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Procedia Computer Science 103 (2017) 495 – 498

Procedia Computer Science

XIIth International Symposium «Intelligent Systems», INTELS'16, 5-7 October 2016, Moscow, Russia

Approach for forming the bionic ontology

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Abstract

In this paper we present our considerations about metadata and ontology application for raising the quality of pertinent information resources retrieval. Main aspects of ontology formation are discussed and the outcome fragment is presented.

Peer-review under responsibility of the scientific committee of the XIIth International Symposium "Intelligent Systems"

Keywords: intellectual system; bionics; bionic technologies; pertinent information resources; knowledge engineering

1. Introduction

Searching information on a particular subject is a difficult task. For example, the bionic study requires data from various sources such as private databases, libraries, different publications. The problem is that these information resources are fragmentary and heterogeneous. Not many of them are consistent and well-ordered, what causes problems even in local search. Also, the contained data can be represented in a variety of formats, e.g. text, graphics and multimedia and have no common indexes.

Separate and detailed examination of Internet-based information resources reveals a set of inner obstacles which lead to the above mentioned situation. This includes inconstancy of datasets, weak normalization and inconsistency, large amounts of overall data.

It has become apparent that despite an increase in the information amount, the results of information retrieval lack pertinence. In this case, the term "pertinence" means the degree of compliance between the output and user's expectation even when the search request is not distinct[1].

Other words, the request result must be pertinent even if the user does not have experience of writing search queries. Such requirement can be explained the following way: the primary goal of the search system is to reply the user

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Peer-review under responsibility of the scientific committee of the XIIth International Symposium "Intelligent Systems"
doi:10.1016/j.procs.2017.01.033

request. This request can demand the particular document, containing pertinent data, or conversely, the aggregated data from a set of the documents which belong to the definite resource. If there is no match, user must be given a detailed explanation of the situation. Thus the problem of information retrieval also includes the issues of knowledge extraction.

Theoretical and practical studies of this problem result in various solutions. Good results have been achieved within the Semantic Web[2], which application sufficiently facilitates the semantic-level document retrieval.

2. Rising quality of the pertinent resources search

In order to improve the quality of the search required the user to information resources in the study of the creation of intellectual information system supporting the creation and development of advanced bionic technology processes have been developed proposals for the use of:

In order to improve the outcome of the information resources retrieval, the former study was conducted. Its aim is to develop methods and techniques for providing user relevant information resources in the scope of bionics. We examined the further entities and issued the recommendations of their practical application:

- metadata[3,4,5];
- ontologies[6,7,8].

The word "Metadata" has a meaning of "data that provides information about data"[9], or "data about data"[10].

The primary purpose of metadata is to determine data characteristics and formalize them in a way that will make it possible to store and process metadata separately from the original dataset.

Depending on the context, the concept of metadata can be more narrow: "metadata is information which describes the data semantics and is represented in a machine-readable form" or "Metadata – data property that determines its inner structure, possible range of values and the ways of their representation, the relationship with other data, allocation method and other characteristics of data which provide heuristics on how it is stored and processed"[11]. However, most definitions come down to the fact that metadata is information about electronic information resources that can be recognized and used properly.

Applying metadata in information storage and retrieval can significantly reduce the chance of getting irrelevant data for user query what leads to the increase in the pertinence in the outcome. Also, metadata can be used to satisfy the requirement of data interoperability. This means, that any dataset which is produced when solving a particular task can be used for the further study, i.e. this requirement emphasizes that any solved task provides knowledge that must be aggregated.

Knowledge aggregation, representation and utilization in information retrieval require the formal representation of the particular scope and can be implemented in an ontology.

Ontology – an agreement on the general use of concepts, which comprises means for presenting knowledge. It can be regarded as a certain image of the world related to the particular discourse, which consists of a set of terms and rules, constraining usage of the terms[12].

Practical implementation of ontologies will make it possible to retrieve bionic resources which are relevant to the initial user query.

It should be noted that using ontologies allows the appropriate software (intelligent agents) to determine the meaning of the terms used in the description of the resources and associate it with the semantics of the current problem automatically (without human supervision)[13].

Ontologies are of great practical importance: they are used in solving problems of artificial intelligence, software engineering task, etc.

3. Bionic ontology formation

The bionic ontology was formed as a part of a research project on creating the intellectual support system for creation and development of state-of-art bionic technologies. The main purpose of this research is to provide a tool for free knowledge exchange on the bionic discourse based on a single conceptual representation of the particular scope.

Forming the ontology requires:

- definition of concepts and relations between them;