

Sino-Japan Land Transportation Research Fall Mini-seminar'98, Disquisition Collection, 1998.10

The Application of Delamination Method in Map Recognition

Bao Yuanlu Zhang Wangshen

Wang Hongxing Hu Yusuo Guo Jiehuua

(Automation Department USTC, Hefei Anhui, 230027 PRC)

Abstract :

This article focus on the problem of color Map delamination. delamination is a key step of the recognition of Object in a color map. We applicated the method of delamination by color, some question of delamination effective and the way to them also supplied. These methods were programmed in computer.

Key words:

Map Color Delamination Clustering Recognition

Introduction

Scan A color Map through a scanner into the computer, then the information in the map was detected, this is an important application of computer.

Usually, a map contents 4 or more color, as to some special physiognomy, special color were used, such as the contour line marked with brown, water system, blue, forest, green, and so. Some marked with the same color, for example, The longitude, latitude, rail, region name and buildings were marked with black. When people make a map, the color assignment must be easy to recognize. When we study a map, we recognize the physiognomy by the color we receipt first. So, we could recognize the physiognomy by their different color in a recognition system. After some map in single color were made, it's easy to transact them .

However, it's some matter of delamination by color from a scanned business map, Because it could be have been polluted in color or in the paper which used to made the map. It's doesn't so when the map be read by the human eyes, but for the computer, an accurate device, the pollution can't be slightinged.

Some people or organization developed some System of Map Recognition, but as to the delamination method, It haven't been appeared or not esthetical. We supply the following two methods which have been actualized in Cyrix 6x86, the solution were exciting

1. The Method of Color Delamination

A scanned map could be in real color or in 265 fake color, in the purpose of using the color information of the original map, we should select the way of true color to scan.

As to a real color map, the scanner divided the image into lots of pels. Every pels carries the pigments of RGB(red, green, blue), every pigment in the pels was marked with 256 grades, this information stored in a byte. So, every pels was expressed with 3 Bytes, the color value in every pels was sorted.

In order to separate the physiognomy and mark from the background, we can record the color of these pels satisfies some special case, then we will get a map expressed in the array of pels, this map contents single color .

We assigned every pels to a pattern, by this way, an original map is a set of unknown pattern

$D=\{D_{11}, D_{12}, \dots, D_{mm}\}$, in which D_{ij} stands for the pels which coordinate is i and j in the map. m, n stands for the number of the rows and columns in this lattice of pels. Delamination by color will started with this lattice.

Suppose $\text{Color}(D_{ij})$ is the color of the pels D_{ij} , it's a vector of 3 dimensions.

$$\text{DColor}(d_{ij}) = (\text{Red}(D_{ij}), \text{Green}(D_{ij}), \text{Blue}(D_{ij}))$$

Suppose $\text{Dcolor}(D_{ij}, D_{kl})$ is a function stands for the color difference between the pels D_{ij} and D_{kl} :

$$\text{Dcolor}(D_{ij}, D_{kl}) = \sqrt{\text{Sqr}[\text{Red}(D_{ij}) - \text{Red}(D_{kl})] + \text{Sqr}[\text{Green}(D_{ij}) - \text{Green}(D_{kl})] + \text{Sqr}[\text{Blue}(D_{ij}) - \text{Blue}(D_{kl})]}$$

Now, we will classify the swatch in the method of enumerate clustering and smoothness clustering.

The procedure of enumerate clustering goes on :

- (1) Set some swatch to be special swatch, the color of these swatch set to be special color;
- (2) Specify the regimentation of these special swatch;
- (3) Assign an integer to be the valve of color difference.
- (4) Compare all the color difference between every swatch and special swatch with the valve, if the color difference less than the valve, this swatch belongs to the same regimentation, namely, if

$$\text{Dcolor}(D_{ij}, D_{kl}) \leq C$$

D_{ij} and D_{kl} belongs to a same regimentation, in which D_{kl} was the special swatch.

When this method be carried out, we could specify many special swatch in a same regimentation, we needn't specify any special swatch too, only specify the special color ; in the program, we can complete this action by the mouse . It's important to specify the valve, there will be miscarriage of justice if the improper valve. If it's needed, we could specify a series of valves.

Enumerate clustering works quickly, the purer the map is, the better.

But in many old map, many color were not pure, some of them may had been polluted. As to these map, smoothness clustering will be better. Which approach comes the following:

- (1) Specify the special color of some swatch;
- (2) Specify the 2 valves of color difference C_1, C_2 ;
- (3) Specify the regimentation of the special color;
- (4) Compare all the color difference between every swatch and special swatch with the valve, if the color difference less than C_1 , this swatch belongs to the same regimentation, namely, if

$$\text{Dcolor}(D_{ij}, D_{kl}) \leq C_1$$

D_{ij} and D_{kl} belongs to a same regimentation, in which D_{kl} was the special swatch.

- (5) Compare all of the unknown swatch with the nearest classified swatch in color difference, if

$$\text{Dcolor}(D_{ij}, D_{kl}) \leq C_2$$

This unknown swatch D_{ij} will belongs to the same regimentation with D_{kl} ;

- (6) Repeat step (5) until all swatch were classified.

The hypostasis of smoothness clustering is the trace of color, it will spend more time than enumerate clustering.

2. The implementation of these two methods

Although both enumerate clustering and smoothness clustering are effective methods in delamination by color, we could apply them depends on the idiographic condition.

(1) The special color ascertain of the surface element

The surface element will be a color block in the map, such as the lake, the sea, the vegetation and so on. But the color in the block will not be only one. We could use smoothness clustering as to surface element and specify the special color in this way: select a swatch in the center of the block, then draw a circle in which contents only one geography element, all the pels in this circle specified as special color.

(2) The ascertain of color difference

It's important of the value of the color difference valve. As to different color base, we should specify different valve.

Generally, valve to block element should be small, the linear element could be some big.

(3) The scan order in smoothness clustering

In the approach of smoothness clustering, we should function the color difference between every unknown swatch and nearest swatch, but the number of unknown swatch is large, and the nearest classified swatch will not be only one, it's needed to nail down the scan order. It's possible to scan some times to a unclassified swatch.

We could scan a map from the top to the bottom, and from left to right in a same line. After this, we could scan from the bottom to the top and from the right to the left in a line.

(5) Create the Record file

Delamination, namely, is to classify by color. In the application, is to create a data file, assigns every data with one pels in the map.

In order to improve the classify rate, we need use the properties of new pels, and mark new or old pels in the data file. Usually, we specify the new pels i with $2I$, where the old pels We assign with $2I+1$. When every swatch were scan near a new pels, this new pels becomes old one. plus one to the corresponding data in the record file

(5) The order of Delamination

We could get many layers in one clustering procedure, or get only one layer in one procedure. This two have their own advantage.

3. Conclusion Remarks

The automatic recognition of a color map is a difficult work, in which the automatic delamination is the key step, it take both academic significance and applied one. The problem We discussed is the question we met in the practice, the methods applied to it have been implemented in Cyrix6x86, we spent 6 minutes and 35 seconds in the delamination of a map scanned by common scanner with 200dpi, in the map contents 9 million pels. We get 5 layers, the recognition is useful.

Reference literature

1. Jiang qinquan, Recognition of map input, Electronic Engineering today, 1989 (1) :69-75;
2. Yang Guangzheng, Pattern Recognition, Hefei USTC press ,1993;
3. Zhou Huayuan, Map recognition by computer ,SJTU journal,1993 (6):26-32;
4. Kasturi R,Alemang J. Information extraction from imagex of paper-based maps. IEEE Trans.On software Engineering, May 1988, 14(5):671-675;
5. Pavlidis T. Algorithms for Graphics and Image Processing. Computer Science Press,1982;