A Integrated Service Platform for Remote Sensing Image 3D Interpretation and Draughting based on HTML5

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Abstract. The purpose of this paper is to solve the problems of the traditional single system for interpretation and draughting such as inconsistent standards, single function, dependence on plug-ins, closed system and low integration level. On the basis of the comprehensive analysis of the target elements composition, map representation and similar system features, a 3D interpretation and draughting integrated service platform for multi-source, multi-scale and multi-resolution geospatial objects is established based on HTML5 and WebGL, which not only integrates object recognition, access, retrieval, three-dimensional display and test evaluation but also achieves collection, transfer, storage, refreshing and maintenance of data about Geospatial Objects and shows value in certain prospects and potential for growth.

Keywords: Integrated Service Platform, 3D Interpretation and Draughting, HTML5

1. Introduction

As the foundation of Remote Sensing Image Processing, Remote Sensing interpretation and draughting can interpret and extract ground objects from images accurately and completely, it can dig out the value of the data and pave the way for the follow-up work. Thus, even in the case of developed and prevalent digital processing technology of various remote sensing data, interpretation and draughting technology for Remote Sensing images is still one of the most fundamental, common, effective and important Remote Sensing information processing technologies.

At present, most of the remote sensing training systems are based on single machine, platform or plug-in, such as the Remote Sensing Image Group Interpretation System designed by Liu Yalan, Yan Shouyong et al.¹, Remote Sensing Image Interpretation Training System designed by Song Yingjin et al.² and Remote Sensing Image Interpretation System Based on "Platform / Plug-in mechanism" designed by Tan Xiangrui et al.³, having the problem of different interpretation criteria, single function, high plug-in dependency, closed system and bad integration. The emergence and development of HTML5 that has features of compatible equipment, offline storage, free plug-in three-dimensional network display etc, provide a new way in to solve these problems. Then a 3D interpretation and draughting integrated service platform for multi-source, multi-scale and multi-resolution geospatial objects is established based on HTML5 and WebGL, achieving the functions of collection, transmission, storage, updating and maintenance of target information data. It all-directionally and integrally making operators carry out geographical space target interpretation, access, retrieval, 3D display and the testing and evaluation of training via the wide area network and improves the operational level of the operator and work efficiency quickly.

2. The overall design of platform
2.1. The objectives and functions
The platform is designed based on wide area network with "Two Points and One Line" as pivot (the administrator and the operator for two points, the geographical space target interpretation learning as the line). A integrated human-computer interaction network system is completed to collect, transfer, store, update and maintain the geo spatial object data by Web, which will greatly improve the efficiency of the collection, management and sharing about the target information data. At the same time, the administrator can maintain, manage and update the system. It also can effectively monitor, count and analyze the training results in the background.

The platform mainly consists of 4 parts: composition and characteristics of spatial objects, design of geo spatial object database, training evaluation of typical target interpretation and draughting based on Network, 3D visualization of geo spatial object network. The "Administrator" and "Operator" two user login mode is adopted by the platform, having respective different functions and permissions. The overall system function structure is shown in figure 1.

2.2. The overall structure of the platform
This platform mainly consists of two parts, the server and the browser. The browser mainly includes the login window, the basic knowledge learning window, the geographical space target interpretation and annotation window, the 3D display window and other parts, providing a visual operating interface. The server side mainly refers to the data layer and web service layer. The data layer mainly includes image data, 3D model data, object map data, basic knowledge information data, etc., all stored in a
certain format. The whole platform is built based on JavaScript, WebGL and other languages, developed by JetBrains WebStorm 10.0.3 System, whose Web Service layer is constructed by the open source web application server Apache Tomcat. The overall architecture is shown in figure 2.

![Overall Structure of the Platform](image)

**Figure 2. Overall Structure of the Platform**

### 3. The implementation of the platform

#### 3.1. The analysis of typical geo spatial objects and establishment of database

It forms the knowledge information database by classification and arrangement the basic knowledge about the target, the content of which mainly includes the definition, the basic knowledge, the main points and the rules of the target acquisition, etc and it is supplemented by the way of the administrator to add and maintain the basic information knowledge database.

The platform database consists of two parts: the business database and the non-business databases, as shown in Figure 3. The business database is the establishment of typical spatial object database, including the target image database, the target map database, the target ground photo database, the 3D model database, the basic knowledge database and so on; non-business database includes user database, authority distribution database, etc.

![Structure of the Database](image)

**Figure 3. Structure of the Database**

#### 3.2. Interpretation and draughting of remote sensing images based on flash

After entering the system training, the operator chooses the target to be trained, and then the image and the object graph are displayed by the image database and the corresponding target database, which
is shown in Figure 4. Fast Fuzzy Query and Classification-based Retrieval of arbitrary objects are designed, which is more convenient for users to learn and browse.

Figure 4. the Module of Interpretation Knowledge

Flash is an interactive animation design tool, as the main programmable vector image processing technology in the current Web browser. There is no distortion in the operation of the vector maps that are made by Flash zooming in and zooming out. Its characteristics of the vector and the nature of the network applications, can be very good to meet the requirements of spatial data graphics display very well. This module mainly uses the Flash+HTML5 technology. The main principles and processes are shown in figure 5.

Figure 5. the Principle of Interpretation Training

3.3. 3D visual interpretation of geo spatial objects based on HTML5

The function of this module is mainly realized by the HTML5+WebGL+ third party library ht.js. HTML5 is another revolutionary technology after HTML4 introduced by W3C organization[4]. It is the open source that makes HTML5 different from HTML4. Therefore, it supports most of the
browser and has significant cross platform characteristics. In addition, HTML5 also adds a lot of new features, such as equipment compatibility, offline storage, free plug-in 3D network display, etc. The Canvas elements in HTML5 makes it possible to display high performance animation in the browser. It designs an API supporting the browser calling graphics card to draw, which can make the JavaScript complete the draughting of 2D and 3D elements in the web by calling the WebGL. The direct rendering of 3D graphics in the web by Canvas elements and WebGL not only has the feature of 3D hardware acceleration but also possesses the characteristic of free plug-in.

WebGL is a 3D drawing standard, which can provide hardware 3D accelerated rendering for Canvas HTML5. So you can create more complex 3D Web scenes without the support of the rendering plug-in.

HT is a one-stop solution for the development and application of graphical interface based on HTML5, of which the core library is ht.js, containing rich graphical interface development package such as generic component, topology component, 3D rendering engine and so on. It provides sets of visual design tools based on HTML5 such as vector editor, topology editor and 3D scene editor, and provides a powerful 3D graphics engine based on WebGL technology. The component showing 3D view in HT is ht.graph3d.Graph3dView. The structure of Graph3dView interface DOM is composed of the bottom of the DIV elements and rendering layer Canvas elements. The bottom of the DIV element can derive from getView () function. The rendering layer Canvas elements can derive from GetCanvas () function. Default interaction events of HT are added to the underlying DIV element and can also directly use the returned elements of getView () to add an event listener to achieve user custom interactive extensions.

Three dimensional mode with .Obj format contains .Obj files and .Mtl files. OBJ file describes the model vertex, surface and map coordinates and other related information of geometric models. The material information of model such as texture images, colors and so on is described by the additional MTL material file, generally using .Mtl suffix. It’s more convenient to realize visualization on Web page by importing the three-dimensional model with the texture using the ht.Default.loadObj () function. Part of the code of aircraft model visualization is as follows:

```javascript
ht.Default.loadObj('obj/plane.obj', 'obj/plane.mtl', {
  cube: true,
  center: true,
  shape3d: 'plane',
  finishFunc: function (modelMap, array, rawS3) {
    var node = new ht.Node();
    node.s3(70, 70, 70);
    node.p3(-300, 0, 0);
    node.s({'
      shape3d: 'door',
    });
    dataModel.add(node);
  }
});
```

For example, in the interpretation and draughting of the radar target, the 3D model and 2D image of radar can be observed at the same time in the visual window. Its 3D model can be controlled by the mouse wheel to complete the movement, scale operation, which will form a full range of 3D visual perception of the target. The display window of the radar target is shown in figure 6.
4. The conclusion
This paper introduces an integrated platform of geographic space target interpretation and draughting based on HTML5, achieving the integrated service of autonomous learning, access, retrieval, geographical space target interpretation and 3D display, test and result evaluation in the network environment. It effectively solves the existing problems in the traditional platform such as inconsistent standards, single function, dependence on plug-ins, closed system and low integration level. The platform with the advantages of standardization, free plug-in, cross platform, openness and so on has a strong development potential.

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