belonging to the range image and this process should be performed as efficiently and automatically as possible. Deformable models, which include the popular deformable contours or snakes are a powerful segmentation technique designed to meet this challenge, they tackle the segmentation problem by considering an object boundary as a single, connected structure and exploit a priori knowledge of object shape and inherent smoothness, usually formulated as internal deformation energies, to compensate for noise, gaps and other irregularities in object boundaries. Our work was fully motivated by the fact that there are no algorithms known from the literature that used an active contour « Snake » for range image segmentation and a classification according to the criterion of homogeneity was never been proposed before.

In this work, the first section will be dedicated to the definition of the range image and its capture mode, then, an extensive survey on the range image segmentation methods will be made to establish a classification that will have an overview of the field and will facilitate a possible proposal of an algorithm for range image segmentation. Finally a deformable model "snake" will be proposed to segments range images.

II. The Range Image

a) Definition

A range image (RI) is a two-dimensional array of 3D positions [1] satisfying the property of spatial coherence, each component of this matrix represents the distance between a reference point and a point in the field of vision sensor. It is the equivalent of a video image [2] in which the gray level of each pixel (x, y) is replaced by an altitude z (2.5D is an intermediate case between the 2D and 3D, it is not fractal dimensions).The peculiarity of this type of data lies in the grid structure (x, y) and the possibility of describing the scene as a graph of function $z = f(x, y)$ the term of Rangel (range image element) denotes an element of the range image. The range images can be seen as clouds of 3D points [3] and have a regular representation [4] and are considered as organized in the sense that neighboring points in the range image are also neighbors in space. In some works [5] an image of accumulation of point clouds is associated to a range image, using a virtual camera positioned on the XY plane, the range image records the maximum distance of 3D points projected onto the plane of the camera and the image of accumulation counts the number of points (3D) that are projected onto the same pixel camera. The range images offer a precise correspondence with the latest laser scanning techniques [6], we found range images in areas such as image recognition, image retrieval, image transmission, modeling object, location and simultaneous construction of a map.

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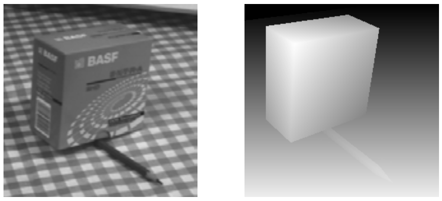

Fig.1: At right the range image, left him the image intensity corresponding

b) Depth of an Image

The depth is the distance between the visible surface of objects in a scene and the sensor of the camera, it is a useful indication for the calculation of the coordinates of points on the surface in three-dimensional space of reference, many methods have been developed [7] to obtain the 3D coordinates of objects using images, all exploit changes in acquisition parameters of the system of shooting, the acquisition parameters of the system or the light environment provides essential information to establish a relationship between the image and the real scene.

c) Range Image Acquisition Systems

There are a wide variety of acquisition systems for range images, they are distinguished by the method of measurement, geometry of the device, the accuracy and speed, here, only two examples are presented for illustrative purposes.

- The first is an [8] experimental laboratory system "Fig.2" made with non-specialized equipment where a laser beam shaped plan illuminates the scene, the beam draws a visible trace on the surface of objects and the trace is marked in the image of a camera and thinned to a width of one pixel. For each pixel of the trace in the image, the 3D point defined by the intersection of the plane of light and line of sight corresponding to the pixel is calculated and this is used as Rangel.

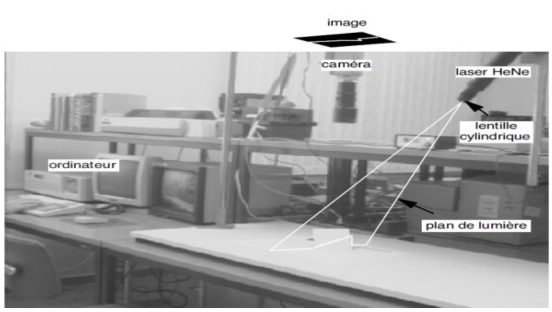

Fig. 2 : Experimental system for range image acquisition

- The second is a system sold, operating on the principle of flight time "Fig.3". An amplitude modulated laser beam is projected in one direction [9] and a light sensor measures the light returning to the source, with amplitude modulation lag between the light signal emitted and received. The time shift is a direct measure of the distance between data acquisition and surface area encountered by the laser beam and a measure of distance in one direction to define a point in the RI, the range image is built by scanning the laser beam.

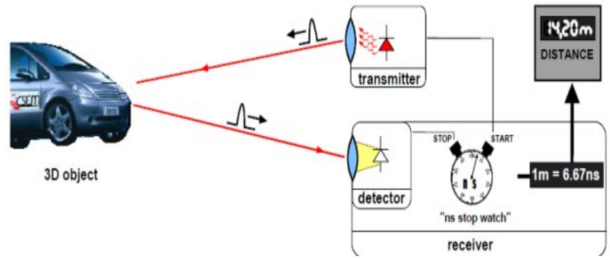

Fig. 3 : Flight time system for range image acquisition

III. Range Image Segmentation Methods

According to documents found in the literature, we can classify the methods of segmentation into four classes according to the criterion of homogeneity which obeys the segmentation, we can find the segmentation depending on the type of curvature, surface, algebraic surface continuity C1 and a fifth category combines other methods.

a) Segmentation by Type of Curvature

The curvature estimation is affected by the presence of noise (measurement error) and the presence of discontinuities. The estimate of curvature is sufficiently good but must be low noise, on the other hand, we must eliminate disturbances due to discontinuities by proper treatment for this type of thresholding segmentation method and labeling of connected components is preferred.

- Besl and Jain [10] use this segmentation only to determine initial seeds and then perform an independent growth region.
- Yokoya and Levine [11] combined with the detection of discontinuities in segmentation type of curvature, discontinuities of the image is used as a mask during the labeling of connected components of the image type of curvature, then a simple region growing is applied to the image.
- Kasvand [12] performs an erosion of 1 to 2 pixels on the image type of curvature to remove the effect of discontinuities, then place in the labeling of connected components of the image type of curvature and finally growing regions is performed.

b) Surface Segmentation

Two criteria define segmentation into homogeneous flat surfaces "same orientation" and "same plane equation" methods based on the first criterion must take into account the discontinuities of depth to prevent a merger between two planes parallel but not collinear (example, an upper surface of a cube and a surface on which it is placed). Taking into account the discontinuities of order 0 is often made implicitly, it is estimated through the orientation of discontinuities, it creates a zone of steep acting separation and the major inconvenient is the appearance of regions (segments) parasites.

- Maitre and Hügli [13] have a fusion method based on normal (gradient) to the surface normal are calculated on the facets of minimum size, these facets are used as initial partition. Then, the fusion is performed sequentially by merging each time, among all pairs of neighboring regions, those with the angle between the normal is the smallest.
- Parvin and Medioni [14] use a method of division-fusion based on the normal to the surface or, more precisely, the gradient of the range image, the gradient is estimated by the conventional method using a 3x3 neighborhoods, the method of division-fusion is then applied to the image gradient, the δ measure defines the homogeneity criterion for the division (the standard deviation of the gradient). The angle value between normal vectors associated with the regions define the homogeneity for fusion, this method is subject to the same phenomenon of parasitic regions as Master and Hügli.
- Taylor [15] applies the method of dividing an image fusion of normal (gradient), the estimated gradient is a suitable neighborhood, and the problem areas of parasites is eliminated at the division and fusion, a depth test must be done when the homogeneity tests are positive on the normal, this prevents parallel planes separated by a discontinuity in depth form a single segment.

c) Segmentation in Algebraic Surfaces

The segmentation of algebraic surfaces (not strictly planar) is divided into two categories depending on the nature of 2.5D and 3D surfaces, surfaces 2.5D all correspond to polynomial functions of two variables and obviously apply only images of scalar type. The 3D surfaces are the quadrics and super quadrics where the treatment is more complex than 2.5D surfaces.

- Leonardi [16] presents a method (independent growth areas) division-fusion linked to a 2.5D surface model type polynomial (the degree of the polynomial can vary from 0 to 3), the test for homogeneity division and the merger is based on the approximation error of image values by the polynomial of best approximation and in the merger, approximation error and the polynomial coefficients are updated from those regions merged (It is not necessary to calculate an approximation of the new region), for this method, it is necessary to extract first the depth discontinuities.
- Gupta and Bajcsy [17] present a segmentation method that result in the description of the range image by superquadrics (specifically super-ellipsoid). To achieve the result, the approach taken by Gupta performs geometric reasoning on the basis of two other segments, the 2.5D surfaces preliminary segmentation and a current segment of super-ellipsoid approximation residues, this process goes beyond the treatment of low-level image depth.
- Jiang and Bunke [18] conduct a region growing constrained approximation by a plane (2.5D), the method of growth is special because it is based on straight line segments, regions are lists segments and the growth is done segment by segment, line segments are obtained by dividing a profile (row or column) of the range image. Regional growth is sequentially (one region after another). The seed which is initialized with the growth consists of three line segments neighboring profiles from three consecutive growth starts with the seed that best satisfies a test of parallelism between segments.

d) Segmentation of Continuity of Order 1

Several methods lead to segmentation with the criterion of homogeneity of surface can be defined as C1 continuity, two principles are applied.

- Detection of discontinuities and labeling of connected components: This is the principle of boundary detection described above, the border points are the points of discontinuity (C ^ 0) and (C ^ 1). In the Davignon's approach [19], growth in the field of border points detected is performed so as to form still closed borders, the growth is done by choosing at each step the neighboring pixel which is the measure of discontinuity nearest (below) the threshold, once the closed borders, regions are approximated by a related algebraic surface (polynomial type) of increasing complexity, until the approximation error is sufficiently small, the position of the discontinuities is then adjusted based on this surface representation.
- Fusion of segments from a segmentation constraint: The method of Besl [20] begins with a segmentation by type of curvature, the derived regions are eroded from seed obtained, the method proceeds by growth, as described above, finally takes place a merger of the regions on the basis of the presence or absence of discontinuity between regions. This process has the effect of systematic closure of borders associated with discontinuities.

e) Other Segmentation Methods

The methods described below apply the same principle of merging segments more constrained as the method of Besl, however, the merger is based on more restrictive conditions than the absence of discontinuities between segments, the final segmentation therefore obeys a homogeneity criterion more stringent than C1 continuity.

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- The method used by Ade and Ylä-Jääski [21] has three steps. The first step is a "clustering" of normal vectors and labeling of connected components, the small regions (narrow) are eliminated at the end of this first stage, the second stage performs a growth of conserved regions, finally, held a melting step in which two adjacent regions are merged if their normal and principal curvatures have similar values and if they have a sufficiently long common border.
- Wand and Suter developed the MDPE (Maximum Density Power Estimator) which is a nonparametric estimator of density and including the gradient estimation techniques [22] similar to many random sampling estimators. The algorithm consists of choosing a search window and a p-random subset, then the Mean Shift algorithm is applied on every point of the window, then the density is calculated on all data points of the window chosen to determine the power density. The essence of the method lies in the application of several procedures for finding the maximum local density of these residues (data points with less residue should be as many as possible, and residues should be as low as possible).
- Paulo Fabiano proposes an algorithm [23] for range image segmentation combining depth and region technical. First, a 3 * 3 median filter and an analysis of main components is applied to estimate the vectors of surfaces, then for each pixel, the angular variation in the normal direction is calculated from the pixel P in a Q pixel neighborhood, after the use of a low and high threshold, each point is then marked as belonging to a flat, curved, or indeterminate (if not), this pre-treatment allows the classification of pixels to be used to identify flat and curved regions.

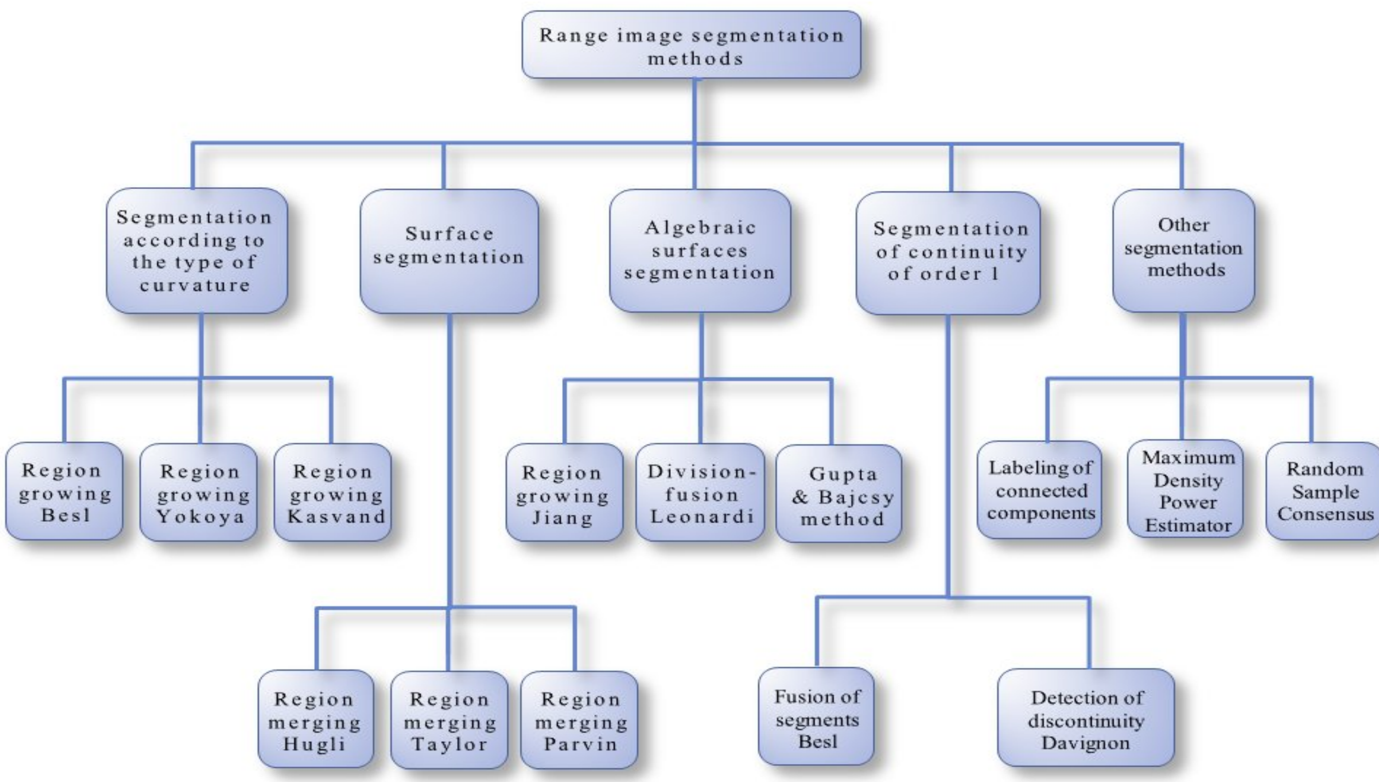

Fig. 4: Range image segmentation methods classification

We can still classify virtually all methods following the four criteria"Fig.4" of homogeneity (type of curve, surface, algebraic surface and continuity C1), here is an overview of methods, accompanied by critical comments.

- Type of curvature methods face the problem of estimating the curvature, it is affected by both noise and discontinuities, segmentation is representative of the measured surface as if the noise is low and if the disturbances due to discontinuities are removed by appropriate treatment.
- Algebraic Surface: On algebraic surfaces there are two types of methods, division / fusion and region-independent growth, methods of division / fusion are poorly adapted to the segmentation of range images based on a model surface because of the particular algebraic discontinuities in the methods of independent growth area, there are two approaches that differ in their fundamental principle, the approach initiated by Besl seeks a minimum approximate representation of the image depth and approach Leonardis is an exhaustive search of the

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best location of one or more surface models in the picture.

- Flat surface: The methods are numerous, but most use specific properties to a flat surface, the segmentation into planar surfaces should be treated the same way as the more general case of algebraic surfaces.
- Continuity C1: Next to the simple method of segmentation following C1, there are sophisticated methods, all the effort invested by these methods is devoted to forcing the closure of borders defined by the discontinuities, a systematic closure of borders is a change in the criterion of homogeneity, making it more restrictive than the pure C1 continuity, it is noted that it provide, unlike other methods, a simplified representation of the segment.

IV. Range Image Segmentation Using an Active Contour

As we can see, so much works on the range images were presented and improvements have been made but not using the deformable model, this may be due to the noise in the range image (the range images are too noisy) which may distort the results knowing the snake sensitivity. The frame work of active contours minimizes the contour energy E defined as the sum of external energy and internal energy. The external energy pulls the contours towards desired image features while the internal energy helps achieve smooth boundaries. An early implementation of active contours, called Snakes, is based on deforming an initial contour at a number of control points selected along a given initial contour. The deformation is directed towards the object boundary by minimizing the energy E so that its local minimum occurs at the boundary of the object.

a) Development and Design

The algorithm developed consists of an active contour model "Snake" defined as a geometric object with parameters such as orientation, position, shape, this parameters change the image to reach a stable state, while respecting a set of constraints. The steady state corresponds to the minimum of energy E. The energy model (Formula1) includes a term of internal energy regularization or smoothing term and external power or fitness to the data. The method is to minimize this energy by deforming the contour until the points of the snake does not change their positions. The proposed algorithm was implemented in java NetBeans which is a RAD (Rapid Application Development) designed by Sun for creating applications and a GUI with the publisher resources while benefiting from the robustness of the Java language.

i. *Our Segmentation Algorithm*

Before starting the segmentation, the image is filtered by the Floyd & Steinberg filter which improves the overall perception of a range image and to avoid the exclusion of the area of low intensity "Fig.5 (d)", as shown in "Fig.5(c)" a piece of bone is neglected because of its low intensity, the aim is to use a simple threshold dithering "Fig.5 (b)" on each pixel and to accurately account for the errors in brightness it induces.

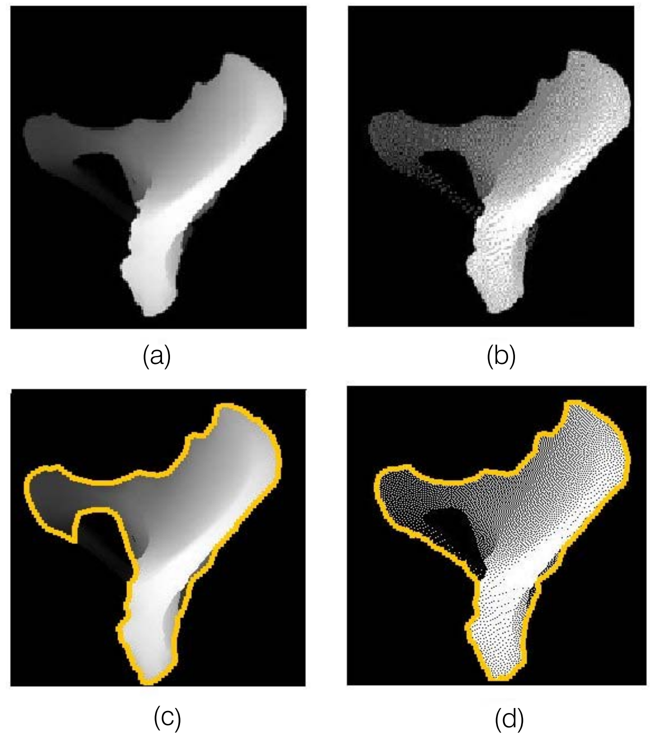

Fig. 5: (a) The range image, (b) the range image filtered by Floyd & Steinberg, (c) segmentation without using the Floyd & Steinberg filter, (d) segmentation after using the Floyd & Steinberg filter

We define our snake model as closed 2D contour elements. We associate with these nodes time varying consisting of a set of nodes connected in series. The Snake is initialized on the center of the image and composed of 40 nodes. The internal and external energies are calculated for each snake point to characterize the outline shape and all the elements of its own and the positioning of the contour on the image taking into account the gradient lines. For each contour point, we determine a new position, on which the contour should minimize the difference constraints. Then, we arrange the contour to respect the constraint of distance between the regular points (we rebuild the snake using cubic spline interpolation). As we can see in Fig.6 these last two steps are repeated until the stopping condition is reached (impossible to improve the positioning of the snake points or when the maximum number of iterations is reached).

ii. *Calculation of the Internal Energy*

The internal energy maintains the consistency of the curve and maintains cohesion and continuity points of the curve. This energy is composed of two terms, a first-order term corresponding to the energy of continuity, which increases when the curve is weakening and a second-order term corresponding to the curvature, which increases when the curve bends sharply such as obtaining a corner (Formula-1).

iii. *Calculation of the External Energy*

External energy is the adequacy of data and therefore depends on the processed image. Typically, in segmentation, this energy (Formula-1) is equal to the gradient that will attract the curve towards the edges of an object in an image.

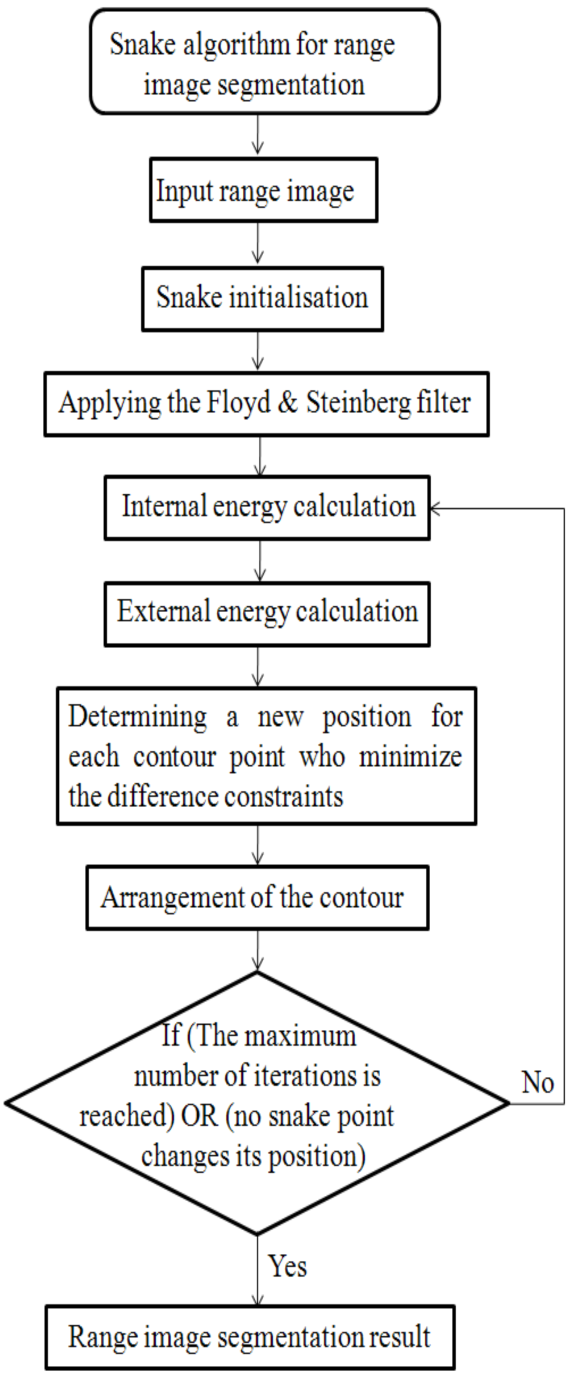

Fig. 6: Our snake algorithm

$$E = \underbrace{\int_0^1 (\alpha |v'(s)|^2 + \beta |v''(s)|_2) ds}_{Eint} - \underbrace{\lambda \int_0^1 |\nabla I(v(s))| ds}_{Eext} \quad (1)$$

Where α and β are two real constants, respectively, coefficients of elasticity and rigidity of the curve. An analogy compares the energy behavior of the snake to that of a membrane (a term related to the spring constant) and that of a thin plate (a term related to the stiffness constant). We denote by v (s) = (x (s), y (s)) (the arc length s $\in$[0, 1]) the current point of the contour C.

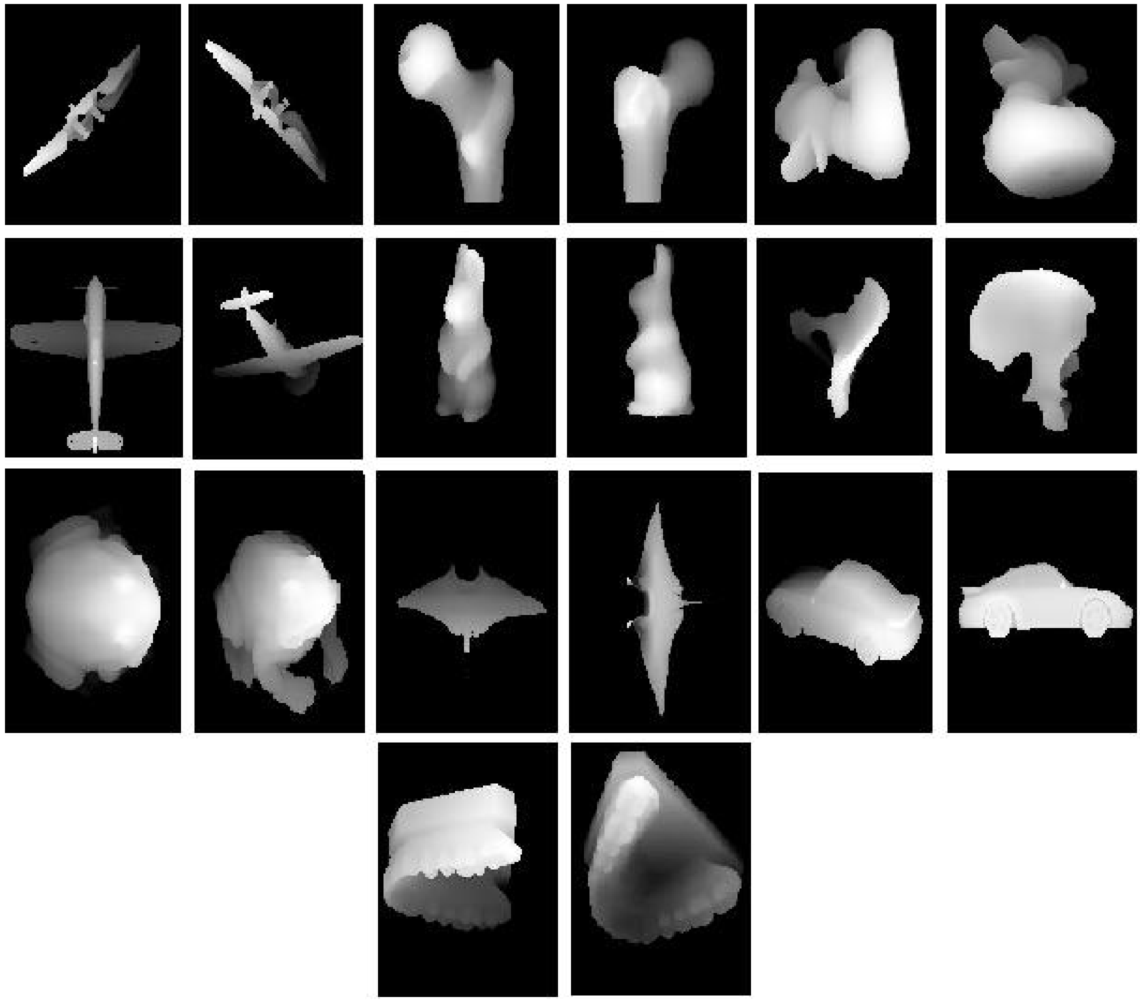

Fig. 7: Sample real range images used

iv. *Convergence Condition*

The snake algorithm stops when it reaches a steady state in which no point change position. To prevent the search does continue indefinitely if the points continue to change their positions, a maximum number of iterations is determined. If this number is reached, the search terminates and the result of the current iteration is proposed as a final solution.

b) Experimentation

Here we present the segmentations produced by our algorithm on several images. We have segmented from a variety of range images from the database of Stuttgart University. The database contains a collection of synthetic range images taken from high-resolution polygonal models available on the web [24]. Six of these models were reconstructed from real range scans in the Stuttgart lab (07_Deoflach, 08_Deorund, 15_Mole, 24_Kroete, 28_Ente, 29_Schwein). These range images are in a custom format (RIF), which is an ASCII file. This database contains 10836 images (42 images from different angles). The snake algorithm was applied to twenty range images. For our first experiment we applied the snake to the simple images containing no cavities, then, in the second experiment we applied the snake for images with cavities. As we can see in Fig.8 segmentations results for range images with cavity obtained are quite satisfactory, however, the results of segmentations obtained for range images with cavities are not complete and the snake did not go after the cavities, this is due to insufficient number of iterations that made the snake stops before reaching these areas.

Unlike traditional snakes, the set of nodes and inter-connecting elements of our snake does not remain constant during its evolution. This model is quite versatile since it can either reproduce the classical behavior of snake with high values of regularization, but also can segment very thin and complex structures. However, this implementation has several disadvantages. First, the Snakes approach the nearest local minimum of the initial contour and are therefore prone to finding a local minimum which in general does not coincide with the object contour. This leads to sensitivity to initialization, e.g. when there are a large number of local minima near the initial contour due to image noise or background clutter. Second, the discretization of the contours into a number of control points may cause problems with uneven spacing and self-crossing while the contours are deforming, and make it difficult to extend the approach to segment 3D objects. Finally, automatic selection of various parameters such as the weights in the energy function is still an open problem.

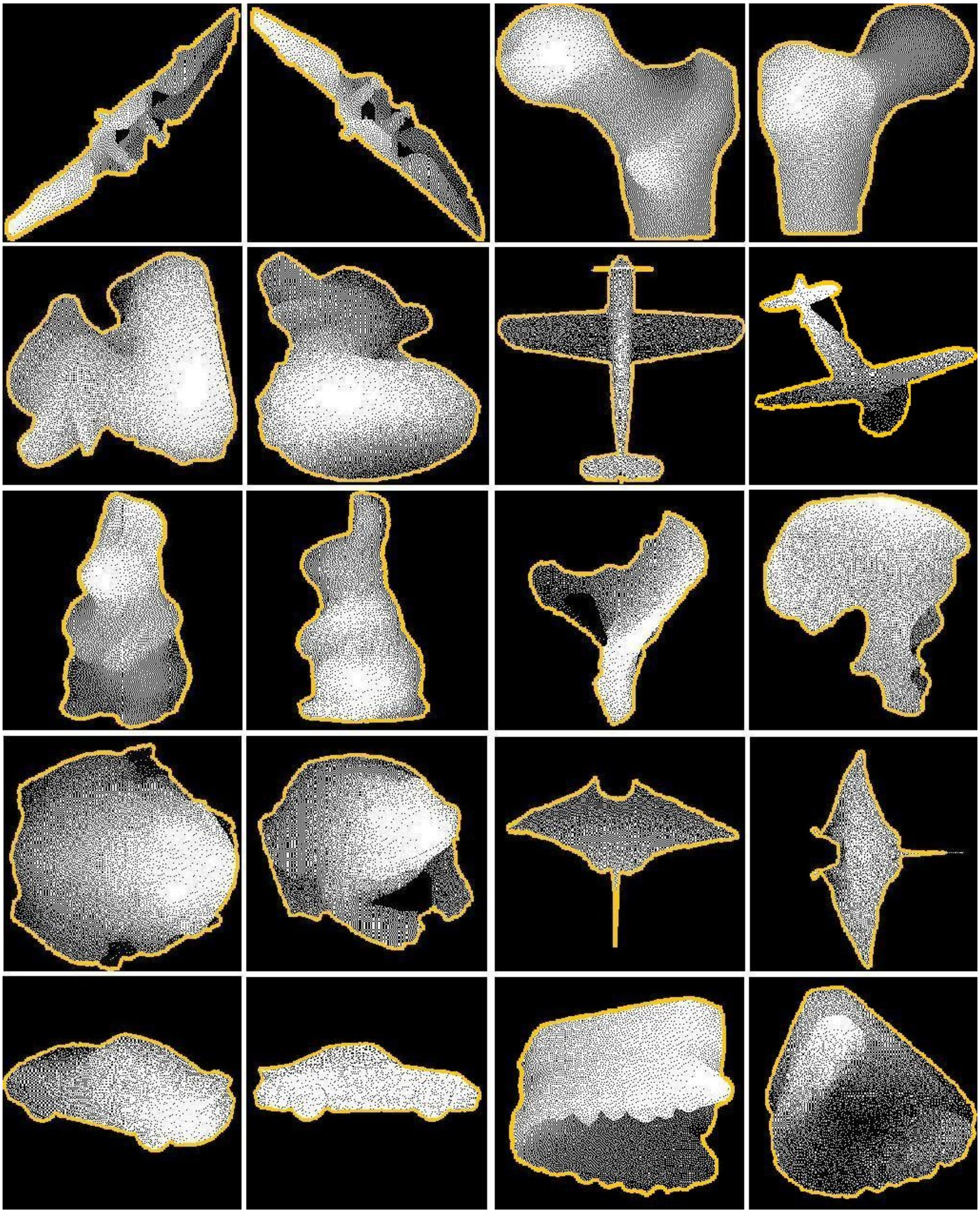

Fig. 8: Segmentation results, the images are 400*400 pixels in size

V. Conclusions

The aim of this work was to provide a new classification of the range image segmentation methods and the literature review has shown how the basic methods were used in practice, sometimes forming methods combined, although the test for homogeneity of the resulting segmentation were not always explicit. A new approach using the deformable model "Snake" was applied and the results obtained was unsatisfactory and incomplete for the range images with cavities, some items do not always converge and require additional iterations.

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Feature-Level Multi-Focus Image Fusion Using Neural Network and Image Enhancement

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Abstract - Image Processing applications have grown vastly in real world. Commonly due to limited depth of optical field lenses, it becomes inconceivable to obtain an image where all the objects are in focus. Image fusion deals with creating an image where all the objects are in focus. After image fusion, it plays an important role to perform other tasks of image processing such as image enhancement, image segmentation, and edge detection. This paper describes an application of Neural Network (NN), a novel feature-level multi-focus image fusion technique has been implemented, which fuses multi-focus image using classification. The image is divided into blocks. The block feature vectors are fed to feed forward NN. The trained NN is then used to fuse any pair of multi-focus images. The implemented technique used in this paper is more efficient. The comparisons of the different existing approaches along with the implementing method by calculating different parameters like PSNR,RMSE.

Keywords : *Multi-focus image fusion, feed forward neural network, image Enhancement.*

GJCST-E Classification: *I.4.0, I.4.3*

FEATURE-LEVEL MULTI-FOCUS IMAGE FUSION USING NEURAL NETWORK AND IMAGE ENHANCEMENT

Strictly as per the compliance and regulations of:

Feature-Level Multi-Focus Image Fusion Using Neural Network and Image Enhancement

Smt.G. Mamatha [α], Shaik Abdul Rahim [σ] & Cyril Prasanna Raj [ρ]

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Keywords : Multi-focus image fusion, feed forward neural network, image Enhancement.

I. Introduction

Image fusion utilises information obtained from a multi-focus images of the same scene. Image processing is one of form of signal processing for which the input is an image and the output of image processing may be either an image or a set of characteristics related to the image. For the most of the image processing techniques, images of two dimensional signals is treated as input and standard image processing techniques are applied to it. The process of image fusion is performed for multi-focus and multi-sensor images of the same scene. In multi-focus images, the physical objects in the scene which are closer to the camera are in focus and the far physical object gets blurred. Adverse to it, when the far physical objects are focussed then the closer objects get blurred in the image. A hierarchical idea of image fusion has been implemented for combining significant information from multiple images into single image. The process of image fusion can be accomplished either in transformed domain or spatial domain. In spatial domain operations are performed on the pixel values. In transformed domain the images are first transformed into multiple levels of resolutions.

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Information fusion can be performed at any level of the image information representation corresponding to other forms of information fusion, image fusion is usually performed at one of the three different processing levels they are Pixel, Feature and Decision Level [5]. The pixel level image fusion is also known as signal level image fusion which represents fusion at the lowest processing level, that is operations such as maximum or mean(average) are applied to the pixel values of the source images to generate the fused image. Feature level image fusion is also known as object level image fusion where fused features and object labels and information that have already extracted from individual input images. Decision level is also known as symbol level, the objects in the input image are first detected and then the suitable fusion algorithm the fused image is generated. In the field of Image Processing, image fusion has received a significant importance for medical imaging, military applications, forensic, remote sensing.

A number of image fusion techniques have been exhibited in the literature. In addition of simple pixel level image fusion techniques. We find the complex techniques such as Laplacian Pyramid [2], Morphological pyramid [6], fusion based on PCA [3], Discrete wavelet Transform (DWT) [1]. These fusion techniques have different advantages and disadvantages such as liner wavelets during image decomposition the fused image doesn't preserve the original data. Likewise due to low-pass filtering of wavelets, the edges in the image becomes smooth and hence the contrast in fused image is decreased.

In this paper, we have implemented a method for multi-focus image fusion. The implemented method is discussed in section II. In section III, the quantitative measures used to evaluate the performance of the implemented method are described. Section IV covers the experiments details and section V concludes the study.

II. Implementing Method

Different images are acquired from the Image Processing websites. From the acquired images consider one image, for that image generate two source images from original image that is one is left focused and right blurred other one right focused and left blurred. Every image is divided into blocks. The block size plays a significant role in differentiating the blurred and un-blurred regions from each other. After dividing the image into blocks, the feature values of block of all the images are calculated and feature file is generated. A comfortable number of feature vectors are used to train NN. The trained NN is then used to fuse any set of multi-focus images. Image data set, feature selection and implemented algorithm are discussed in the following sections.

a) Creating Image Dataset

In the implementing method, we created an image-data set of ten grayscale images. These images are acquired from the different image processing websites. For each image in the data set, we generated its two versions of the same size. In the first versions, the left half of the image is blurred and right image is focused. A similar process is performed in the right image is blurred and left image is focused. The blurred versions are generated by Gaussian blurring of radius 1.5.In implementing method experimentation, we resize all the images into 256*256 resolutions.

b) Feature Extraction

In feature-level image fusion, the selection of different features is an important task. The blurred objects in an image reduce its clearness. In multi-focus images, some objects are in focus and some objects are blurred. In this paper, we extract five features from each image block to represent its clearness. These are the Variance, Energy of gradient, Contrast visibility, Spatial frequency and canny edge information. From the figure (1), we calculate the blueness of Gaussian radius for source image, Left blur and Right focused ,and Left focused and Right blur. The value of features in the image against blurriness is given in table (I). If the blurriness is increased the values of energy gradient, spatial frequency and edge information are reduced.

1) *Contrast Visibility :* It calculates the deviation of a block of pixels from the block's mean value. Therefore it relates to the clearness level of the block. The visibility of the image block is obtained using equation (1)

$$CV = \frac{1}{p*q} \sum_{(i,j)Bk} \left| \frac{X(i,j) - \mu_k}{\mu_K} \right| \qquad (1)$$

Here μ_K and $p*q$ are the mean and size of the block Bk respectively.

2) *Spatial Frequency: Spatial* frequency measure the activity level in an image, it used to calculate the frequency changes along rows and columns of the image. Spatial frequency is measured using equation (2).

$$SPF = \sqrt{(RF)^2 + (CF)^2} \qquad (2)$$

Where

$$RF = \sqrt{\frac{1}{p*q} \sum_{i=1}^{p} \sum_{j=2}^{q} [X(i,j) - X(i,j-1)]^2}$$ and

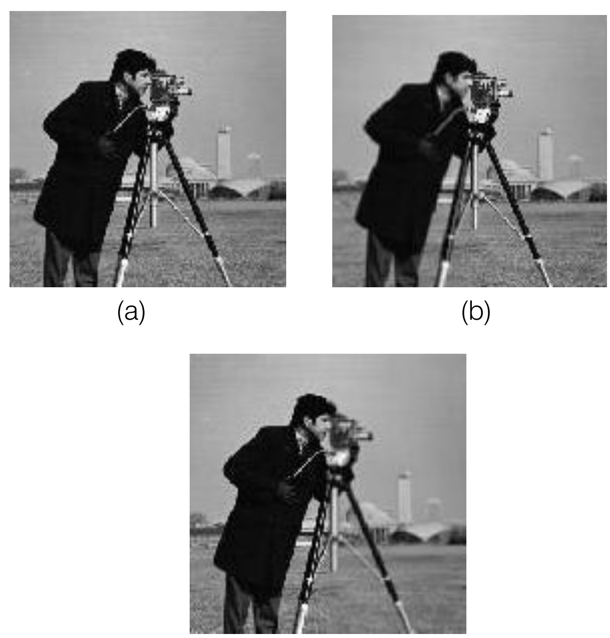
$$CF = \sqrt{\frac{1}{p*q} \sum_{i=1}^{p} \sum_{j=2}^{q} [X(i,j) - X(i-1,j)]^2}$$

Here X is the image and p*q is the image size. A large value of spatial frequency describes the large information level in the image and therefore it measures the clearness of the image.

3) Variance: Variance is used to measure the extent of focus in an image block. It is calculated using equation (3)

$$Variance = \frac{1}{p*q} \sum_{i=1}^{p} \sum_{j=1}^{q} (X(i,j) - \mu)^2 \qquad (3)$$

Here μ is the mean value of the block image and p*q is the image size. A high value of variance shows the greater extent of focus in the image block.



(a) (b)

(c)

Figure 1: Cameraman image (a) Original Image (b)LBRF (c)LFRB

Table 1: Feature values for Original Image, LBRF and LFRB

Figure	Variance	EG	SPF	CV	Edge
1 (a)	148.41	26274	0.0286	0.1057	5747
1 (b)	146.18	21752	0.0264	0.1003	5402
1 (c)	145.19	17854	0.0243	0.0992	5106

4) Energy of Gradient (EG): It is also used to measure the amount of focus in an. It is calculated using equation (4).

$$EG = \sum_{i=1}^{p-1}\sum_{j=1}^{q-1}(r_i \wedge 2 + r_j \wedge 2) \tag{4}$$

Where $r_i = r(i+1, j) - r(i, j)$

and $r_j = r(i, j+1) - r(i, j)$

Here p and q represent the dimensions of the image block. A high value of energy of gradient shows greater amount of focus in the image block.

5) Edge Information: The edge pixels can be found in the image block by using canny edge detector. It returns 1 if the current pixel belongs to some edge in the image otherwise it returns 0. The edge feature is just the number of edge pixels contained within the image block.

c) Artificial Neural Networks

Many Neural Network models have been implemented for tackling a diverse range of problems*, including pattern classification. The fusion we examine here can be considered as classification problem. Here we have considered a NN applications model, namely the PNN (Probabilistic Neural Network) .The basic idea underlying NN is to overlap localized receptive fields of the hidden units to create arbitrarily complex nonlinear ties. The normal architecture consists of one hidden layer and one output layer. Each hidden unit corresponding to a kernel or basis function of the input vector x, and is usually of the Gaussian form. The basic architecture of feed forward NN is shown below

$$Z(x) = \exp(-\|x-c\|) \wedge 2 / \sigma \wedge 2$$

Here, c is the position of the hidden unit and is a user-defined width that controls is spread. For PNN a hidden unit is positioned at every training data point.

d) Neural Network Algorithm

The algorithm first decomposes the source images into blocks. Given two of these blocks (one from each source image), a neural network is trained to determine which one is clearer. Fusion then proceeds by selecting the clearer block in constructing the final image. The fusion result of DWT is shift dependent. The use of image blocks on the other hand, avoids this problem even if there is object movement or mis-registration in the source images, each object will still be in better focus in one of the source images. In detail, stepwise working of the implemented method is given under. 1) LFi is the left-focused and RFi is the right-focused versions of the ith image in the dataset in section(II-A). 2) Divide the versions LFi and RFi of every image in the dataset into k number blocks of the size M*N. 3) Create the features file for all LFij and RFij according to the features discussed in section (II-B). Here j=1,2,3...k. For all i, there are two sets of features values for every block j named as FSLFij and FSRFij each of which contains five feature values. Subtract the features values of block j of RFi and include this pattern in feature file. Normalise the feature value between [0 1]. 4) Assign the class value to every block j of ith image. If block j is visible in LFi then assign it class value 1 otherwise give it a class value -1. In case of class value -1, block j is visible in RFi. 5) Train a neural network to determine whether LFi or RFi is clearer. Identify the clearness of all the blocks of any pair multi-focus images to be fused. 6) Fuse the given pair of multi-focus images block by block according to the classification results of the neural network. Such that Output of NN for block J If>0,select J from left-focused Image If<0,select j from right-focused Image The block diagram of the implemented method is shown in figure (2).

III. Quantitative Measures

There are different quantitative measures which are used to evaluate the performance of the fusion techniques. These are PSNR (Peak Signal to noise ratio), RMSE (root mean square error), Entropy, Correlation Coefficient, MAE (mean absolute error).

a) PSNR

Determines the degree of resemblance between reference images fused image and fused image. A bigger value shows good fusion results.

$$PSNR = 20\log_{10}\left[\frac{L \wedge 2}{\frac{1}{p*q}\sum_{i=1}^{p}\sum_{j=1}^{q}(R(i,j)-F(i,j))\wedge 2}\right]$$

L denotes to number of gray level in the image.

b) RMSE

Calculate the deviation between the pixel values of reference image and fused image. A lesser value shows the good fusion results.

$$RMSE = \sqrt{\frac{1}{p*q}\sum_{i=1}^{p}\sum_{j=1}^{q}[R(i,j)-F(i,j)]\wedge 2}$$

Here R, F are the reference and fused images respectively.p*q is the image size.

c) Entropy

Quantifies the quantity of information contained in the fused image. A bigger value shows good fusion results.

$$H = -\sum_{i=0}^{L-1} h_F(i)\log_2 h_F(i)$$

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Here h_F is the normalized histogram of fused image and L is the number of gray levels.

d) Correlation Coefficient

The correlation coefficient matrix represents the normalized measure of the strength of linear relationship between variables.

$$CC = \frac{\sum_{t=1}^{N}(x_t - \bar{x})(x_{t+k} - \bar{x})}{\sum_{t=1}^{N}(x_t - \bar{x})^2}$$

Where x_t is a data value at time step t, k is the lag.

e) MAE

It is used to calculate the mean absolute error between reference image and fused image.

$$MAE = \frac{1}{p*q}\sum_{i=1}^{p}\sum_{j=1}^{q}\left|R(i,j) - F(i,j)\right|$$

Where $F(i,j)$ the predicted is fused image and $R(i,j)$ is the true value fused image.

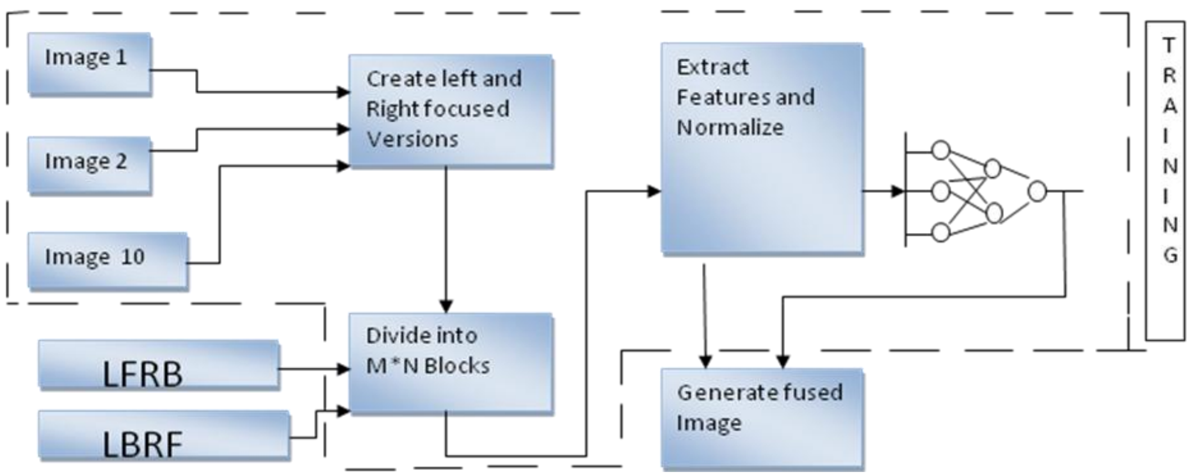


Figure 2: Block Diagram of the Implementing method

IV. Experiments and Results

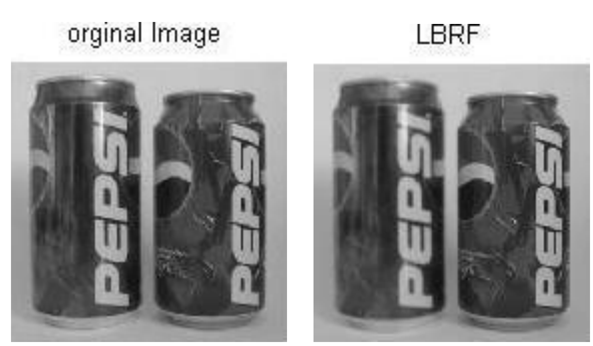
Image fusion is performed. The implemented technique used in this paper is more efficient and useful, to highlight the efficiency. We have performed broad experimentation on this technique. We trained the feed forward neural network with different number of hidden layers and with different number of neurons on each layer. The results of the implementing technique are compared with different existing methods including DWT, PCA, Laplacian pyramid, Morphological processing based image fusion techniques. To calculate the performance of the implementing technique, the results for two different pairs of multi-focus images are obtained including Pepsi, balloon, and cameraman images.

a) Difference between DWT based Image fusion and the Implementing Technique

Gonzalo pajares, implemented a DWT based image fusion technique to perform multi-focus image fusion. The fusion result Discrete Wavelet Transform is shiftdependent. The use of image block, on the other hand avoids the problem of shift dependent. We have used five different features like (SPF, EG, CV, Variance, Edge) to calculate the clearness of a block more accurately as compared to DWT. Even though if there is object misregistration or movement in the input images, each object will still be in finer focus in one of the input images. Thus, in the fused result, all the blocks covering a particular object will come from the same input image and its clarity will not be affected due to any misregistration problem.

b) Visual Comparison Assessments

The visible comparisons has shown in below figures (3) for Pepsi images, figure (4) for balloon images, figure (5) for cameraman images. All the images are of size 256*256.



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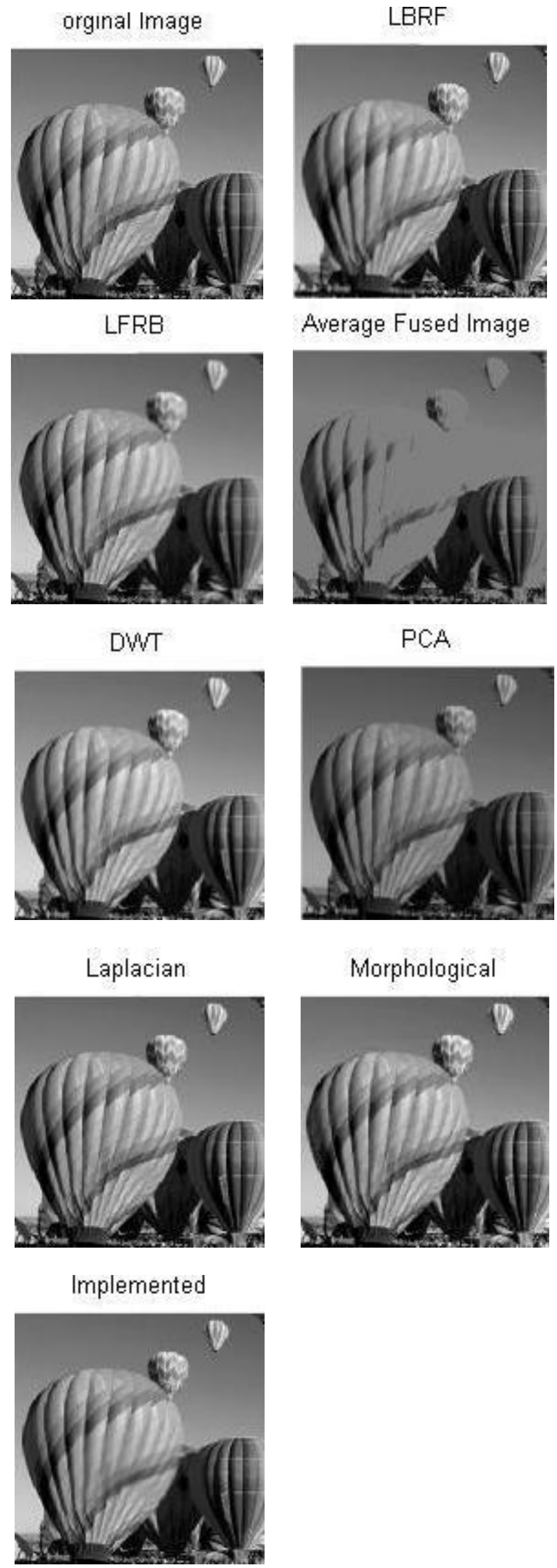

Table 2: Results of Quantitative Measures for Pepsi Image

Method	PSNR	RMSE	Entro	Corre	MAE
Average	17.64	33.42	4.4408	0.955	20.57
DWT	5.621	133.0	0.9978	0.998	118.7
PCA	19.52	9.73	6.9321	0.998	117.1
Laplacian	5.88	129.5	7.2997	0.996	117.0
Morphological	5.88	129.5	7.2815	0.991	117.0
Implementing	**34.80**	**4.635**	**7.2913**	**0.9966**	**0.0104**

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Method	PSNR	RMSE	Entro	Corre	MAE
Average	19.79	26.124	5.0694	0.9182	12.62
DWT	6.322	123.14	0.975	0.9946	111.55
PCA	20.07	10.12	7.214	0.9946	111.20
Laplacian	6.356	122.66	7.598	0.9892	111.11
Morphological	6.357	122.65	7.602	0.9850	111.10
Implementing	**35.89**	**4.0886**	**7.5827**	**0.9971**	**0.0947**

Table 3: Results of Quantitative Measures for Ballon Image

PSNR result for Cameraman images:

Original image

LBRF

LFRB

Average Fused Image

DWT

PCA

Laplacian

Morphological

Implemented

Sharpened Image

PSNR=31.26

High performance.

Texture Calculations:

Texture Features	Source Image	Fused Image Implemented
Energy	1.1785e+009	1.1726e+009
Dissimilarity	688002945	687848288

V. Conclusion

In this implemented technique, a feature level focus image fusion has been implemented in this paper. In this method we have trained the feed forward neural network with the block features of pairs of multi-focus images. A feature set including SF, CV, edges, variance, and EG is used to define clarity of the image block. The trained neural network was then used to fuse any pair of multi-focus images. Experimentation results show that the implemented technique performs better than the existing techniques. The fusion result of Discrete Wavelet Transform is shift dependent. The use of image block, on the other hand avoids the problem of shift dependent.

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Implementation of Image Encoding Based on RGB and ARGB

By Fadi Al-Kalani & Mohamed Al Rabei
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Abstract - The study focuses on pixels while doing the process of implementation of image encoding. However, pixels can have enough power to protect the image and save the copyright of it. Images are nothing but set of pixels, each pixel can be considered as a box holding the colors' codes in a known sequence. Modifying those codes is kind of encoding. This study emphasizes the coding technique, the RIJNDAEL encryption and watermarking images.

Keywords : Image processing, image encoding, string encryption, watermark, image layers, RGB, ARGB, transparency.

GJCST-E Classification: FOR Code: I.4,E.3

IMPLEMENTATION OF IMAGE ENCODING BASED ON RGB AND ARGB

Strictly as per the compliance and regulations of:

Implementation of Image Encoding Based on RGB and ARGB

Fadi Al-Kalani [α] & Mohamed Al Rabei [α]

Abstract - The study focuses on pixels while doing the process of implementation of image encoding. However, pixels can have enough power to protect the image and save the copyright of it. Images are nothing but set of pixels, each pixel can be considered as a box holding the colors' codes in a known sequence. Modifying those codes is kind of encoding. This study emphasizes the coding technique, the RIJNDAEL encryption and watermarking images.

Keywords : Image processing, image encoding, string encryption, watermark, image layers, RGB, ARGB, transparency.

I. Introduction

The encoding process will be applied on 32-bit per pixel standards images (i.e. BMP, GIF, JPG and PNG).Pixels are encoded into four parts (RGBA) or (ARGB). (A) stands for Alpha, (R) for Red, (G) for Green and (B) for Blue.

ALPHA	*RED*	*GREEN*	*BLUE*
(0-7) bits	*(8-15) bits*	*(16-23) bits*	*(24-31) bits*

Fig. 1: The format of ARGB pixel

RGB was uniquely used as a base of pixels and to reproduce and present a broad array of colors while alpha has been added later to represent the transparency of the color [4].

Using RGB for encoding in this paper doesn't mean using old methods. RGB is still alive; it's the core of ARGB or even RGBAX. While alpha will be excluded from being processed in the first encoding method and will included later on.

As mentioned, the structure of a pixel (let us refer to it as color) is a set of 32 bits; 32 bits = 4 bytes. 4 bytes/ 4 sets {A, R, G & B} = 1 bytes for each set. Therefore; Only 3 bytes will be modified when using the RGB encoding method while 4 bytes will be used in the ARGB encoding method. Hence, the described encoding method is light compared to those which use 256 or more [5, 6].

Encoding and encryption are both routines performed on data; however the end results are quite different. In the case of encryption the purpose is to disguise the data such that it can't be read, except by the intended recipient. On the other hand, encoding is used merely to transform data into a more suitable format; it is the process of putting a sequence of objects (characters, letters, numbers, punctuation or any storage data type) into a specialized format for efficient transmission or storage.

Consequently, encoding and encryption can be integrated to secure data, to prevent others from reaching it. Encryption is needed to prevent hackers, and encoding to communicate, transmit or exchange data [9].

The implementation is accomplished in three integrated phases to get the full vision.

1. Encryption (used to encrypt the keys of encoding and decoding)
2. Encoding/Decoding methods
3. Watermarking the image.

II. Implementation

We have two directions in term of implementing our image encoding/ decoding. The first demonstrates the encoding processes. And the other is for the decoding. The process is described in the following figure:

a) Encoding Processes

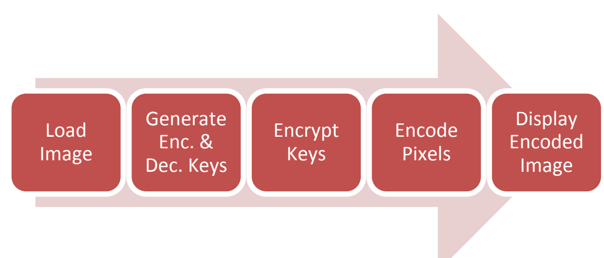

Fig. 2: Encoding process

As shown in figure 2, the first step, we start encoding by loading the image we'd like to encode. In the second step, we generate encoding key as well as decoding keys. These keys are strongly recommended to be saved safely. They are basically the sole of encoding and decoding. Hence, we will encrypt them in such a way that we empower their safety. Then encrypt the keys and start encoding each pixel in the image. Finally, we display the new encoded image (or save it into a file).

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b) Decoding Processes

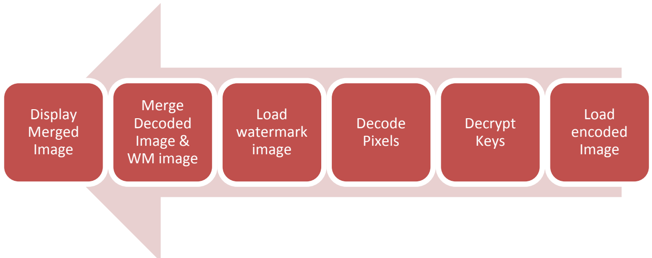

Fig. 3: Decoding process

Referring to figure 3 we realize that the decoding process starts by loading the encoded image, then decrypting the keys and verify them in the following step. While in the third step the image to decoded. The process ends by watermarking the image.

The three main important steps in both processes are:

1. Encryptions/Decryption the keys
2. Encoding/Decoding the image
3. Watermarking it.

c) Encryption/ Decryption

Generally, our methods of encoding images depend on a generated key of type integers. It contains 6 to 8 digits. And the same is for decryption. Thus makes it "unsafe". So we found that there is a need to encrypt them.

There are two kinds of encryption ciphers that use keys.

a. Single key encryption
b. Two keys based encryption

Two keys are used to strengthen the security; a public key which is used within the team to encrypt the data, and a private key which no data will be decrypted without it [2].

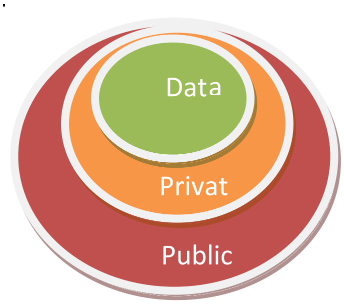

Fig. 4: Two Keys based Encryption

Similar to encryption ciphers, in fact the encoding process; explained through this paper is a single key encoding and another key – decoding key – is generated based on the first one. As a result, the encoding method that we develop supports both the Single and the double key encoding.

Practically, "Good encryption algorithms are hard to come by. They are exceptionally difficult to invent, and even when a new one is created, it is often quickly laden with patents and export restrictions, making it inconvenient or even impossible for others to reuse"[1].

Hence, we tried to use a very well-known encryption cipher called "RIJNDAEL Algorithm". RIJNDAEL is two ways encryption and used in keys decryption as well. It is one of the most powerful encryption solutions that serve the need in our research among several good encryption techniques of "System Security Cryptography" which is provided by .NET environment.

Most variables needed for encryption using RIJNDAEL class could have static values like hash algorithm, Initial vector, salt and others. These variables can be managed dynamically to empower encryption/ decryption. More encryption power in is better encoding [10].

d) Encoding / Decoding images

As mentioned previously, we have used two methods for encoding/ decoding images based on pixels.

i. RGB based encoding/decoding
ii. ARGB based encoding/decoding

Encoding using RGB and ARGB are almost the same in their structures. The only difference is that in the first one encodes the values of Red, Green and Blue whereas the second method encodes Alpha value - the transparency

The main function is "Encode". It's of type color (pixel). It takes source color and the encoding key and returns a new color to be replaced at the same position. Simply, the idea of the encoding is to rearrange the color in hexadecimal format with the help of the generated encoding key. Then convert the new hexadecimal value to color data type to present a new Red, Green and Blue or new (Alpha, Red, Green and Blue in case of ARGB).

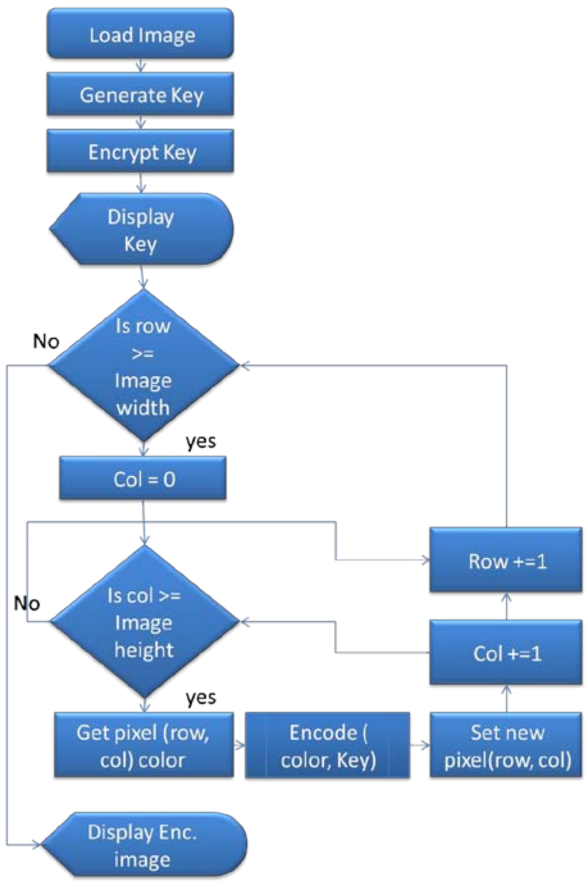

Fig. 5: Flowchart of encoding image

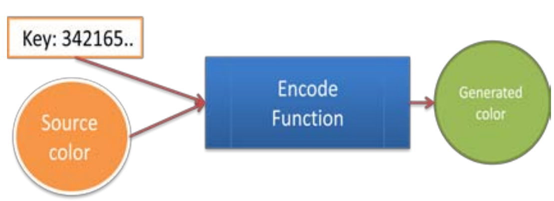

Fig. 6: Encode Functuin

The process used to decode the image is accomplished by generating a decoding key based on the key used in decoding. Based on the decryption key, we use the same function of encoding with different resources; the encoded image as well as the decoding key.

Fig. 7: Decryption Process

Due to the fact that this kind of encoding is based on independent small blocks (pixels), it cannot be classified as strong encoding. However, our challenge was to develop a method based on recoloring the pixels. But is that all? off course not. What remains is watermarking the image.

e) Adding Watermark

Adding watermark to an image is the process of embedding information (usually text or image) into an image in a way that it is difficult to remove [3]. Watermark is highly recommended for saving the copyrights especially in our case.

Watermark is not a part of encoding, but we took the decision to integrate it with our encoding system to add the flavor of security and to save the copyright [7, 8].

Programmatically, Adding watermark means merging two layers (or two images) one over the other and controlling the transparency of both based on the following formulas:

$$C_o = C_a\alpha_a + C_b\alpha_b(1-\alpha_a)$$
$$\alpha_o = \alpha_a + \alpha_b(1-\alpha_a)$$

Where C_o is the result of the operation [5].

C_a is the color of the pixel in Picture A; C_b is the color of the pixel in Picture B

α_a and α_b are the alpha of the pixels in Picture A and B respectively[6].

Programmatically, we can implement the previous equations easily like the following:

For the first formula:

$$C_o = (C_a\alpha_a / 255) + (C_b\alpha_b(255-\alpha_a)/(255*255);$$

For the second formula:

$$\alpha_o = \alpha_a + (\alpha_b(255-\alpha_a)/255);$$

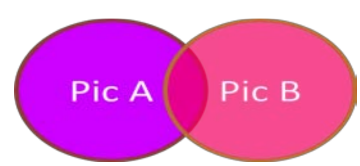

Fig. 8: Pic. A over Pic. B

Implementation of watermarks can be done in two steps.

I. Preparing the stamp image (signature).

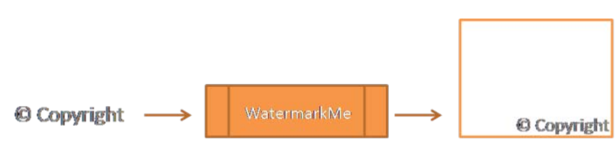

Fig. 9: Process line of preparing Signature image

In the preparation step, the size of the signature image is checked and compared to the decoded image, to assure that it fits the decoded image or needs resizing.

The next is to create a new empty image with the same size of the decoded image to draw the signature in down right corner or any elsewhere primary chosen.

I. Merging the signature and the decoded image.

Fig. 10: Process line of merging Signature and decoded image

Merging both images together is merging each pixel of them based on the formulas mentioned before; within this process the transparency of the signature is to be set to be half of the real value of it.

As a result of our work, the following screenshots show the images before and after the encoding. They show the original image, and how it has been encoded using both methods RGB and ARGB.

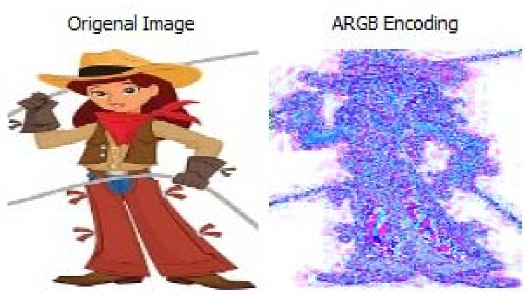

Fig. 11: An image before and after RGB encoding

Fig. 12: An image before and after ARGB encoding

Due to the fact that this encoding method is based on encoding each pixel in separate, we clearly notice that it is not powerful for encoding plain colors that have same hexadecimal values for all bytes of the pixel like white color (A=FF, R=FF, G=FF, B=FF) as seen in the backgrounds in figure 11 and 12. Other than that it will work fine.

III. Conclusion

We tried in this study to test image encoding/decoding by changing the sequence of hexadecimal values of RGB and ARGB. Each pixel is encoded to have the same structure and different values. We provided the encoding method by generating public and private keys. However, we used a function to generate a decoding key as a gate for decoding. Because we have two keys, we worked on a fast and powerful encryption cipher called "RIJNDAEL Cipher". Finally, to strengthen the encoding we watermarked the decoded images.

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Feature Selection Method for Iris Recognition Authentication System

By Pooja Garg & Anshu Parashar
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Abstract - Iris-based biometric authentication is gaining importance in recent times. Iris biometric processing however, is a complex process and computationally very expensive. In the overall processing of iris biometric in an iris-based biometric authentication system, feature selection is an important task. In feature selection, we ex-tract iris features, which are ultimately used in matching. Since there is a large number of iris features and computational time increases as the number of features increases, it is therefore a challenge to develop an iris processing system with as few as possible number of features and at the same time without compromising the correctness. In this paper, we address this issue and present an approach to feature Selection Method.

Keywords : Iris recognition, biometric, feature Selection method, feature extraction.

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FEATURE SELECTION METHOD FOR IRIS RECOGNITION AUTHENTICATION SYSTEM

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Feature Selection Method for Iris Recognition Authentication System

Pooja Garg [α] & Anshu Parashar [σ]

Abstract - Iris-based biometric authentication is gaining importance in recent times. Iris biometric processing however, is a complex process and computationally very expensive. In the overall processing of iris biometric in an iris-based biometric authentication system, feature selection is an important task. In feature selection, we ex-tract iris features, which are ultimately used in matching. Since there is a large number of iris features and computational time increases as the number of features increases, it is therefore a challenge to develop an iris processing system with as few as possible number of features and at the same time without compromising the correctness. In this paper, we address this issue and present an approach to feature Selection Method.

Keywords : Iris recognition, biometric, feature Selection method, feature extraction.

I. Introduction

We discuss feature selection method, that operates after the physical installation of the imaging system and through a learning stage where typical images resultant of the imaging setting are processed, selects the higher discriminating features, according to the environment specificities.

The non-cooperative image capturing setting, either under natural light or varying lighting conditions leads to the appearance of images whose typical characteristics are termined by the used optic device and the environment itself. For instance, it is expectable that some imaging conditions propitiate the existence of reflections (specular or lighting) in specific iris regions, while others propitiate the iris occlusion by eyelids and eyelashes. Current iris matching proposals (feature extraction and comparison) are independent of the imaging environments and do not take into account this information in the recognition task.

II. Feature Selection Method

The problem of feature selection is to take a set of candidate features and select a subset that best performs under some classification system [11]. This procedure can reduce the cost associated with classification, by reducing the number of features that must be collected, and in some cases it also provides better results due to the finite sample size effects: as the number of features is reduced, and the number of points is maintained, the feature space becomes more densely populated.

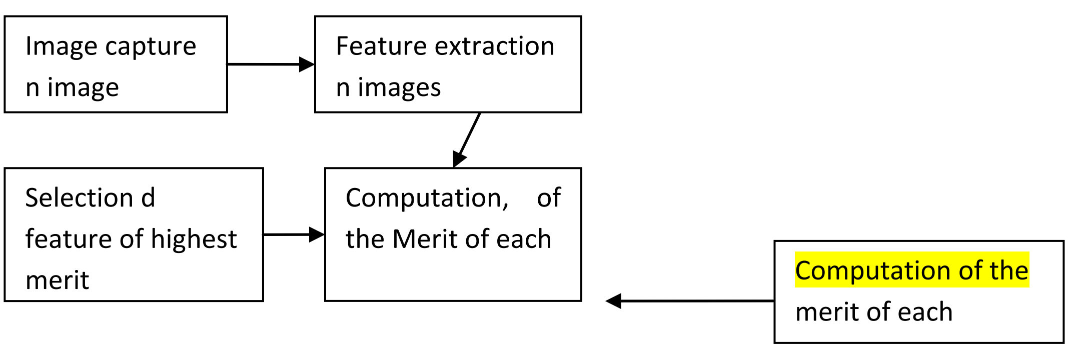
Formally, let T and S be respectively the candidate and selected feature sets, S is subset to T. Also, let ‖.‖ denote the cardinality of the set, such that ‖T‖= t and ‖S‖= s. The feature selection criterion function for the set X is represented by J(X).

Considering that higher values of J indicate better feature sets, the problem of feature selection is to find a subset S to set T such that

|S| = s and

$J(s) = max_{x\subseteq T,|x|=s}$ (equ.→ 1)

Figure 2.1: Block diagram of the feature selection method



According to this definition, the block diagram of the feature selection method is given in above figure. After the physical installation of the image capturing framework, n images from the irises of k subjects is collected, this should represent the typical characteristics and noise regions of the images captured within the environment. Further, the candidate features are extracted for all these images and their values used in the computation of the features' merit (equ.→ 2). Finally, the s features with highest merit are

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selected. The motivation behind this proposal is the valorisation of the features which respectively maximize and minimize the signatures dissimilarity in the inter- and intra-class comparisons.

As can be seen in (equ.→ 2), the dissimilarity between two feature values contributes to an increase of the respective merit if they were extracted from different irises and, inversely, contributes to its decrease if the features were extracted from images of the same iris.

In the following discussion we will use F^{p}_{i} to denote the ith feature set extracted from the iris p and $f^{p}_{i,j}$ to denote the jth feature of the ith feature set extracted from the iris p. Thus, $F^{p}_{i} = \{f^{p}_{i,1}, \ldots, f^{p}_{i,t}\}$. Let $A = \{F^{p1}_{1}, \ldots, F^{pk}_{n}\}$ be the set of training feature sets extracted from n images of k subjects. The merit value m(.) of each candidate feature i is given by: $m(i) : \{1, \ldots, t\} \rightarrow R$

$$m(i) = \sum_{J=1}^{N+1} \sum_{K=J+1}^{N} \frac{d\left(f^{p}_{j,i}, f^{r}_{k,i}\right)}{(t_I - t_j)\delta_{p,r} + t_E}\left(1 - 2\,\delta_{p,r}\right)$$
(equ.→ 2)

Where d(.) is the function that gives the features dissimilarity (e.g., Hamming or Euclidean distance), $\delta_{p,r}$ is the Kronecker delta and t_I and t_E are, respectively, the number of intra and inter-class comparisons between elements of A. This definition implies that the highest values occur when the features dissimilarity is respectively smaller in the intra- and higher in the inter-class comparisons, obtaining a value that is directly correspondent to the feature discriminant capacity within the respective imaging environment.

According to (equ.→ 1), the function J(.) that performs the feature selection will give us the feature set S, which contains the s features with highest values of q(.). However, if the features are selected as above described, it is not possible to achieve invariance to iris rotation through signature shifting, and this is a very common technique used in the feature comparison. We compensate this by making the normalization process into the dimensionless polar coordinate system starting from 5 different deviation angles of the segmented iris image (-10^{o}, -5 ^{o}, 0 ^{o}, +5 ^{o}, +10 ^{o}) and obtaining 5 normalized iris images. The subsequent processing is further made separately for each of these images and the dissimilarity between iris signatures is given by the lowest dissimilarity between the enrolled signature and those extracted from each of these images.

Algorithm contains the pseudo-code of the above described feature selection method. Its computational complexity of $O(n^3)$ is not a concern, as it will be executed before the functioning stage of the recognition system and, due to this fact, without critical time constraints. In this algorithm f (i, j) represents the ith feature extracted from the image j and id (f) the identity of the subject from where the feature f was extracted.

III. Algorithm For Feature Selection

```
for i = 1 to n do
merit(i) ← 0
end for
for i = 1 to t − 1 do
for j = i + 1 to t do
for k = 1 to n do
x ← dist(f(k, i), f(k, j))
if id(f(k, i)) = = id(f(k, j)) then
merit(k) ← merit(k) - x / tI
else
merit(k) ← merit(k) + x / tE
end if
end for
end for
end for
S=Select_Features_Highest_Merit (n, s, merit)
return(S)
```

In the above algorithm

t →Number of feature sets in the training set

n → Number of candidate features

d →Number of features to be selected

t_I → Number of intra-class comparisons between elements of T

t_E → Number of inter-class comparisons between elements of T

IV. Result

Figure 4.1: 1st Original image of the eye showing the iris

Figure 4.2: Binary image of 1st iris image

Figure 4.3: 2nd Original image of the eye showing the iris

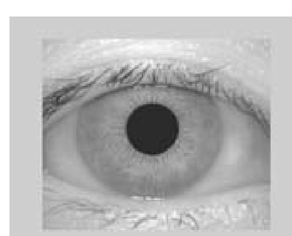


Figure 4.4: Binary image of above iris image

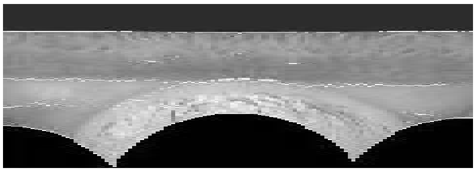
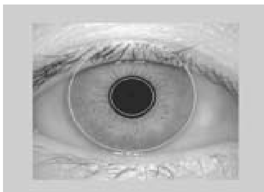


Figure 4.5: Segmentation results with contours outlining the pupil and the iris



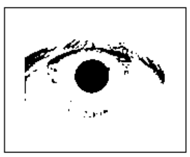
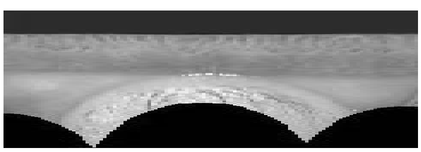


Figure 4.7: Segmentation results with contours outlining the pupil and the iris



V. Conclusion

The typical noise regions and characteristics of the images captured within non-cooperative environments are highly influenced by the used optic device and the specific lighting conditions of each environment. This leads to a significant increment of the error rates, which was the main motivation for this section proposal. We described a method for the feature selection that takes into account the typical characteristics of the images, namely their noise regions determined by the imaging environment. Using a training set composed of images captured after the physical installation of the imaging system, we computed the merit value for each candidate feature and selected those with highest values. Since the training set images are representative of the ones that the recognition system will have to deal with, this process contributes for the adaptability of the recognition system to the specific environment. We stress that this approach is compatible with different imaging environments, since each recognition system will select a proper sub set of features that are further taken into account in the recognition process, through the comparison with the correspondent enrolled features. Experiments led us to conclude about an improvement in the system's accuracy when the cardinality of the selected feature set is between 30 and 50% of the number of candidate features. In this situation, the error rates significantly decreased (about 50%) in the recognition of noisy iris images, which must be considered an achievement.

VI. Future Work

We are currently working on the analysis of the requirements for the physical implementation of the non-cooperative prototype system. This has revealed, specially the planning of the optical framework, as a task with higher difficulty than we initially thought. Simultaneously, we are implementing, and in specific situations adapting and improving, algorithms for the real-time human face and eye detection. Our purpose demands algorithms with high performance, which decreased the number of potential alternatives. Regarding the experiments and results contained in this dissertation, we are presently per forming the experimental evaluation of the proposed methods with larger data sets, in order to obtain information about the advantages resultant of the methods with higher statistical relevance. Moreover, we are performing the comparison between three common iris recognition proposals (Daugman's [3], Wildes' [14] and Ma et al. [15]) as they are described by the authors and together with the totality of our proposals. This will bring us new information about the improvements in the recognition accuracy, according to different recognition strategies. The evaluated types of noise should be the subject of further work, since this work has not dealt, for instance, with off-angle iris images. This will obviously introduce new challenges to the recognition that must be overcome, and predictably demand the adjustment of some of our methods to these new constraints.

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Human Vision Inspired Technique Applied to Detect Suspicious Masses in Mammograms

By Ehsan Kamrani & Mohamad Sawan
Ecole Polytechnique, Montreal, Canada; and Harvard University, USA

Abstract - Several competitive techniques have been applied for efficient image segmentation and automatic feature extraction through the literatures. There are a lot of open problems and controversial ambiguities regarding to the mechanism which applied by human eye for image segmentation and feature extraction. Here we have first extracted the human vision technique applied for image segmentation and we have implemented this technique for automatic image segmentation and feature extraction. The features have been categorized into the internal and external modalities. We have introduced the negative curvature minima (NCM) points as a dominant external feature and the textures detected using pulse coupled neural networks (PCNNs) and LAWs methods as the dominant internal feature used by human vision to segment and extracts the features of an image. These features have been used to detect suspicious masses in mammogram images using the proposed human eye inspired technique. The results justify the efficiency of the proposed method.

Keywords : Image Processing, Mammography, Segment Detection, Human Vision, NCM.

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HUMAN VISION INSPIRED TECHNIQUE APPLIED TO DETECT SUSPICIOUS MASSES IN MAMMOGRAMS

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Ehsan Kamrani [α] & Mohamad Sawan [α]

Abstract - Several competitive techniques have been applied for efficient image segmentation and automatic feature extraction through the literatures. There are a lot of open problems and controversial ambiguities regarding to the mechanism which applied by human eye for image segmentation and feature extraction. Here we have first extracted the human vision technique applied for image segmentation and we have implemented this technique for automatic image segmentation and feature extraction. The features have been categorized into the internal and external modalities. We have introduced the negative curvature minima (NCM) points as a dominant external feature and the textures detected using pulse coupled neural networks (PCNNs) and LAWs methods as the dominant internal feature used by human vision to segment and extracts the features of an image. These features have been used to detect suspicious masses in mammogram images using the proposed human eye inspired technique. The results justify the efficiency of the proposed method.

IndexTerms : Image Processing, Mammography, Segment Detection, Human Vision, NCM.

I. Introduction

Image segmentation plays a crucial role in many medical imaging applications by automating or facilitating the delineation of anatomical structures and other regions of interest. Many methods for image segmentation proposed by researchers have some advantages and disadvantages related to its application and purpose [1]-[3]. Almost all of these methods focus on development of a method to improve image understanding by computer and/or develop image representation for extract computerized parameters of an image. But we must note that the best intelligent and complicated image processing machine is human vision system. With no doubt, all what we know and use today as image processing techniques is only a little projection of our vision system [4]-[5].

We in our research, first study nearly all of the current methods that are in use for image segmentation, then we with study the human vision system parameters in order to detect and extract segments of an image, propose the dominant parameters that are used by human vision system for segmentation and understand the image [3]. Finally we applied these parameters to detect the segments of a medical diagnosis mammogram database and detect the tumors in the mammograms.

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In this paper at first we survey current image segmentation methods, and mammogram image processing techniques. Then we based on Kandel theorem and Minima rule, implement some experiments to detect dominant parameters of human vision system in image segmentation. Then we introduce NCM points and textures detected using PCNN and LAW operators as dominant features in an image and try to extract them. After that we augment our detected and proposed parameters with NCM detection technique to implement our new algorithm. Finally we have developed our method on a standard database of mammography images and depicted the results.

II. Mammogram Image Processing

Breast cancer is the most common cancer in women. Early detection of the cancer leads to significant improvements in conservative treatment. We based on study the almost all current methods in mammogram image analysis saw that nearly all of these methods are focused on internal features of image rather than external features.

III. Detecting NCM Points

Many objects have component parts, and these parts often differ in their visual salience. Based on the Kandel theory [6] which introduces edges as dominant features of an image, we have developed two different psychological experiments. In one of the experiments we understand the most effective factor of image edge that affect on human vision, and in the other one we found that the negative curvature minima (NCM) points are most effective points in an image that excite the human eyes [1].

IV. PCNN and Texture Analysis

We introduce the external feature on an image as dominant features and tried to detect them, but this is not enough to refuse the external features. So we select the PCNN and texture analysis using LAWs operators [7]-[9] as dominant external features that are much similar to and based on human vision technique for image segmentation.

V. Proposed Method

Detecting and extracting the dominant feature used by human vision system to understand segments

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of an image and introducing the most similar image segmentation techniques to human vision were our purpose. We have combined the internal and external dominant detected features and introduced our new method and schema based on it. After preprocessing of image and extract it's contours, at firs we using cubic B-spline technique to fit a curve on image contours, then we find the NCM points and connect them using Euler spiral. Then we select the regions based on some introduced parameters such as Proximity, Co-circularity, Transparency, and Sharpness parameters. Finally we apply the PCNN and LAWs operators to the extracted region to detect the segments (tumors) more accurately. This technique also improves the efficiency of PCNN and LAWs operators by limiting the processing region to a small region.

VI. Implementation and Results

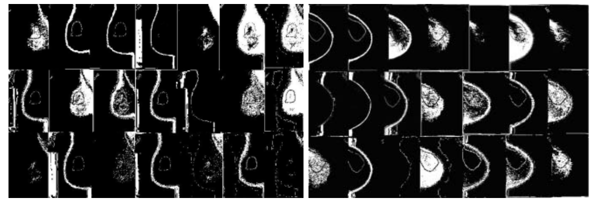
In order to study and analysis the efficiency of our method, we used 200 mammograms of DDSM Data base. We designed a package called HMAM for implement our method. With introducing two parameters of TPR (True Positive Region) and FPR (False Positive Region) we measure these parameters in different images and compare the results with traditional methods. Some of the results are shown in Table 1 and Table 2. Some of the results of the applying proposed method on a cancerous mammogram are shown in figure 1. We repeat applying the method on images and saw that the results are dependent on number of iteration (figure 3).

Table 1: FPR% and TPR% variation with tumor type and size of extraction for traditional texture analysis method

		Star masses		Regulated masses	
		FPR%	TPR%	FPR%	% TPR
Small Extracts	Low lev.	11	19	5	10
	Up lev	58	88	11	85
Big Extracts	Low lev.	1	97	0	84
	Up lev	19	89	5	93

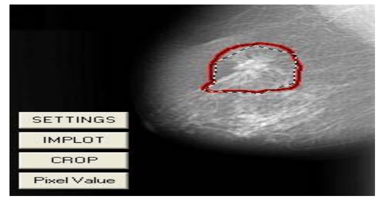
Table 2: FPR% and TPR% variation with tumor type and size of extraction for the proposed method

		Star masses			Regulated Masses
		FPR%	% TPR	FPR%	TPR%
Small Extracts	Low Lev	8	23	0	14
	Up lev.	50	88	12	89
Big Extracts	Low lev.	10	21	2	34
	Up lev.	150	72	155	93

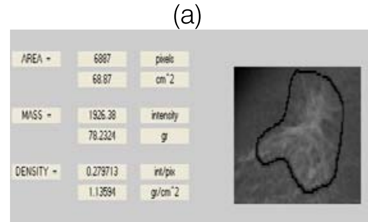


(a) (b)

Figure 1: Mass detection and extraction process regarding to the small (a) and big (b) masses



(a)



(b)

Figure 2: Detected mass (a) and its characteristics (b)

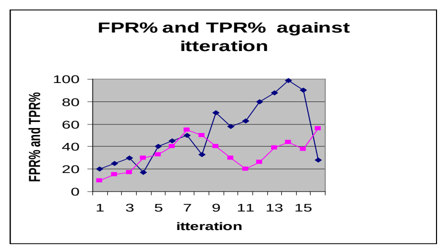


Figure 3: dependent of results on iteration

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3. Submission of Manuscripts,

4. Manuscript’s Category,

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- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.
- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

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- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

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- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
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- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

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Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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