The Improvement of Rough- set Theory Histogram in Color- image Segmentation

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Abstract

Roughness set theory is a popular topic to use in color-image segmentation. A new popular color image segmentation algorithm is proposed by scientists with the point using traditional histogram and Histon construct roughness set histogram. But, there is still a problem about that is the correlativity of color vector in roughness set histogram, which take an inactive effect in the process of color-image segmentation. Therefore, this paper represents further research based on this and proposed an improved method proved through lot of experiments. The experimental result reduces the correlativity of color vector in roughness set histogram and calculation time remarkably.

1. Introduction

Image segmentation is a key and difficult field of image processing, image analysis, computer vision and pattern recognition. It is an important problem in preprocessing stage in many applications. Finally, to the classification of the object Quality and the scene explain depends to a great extent on high quality division to lose out.

The histogram threshold value of image segmentation can use based on wide application of image segmentation method, its advantage is not to need any prior information about the image, the algorithm is simple, but failed to take into account each pixel in space ties. In order to overcome the disadvantages, Mohabey proposed Histon improved histogram [2], in the original histogram, it on the basis of the pixels and consider each pixel color around between the approximate relationship. But through the test showed that due to the original histogram Histon calculated on the basis of the value of the original, it more influence by histogram, in many cases and can't quite clearly and accurately reflects the pixels in space of contact, go against segmentation.

Mushrif and Ray[1], through the calculation histogram and Histon histogram, got rough set histogram, based on rough sets histogram method of using single peak subset color image segmentation. Visible, rough set histogram quality will directly affect the color image segmentation. In the paper [1] in the rough set histogram calculated, the contrast of histogram or Histon histogram may well get some tiny break up area, but, R, G, B rough set histogram of correlation did not get the overcome, which directly affect the segmentation result. In this paper the weakness was improved, committed to eliminate R, G, and B rough set histogram of correlation.

2. Concept of Rough Sets

Rough Set is a mathematical formulation of the concept of approximate (rough) equality of sets in a given approximation space. An approximation space is the pair (U, R), where U is the universe, and

$$R \subset U * U$$

is an indiscernible relation on U. The concept of Rough Sets consists of an approximation of a set by a pair of sets called the upper approximation and lower approximation of this set. Let $X \in U$, then

$\underline{R}(X) = \{x \in U : [x]R \subseteq X\}$, or

$\underline{R}(X) = \mathrm{U}\{y \in U \,|R : Y \subseteq X\}$ is the subset of all X such that X surely belongs to X in A is the lower approximation of X.

and

$\overline{R}(X) = \{x \in U : [x]R \,\mathrm{I}\, X \neq \varnothing\}$, or

$\overline{R} = \mathrm{U}\{Y \in U \,|R : Y \,\mathrm{I}\, X \neq \varnothing\}$

is the subset of all X that possibly belong to X in A, meaning thereby that X may or may not belong to X in A. This is the upper approximation of X as depicted in figure: 1.

The redact and core are evaluated for the reduction of knowledge. A redact of knowledge is its essential part, which suffices to define all basic concepts occurring in the knowledge base. Whereas, the core is in a certain sense the most important part of the knowledge.

$$CORE = \mathrm{I}\ RED(P)$$

Where RED (P) is the family of all redacts of P. A redact in essence is the core with additional attribute values such that the computed value in its entirety is independent, and that it's value is true. Let R be a family of equivalence relations and let R belong to R. R is dispensable in R if

$$IND(R) = IND(R - \{R\})$$

Otherwise R is indispensable in R. The family of R is independent if each R belonging to R is indispensable in R; otherwise R is dependent.

The Set of all indispensable relations in P is the core of P denoted by CORE (P).

The Set

$$BNR(X) = \overline{R}(X) - \underline{R}(X)$$

is the R-boundary of XI which is the set of all elements which cannot be classified in X or -X having the knowledge R. This region can be dilated or eroded by suitable application of a different knowledge base. The boundary

region is the focus of attention of the proposed concept

3. Histon histogram

Histon histogram is the concept of the Mohabey and Ray brought out, and the original histogram in the proc ess of calculation than it is to consider each pixel and i ts surrounding the approximate relationship between pixe l color and help to image segmentation. I was a size fo r M × N RGB image, I (M, N, I) said coordinates for (M, N) of pixels I primary colors component gray value , the R, G, B colors histogram respectively from the for mula

$$h i(g)=\sum_{m-1}^{M}\sum_{n-1}^{N}\delta\left(I(m,n,i)-g\right)$$
$$0\le g\le L-1 and\, i\in\{R\ G\ B,\}\ , \qquad (1)$$

δ( ) is Impulse function, g is gray value about pixel i primary colors. L is biggest grey value, h i (g) is i p rimary colors histogram function.

If pixels I (m, n) have the P×Q pixels, then it with around pixels distance is

$$dT(m,n)=\sum_{p\in P}\sum_{q\in Q}d\left(I(m,n),I(p,q)\right) \qquad (2)$$

$$d(I(m,n),I(p,q))=\sqrt{\begin{matrix}(I(m,n,R)-I(p,q,R))+\\(I(m,n,G)-I(m,n,G))+\\(I(m,n,B)-I(m,n,B))\end{matrix}} \qquad (3)$$

d (I (m , n) , I (p , q)) is pixel I (m , n) and I (p , q) of Euclid distance.

Define a M × N matrix of each element, it can get by type (4), which expanse is used to denote threshold a constant

$$X(m,n)=\begin{cases}1 & dT(m,n)<expanse\\ 0 & otherwise\end{cases} \qquad (4)$$

Histon by type (9) find out

$$Ht(g)=\sum_{m=1}^{M}\sum_{n=1}^{N}(1+X(m,n))\delta(I(m,n,i)-g)$$
$$0\le g\le L-1, i=\{R,G,B\} \qquad (5)$$

4. The rough set histogram

In Basic histogram and Histon histogram can and rou gh set theory of the concepts of space is connected. On e basic histogram pixel gray value according to the pixe l is divided into many subsets, each pixel can be clearl y to belong to own subsets, so it is as to the lower ap proximation is; And Histon histogram each subset of als o contain all around and the pixel color close, so it can be regarded as the upper approximation. According to t he relative concepts of rough set, the type (6) for the r oughness

$$p_i(g)=1-\frac{h_i(g)}{H_i(g)}$$
$$0\le g\le L-1, i=\{R,G,B\} \qquad (6)$$

Ⅴ. Improve the rough set histogram

According to the type (6), it is known that H I (g) f or roughness Q I (g) have a decisive role, and the d (I (m, n), I (p, Q)) and directly affect the H I (g). D (I (m, n)), I (p, q)) said pixels I (m, n) and I (p. q) of E uclid distance between, the type (3) we can see d (I (m , n), I (p, q)) R, G, B is highly related, so to get the r ough set histogram is highly related. For this, we introd uce the YUV color space, linear YUV color space can be partly eliminate R, G, B correlation, and Y often use d to boundary detection component. Thus, we improve t he d (I (m, n), I (p, q), such as type (7) shows, so it can improve rough set histogram of purpose

$$d(I(m,n),I(p,q))=|I(m,n,R)-I(p,q,R)|*0.299$$
$$+|I(m,n,G)-I(p,q,G)|*0.587$$
$$+|(m,n,B)-(p,q,B)|*0.144 \qquad (7)$$

5. Conclusion

Based on the rough set of color image segmentation, I propose that improvement Rough set histogram. The new way can shorten the computation time. But there are another many problem need to be solved. Such as Histogram de-noising etc. maybe in the future, let us do more research about it

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