Multi-spetral Data Integrated Process and Its Multimedia Expression in GIS

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Abstract: This paper introduces the basic types of multi-spetral data, and discusses the basic expressing and integrated displaying forms, namely multimedia map. Expressing of multi-spetral data and their relation of multimedia integration are described by use of time-stamp. Finally, application example of multi-spetral information and multimedia integrated display are also given.
Keywords: Multi-spatial information, Multimedia integration, Multimedia map, Time-stamp.

1 Basic types of multi-spetral data

The multi-spetral information can be divided into remote sensing data, spatial data of GIS, DEM(namely Digital Elevation Model) Data, GPS(namely Globe Position System) Data and statistics data of associate economics based on the data captured method. The remote sensing data is one important data for GIS, especially, it is the foundation for the establishment of three-dimensional terrain expressing and virtual realization. The remote sensing data from aero-photogrammetry and satellite image are usually used to produce digital ortho-maps. It can display the distribution conditions of wide landform area, certainly, can display detail condition of small area. Data of GIS are mainly include all kinds of data from spatial analyzing results in GIS or from database of GIS, not only they are used to express the basic conditions, for example, communication condition, water system, terrain condition and so on, but also integrate with image to produce three-dimensional stereo-map, and are combined with statistics data to produce all kinds of thematic map. DEM data are the digitalization expressing of topographic condition. GPS data are mainly used to position, and it is the main method of modern geodetic. The statistics data of associate economics are the main one content of national information infrastructure. Usually, they are combined with the foundational data to analysis spatial distribution characteristics and produce another useful information.

2 Expression and integrated displaying form of multi-spetral data

2.1 Basic expression form of multi-spetral data

All kinds of multi-spetral data can be expressed using text, graphics, image, sound, animate and video and so forth.

1) Text media. In the multimedia information system, text is the most one popularization and useful expressing method of spatial information. For example, all kinds of text introduction, system header, function menu, explanation, geographic name, quality and quantity. All of them are the important contents in information system, such as geographic name database, statistics database.

2)Graphics media. In fact, graphics media in multimedia information system is all the kinds of map expressed and stored using vector data. Sometimes, it is called as vector graphics. All kinds of map are actually projection of spatial point set on two-dimension plane. They can be divided into three basic elements such as point, line, area. Everyone element includes geometry position and corresponding attribute. Three elements can be expressed and organized as following forms.

Point can be expressed as couple of coordinate such as X and Y, namely, Point = (X,Y).

Line can be expressed as a series of coordinates X and Y, namely,

$$\text{Line} = \{(X_1,Y_1), (X_2,Y_2), \ldots\ldots, (X_n, Y_n)\}$$

Area can be expressed as a series of coordinates that start is equal to end, namely,

$$\text{Area} = \{(X_1,Y_1), (X_2,Y_2), \ldots\ldots, (X_n, Y_n),(X_1,Y_1)\}$$

3) Static image media. Static image is one visual elements that actually display terrain form. It includes satellite image, aero-image, photo and raster graphics. Satellite image and aero-image are widely used to display spatial distribution of geographic environmental elements as background, or combine with DEM to produce three-dimension terrain model.

4)Video image media. Video media is the most one important dynamic seeing media. It can vividly and actually re-display real conditions of terrain or someone phenomenon.

5) Digital audio-media. Sound is the indispensable content and component in multimedia information system. The sound in multimedia information system mainly includes background music and text introduction. They are important content of media data procession in multimedia information system.

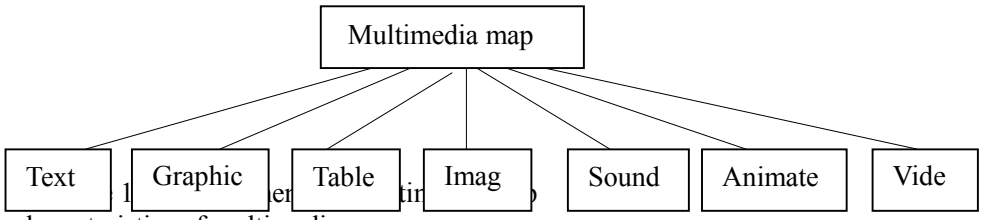
2.2 Integrated form of multi-spetral data

All of above-mentioned basic expressing forms can be integrated using multimedia map.

1) Basic concept of multimedia map

Multimedia map is a new kind of map that combined with text, graphics, image, sound, animate and video to put many media together and form a spatial information visual production or tools based on the hardware and software. In a word, multimedia map is a new kind of map that integrate function of text, graphics, image, sound, animate and video media into one form.

Thus, multimedia map includes text, graphics, image, sound, animate and video media and son on. They are composed of basic elements of multimedia map and can be showed as figure 1..



2) Basic characteristics of multimedia map

The basic characteristics of multimedia map can be summarized as follows.

a) Inter-operation. For the traditional map, map users only can search some information by use of legend. Apparently, the results of using map are usually difficult for some no-professional users. But by use of multimedia map, map users can visually and actively query some information what her needed recur to icon, button and menu function.

b)Dynamic characteristics. The traditional paper-map is only one static symbol graphics since it integrate content and expression into one form. But in multimedia map, not only it can dynamic display spatial information using twinkle and rolling function, but also can display and query all kinds of spatial information using ramble, animate and video forms.

c) Integrated characteristics. The multimedia map can synthetically expressing spatial information using integrated form of many media such as text, graphics, image, sound, animate and video media and son on.

3 Integration Relation expression of multi-spetral information

For the multimedia spatial information, not only we need to process all kinds of media data, but also need to describe and express integrated form for all kinds of multimedia data. Among of All kinds of media usually has close-relation. Therefore, we need to study description of cooperated-relation among all kinds of media. Here, we quote Time Interval, and using Time Stamp(TS) to describe and express cooperated-relation among all kinds of media.

3.1 Time Interval and its relational description

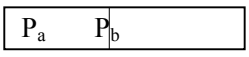
1)Concept of Time Interval

Definition 1. Let [E.ó]is a part of ordered set, where E stands for someone event, T_a.T_b are two time unit. If T_aóT_b, then, set.t| $T_a$ótóT_b.or t.[T_a.T_b] is called as Time Interval.

In other words, Time Interval is a non-time sect what anyone time unit denoted. Time Interval maybe long or short, it is a describing method for time.

2) Relation of Time Interval and its describing method

According to the characteristics of time, the relation of Time Interval can be summarized as seven, that is Before, Meets□During□Overlaps, Starts□Ends□Equal. Let P_a and P_b are the handling process of event E, and its corresponding duration is T_a and T_b□then, among their relation –ship can be given as figure2.



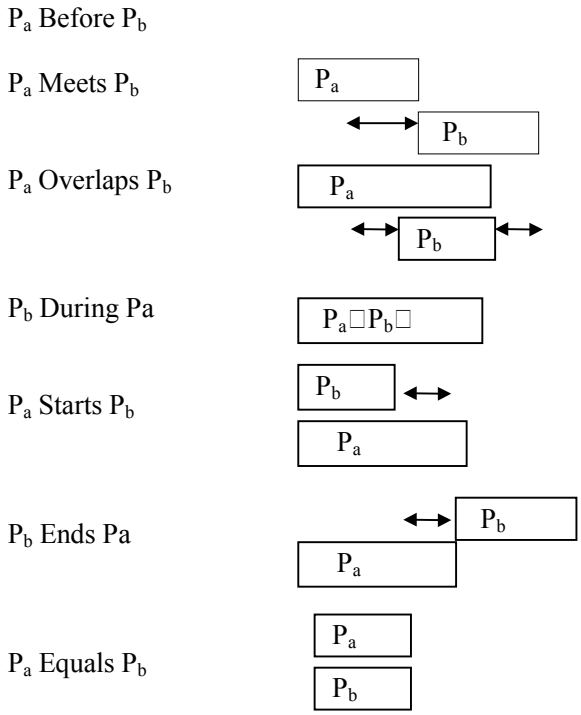


Figure 2 Time Interval and its relational description

3.2 Description of media cooperated relation ---Time Stamp

Definition 2. Let someone multimedia object situates zero relative time system, then, the position of media unit at someone moment in relative time system is called as Time Stamp(TS).

Based on this definition, everyone media unit has one *TS*. During the system display, media units that has the same *ST* will represent at the same time.

Definition 3. Let media unit . $_m$ is produced by main equipment / $_m$, and . $_s$ is produced by sub-equipment / $_s$ .When it is true that / *Gr*(*Um*) - *Gs*(*Im*) - (*Gr*(*Us*) - *Gs*(*Is*)) / ó *d*, we call U_m and U_s are synchronous set.

Where, *Gr(Um*□is the real time of U_m ,and *Gr(Us*□is the real time of U_s . *Gs(Im)* is the start time of media object based on I_m , and *Gs(Is)* is the start time of media object based on I_s . *d* is the largest non-synchronous time of media unit that is decided by system and users. *TS* of media unit is decided by *d* and I_m .

Based on the above-mentioned, during the display of multimedia information system, firstly, displaying equipment send a reactive unit in which includes *TS* value of media unit to present main equipment I_m .The main equipment I_m judge the time interval relation of present displaying media unit by aids of *TS* value of reactive unit, if they are synchronous set, then display at the same time. Otherwise, displaying equipment will search next media unit.

3.3 Description and basic algebra operation

Based on the above-mentioned principle of *TS* and synchronous set, we can use two meta predication to describe the cooperated relation of media object. Let *S(t,O)* stands for scheduling operational formula of object *O* at some one time t_0 during the time *t,* and $S(t_0, \rho)$ stands for condition of ρ at time t_0 .Then we have,

(1) If ρ is O_1 at O_2 , then,

$S(t_0, \rho)=S(O_2, O_1), O_2>t_0$

Otherwise, we have,

$(\exists\rho)(O_1 \text{ at } O_2)<=>S(t_0,\delta)=S(O_2, O_1)$

(2) If ρ is O_1 simultaneous O_2, then,

$S(t_0, \rho)=S(t_0,<O_1, O_2>)$

Otherwise, we have,

$(\exists\rho)(O_1 \text{ simultaneous } O_2)<=>S(t_0, \rho)=S(t_0,<O_1, O_2>)$,

(3) if ρ is O_1 Before O_2, then,

$S(t_0, \rho)=(\exists t_1)(t_1<t_0)\square\forall(t<t_1)(S(t, O_1)\square\neg S(t, O_2)\square\forall t(t>t1)\vee\neg S(t, O_1)\square S(t, O_2)$

(4)If ρ is O_1 meets O_2,, then,

$S(t_0, \rho)=(\exists t_1)(t_1>t_0)\square(\forall t)(t< t_1)(S(t, O_1)\square\neg S(t, O_2)\square(\forall t)(t > t_1)\vee \neg S(t, O_1)\square S(t, O_2)$

4. Application example of multi-spetral spatial data integration

Application of the multi-spetral spatial data integration can be realized in multimedia GIS. Here, we give a simple example as figure 4.

In figure 4, TM image as background to express outline and basic geographic characteristics of Hainan island.. text describe general condition of touring area. Photo and video show the real sight of touring area. Sound introduce general condition of touring area, and sound, text and video can be displayed at the same time. Thus, integrated expression of multi-spetral spatial information and multimedia has realized.

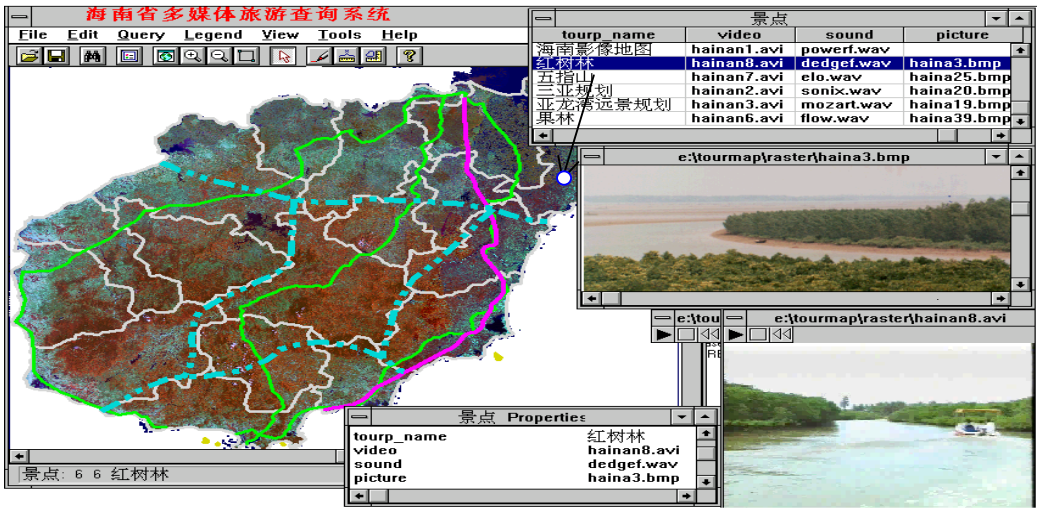


Figure 4 Application example of multi-spetral spatial data integration in multimedia GIS

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