Remote Sensing using Object Knowledge Method

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***Abstract* - For remote sensing understanding the image knowledge plays a very important role. We have considered various kinds of knowledge related to remote sensing image understanding, and present a knowledge representation (KR) architecture. In the KR architecture, knowledge is classified into six types, including image knowledge, object knowledge, algorithm knowledge, environment knowledge, integrated knowledge, and task knowledge, which combines knowledge from computational intelligence and symbolic representations. Among these we have chosen object knowledge for preposition logic, and we have illustrated the same with an example. This example shows the representation of object knowledge which satisfies the steps required to build a good knowledge object system.**

Keywords: Object knowledge, KR architecture, Environment knowledge, Remote sensing;

I.INTRODUCTION

For military mapping and surveying, survey on resource, planning for land, surveillance of marine use of remote sensing image understanding is very important. In remote sensing image understanding knowledge claim a very important role. An image understanding system can also be considered as a knowledge-based vision system. And the use of knowledge in the automatic methods is necessary [1,2].

There is much work has been done about knowledge classification and representation in remote sensing image understanding. R.C. Gonzalez, R.E. Woods [3] in Digital Image Processing explains the classification of knowledge related to image understanding. The knowledge is classified into three types: visualization knowledge, programming knowledge, and biosphere knowledge. Imaging process is represented by visualization knowledge. The operations such as selecting an algorithm is represented by programming knowledge. World knowledge represents the all-inclusive or universal knowledge. According to Baltsavias [4] knowledge is of four types: the target objects and their context within the scene, for object extraction the input data to be used, the application ofprocessing methods, and the controlling mechanism. According to Baltsavias the first aspect is the very essential one.Yu[5] in his thesis,considers knowledge is of two types: descriptive knowledge and procedural knowledge. Till now the types of knowledge according to various authors has been discussed, now discuss about knowledge representing methods. For remote sensing image understanding systems many methods are used. T. Matsuyama and Hwang, [6] to signifies knowledge frames are employed. J. Buckner, M. Pahl, O. Stahlhut, in geoAIDA, [7] for knowledge representation semantic network is used. Along with this languages for image processing, databases for image token, languages for logical programming and description logic systems are used for KR in image understanding.

However, some problems still exist in knowledge classification and representation: (1) methods for KR in many image understanding systems are traditional symbolic ones, which is not good in representing knowledge from computational intelligence and other knowledge such as image ROI masks, [9] etc.

In this paper, we extant a KR architecture for remote sensing image understanding systems. This KR architecture covers many kinds of knowledge with respect to remote sensing image understanding. The KR architecture contains six types of knowledgewhich are: image knowledge, object knowledge, algorithm knowledge, task knowledge, environment knowledge, and integrated knowledge as described in figure.1. In the KR architecture, algorithms does not includes object recognition or object detection, but includes low-level image processing methods such as edge detection, corner detection, and simple inferences. Task knowledge representation is based on agent to finish a corresponding task each item of task knowledge corresponds to an agent called task agent. To fill the gap between high-level semantic descriptions and low-level image features, task agents are used.

The sections we are going to discuss in this paper is organized as follows. The principles considered for

establishing the architecture is discussed in section II. The classification of knowledge, and proposed system for representing knowledge is discussed in section III. Finally, in section IV we concluded about this paper.

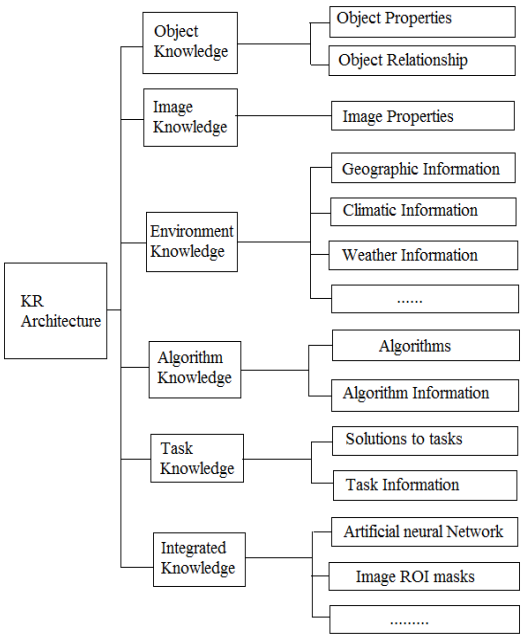

Fig 1: Types of knowledge in KR architecture.

II. THE PRINCIPLES CONSIDERED FOR ESTABLISHING THEARCHITECTURE

The knowledge-based remote sensing image understanding systems provides base for a KR architecture [1]. The following principles are considered:

- *Comprehensiveness:* The suitable knowledge related to remote sensing image understanding should be provided by a KR architecture. This comprehensiveness principle which has anexcessiveinfluence on knowledge learning and updating is comprehensiveness.
- *Independence between different knowledge types:* According to the various fields related to remote sensing image understanding the knowledge is classified and represented independently. This principle refers to preventing pairing between different knowledge types. This principle gives a benefit of knowledge updating and maintenance.
- *Efficiency of knowledge retrieval:* The KR architecture contain a lot of knowledge with knowledge learning of remote sensing image understanding systems. In the process of architecture establishment this principle has to be considered.
- *Conveniency of updating knowledge:* According to Meystel and Albus the definition of completeness of KR is any knowledge representation is incomplete [9]. To improve the performance of image understanding systems, the capability of knowledge updating appropriately should be included in the KR architecture.

The KR architecture including these principles for establishment ensure that the architecture has good properties, for remote sensing image understanding systems which provides knowledge services.

III. CLASSIFICATION AND REPRESENTATION OF KNOWLEDGE

A. CLASSIFICATION OF KNOWLEDGE

We classify knowledge based on a comprehensive principle of variety of knowledge correlated to remote sensing image understanding in the KR architecture into six types, which includes image knowledge, object knowledge, algorithm knowledge, environment knowledge, integrated knowledge, and task knowledge. Each of these knowledge type is described below.

The goal of remote sensing image understanding is to automatically find and label major objects in the remote sensing image. There are many major objects contained in remote sensing image, such as roads, airports, ships, buildings, etc. Variety of objects have various features due to different materials, components, shapes, etc. The descriptive information of objects is necessary, when finding objects automatically for image understanding, which is the KR architecture's first knowledge type that is, object knowledge. The object knowledge is only dependent on objects, which is the descriptive information about the properties of object. This type of knowledge refers to the descriptive information of single object and the relationship between objects. The relationship contains subordinate relationship, such as fighter plane and plane, and component relationship, for example, an airport contains airport runway, dispatcher center and parking apron. This kind of knowledge is unvarying in different environment nature.

With image sensors, climatic conditions, elevation, shooting angle, and so on, the imaging process of remote sensing images has nearby relationship. In different remote sensing images the same area or object shows different image features. Hence, the information of remote sensing images is necessary during remote sensing image understanding. The image knowledge is the imaginative information of remote sensing images, related to the imaging process, including resolution size, image type, latitude/longitude coordinates, shooting angle, time, etc. Using existing remote sensing systems the image knowledge is represented.

In case of environment knowledge, environment has an important effect on imaging process of remote sensing images. Here, environment mainly refers to climate, geography and weather. Environment knowledge is the information of environment such as geographical information, weather and climate. This kind of knowledge

can be represented with the help of existing information systems, which correspond to geographic information system(GIS), weather information system and climate information system. Digital elevate model (DEM) is also an important type of environment knowledge.

For low-level image process methods, algorithms are used such as edge detection, simple inferences, and corner detection. But these algorithms does not include object detection. There is no direct relationship between semantic descriptions and algorithms, and these are low-level operators. The algorithm knowledge includes descriptive information about algorithms. Descriptive information of algorithm defines the descriptive information of an algorithm and also the relationship among algorithms. An algorithm descriptive information contains function, name, working conditions, input, executable address, and output. The relationship consists of subordinate relationship, which gives benefits to management of algorithm.

B.PROPOSED SYSTEM FOR REPRESENTING KNOWLEDGE

We propose the following method and properties for the KR architecture to work much more efficiently along with the images.The following steps/properties are to be satisfied by such architecture:

i) Representational completeness.

ii) Inferential completeness.

iii) Efficiency in the inference made.

iv) Efficiency in getting the knowledge.

Examples of proposed Architecture

A knowledge object can be described as the subject matter content or the knowledge which can be taught. It is type of knowledge which is used in KR architecture for recognizing the knowledge components. It provides a way to organize the knowledge base of content resources such as text, video, graphics and audio. Knowledge objects contains components which are not specific to a particular subject domain. A knowledge object has five important components:

- The person, symbol, thing, object, place and devices;
- Parts of an entity;
- Qualities and quantities of an entity;
- Actions associated with an entity;
- The processes which are triggered by an entity;

Consider an example, "The smell of a wood fire makes me think of camping". This sentence can be represented as shown in Table1.

Sentence	**The smell of a wood fire makes me think of camping.**
Part:subject	The smell of a wood fire
Part:simple subject	Smell
Part:predicate	Makes me think of camping
Part:simple predicate	Makes….think
Property:purpose	Make-a-statement
Property:number of complete thoughts	One

Table 1: Sentence instances in the knowledge object

IV. CONCLUSION

Knowledge representation plays an important factor for measuring the performance of remote sensing image understanding systems. In this paper, weare representing KR architectureswith respect to object knowledge with a bit of remote sensing image understanding. Among the 6 knowledge types, we are choosing the best techniques and we have given sufficient example to depict a well versed representation of object knowledge. This is beneficial to remote sensing image understanding and greatly improves the efficiency of image understanding systems. Meanwhile, we employ preposition logic, which helps in grouping a set of objects.

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