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Knowledge Base Reuse With Frame Representation In Artificial Intelligence Applications

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Abstract

The creation and upkeep of knowledge bases have emerged as the primary issue in artificial intelligence development. The knowledge domain is expanding, and application interoperability is urgently demanded. To accommodate this modification, the knowledge base, which serves as the foundation of the artificial intelligence architecture, must be updated. XML (extensible markup language), RDF (resources description framework), DAML (DARPA agent markup language), OIL (ontology inference layer), and OKBC are just a few of the standards that have been introduced as a result of the development of the internet (Open Knowledge-Base Connectivity). One type of knowledge representation that can store information and facts about a subject is frame-based representation. The OKBC, which can help with knowledge base interoperability, supports this approach. In this work, the main issues covered are the comprehension and fundamentals of knowledge base creation with frame representation. To better understand how frame representation functions as a reusable component, a case study from a news publication was used as an example.

Keywords: Reusable Knowledge Base, Artificial Intelligence, Frame Representation System, Knowledge base.

1. Introduction

Building and managing a knowledge base has become a major problem in artificial intelligence research. The growing knowledge domain and the demand for interoperability with other applications or systems is the reason for research in this field[1][2].

The knowledge base itself is a major component in artificial intelligence architecture. The knowledge base is applied to various artificial intelligence applications, such as expert and knowledge-based systems. With the development of internet technology itself, various standards were launched to enable knowledge exchange, such as XML (extensible markup language), RDF (resources description framework), DAML (DARPA agent markup language), OIL (ontology inference layer), OKBC (Open Knowledge-Base). Connectivity) and many others.

A frame-based representation model is a knowledge representation that is used to store knowledge and facts about a particular subject. This model is supported by OKBC, which can facilitate interoperability between knowledge bases[3][4].

The main issues that will be discussed in this paper are regarding the understanding and basis of the knowledge base and the creation of a knowledge base frame representation

model. Writing this paper is only limited to developing and creating a knowledge base. To further clarify, a case study related to its development in newspapers will be taken in this case[5].

This research is expected to contribute to the field of artificial intelligence, especially in developing expert systems with frame model knowledge representation. For academics themselves, this research can be research material for further development. Practically, the case studies in this newspaper can be utilized by related parties, such as the publishing industry, in preparing knowledge-based systems.

2. Research Method

The knowledge base is a collection of knowledge expressed using a formal knowledge representation language such as predicate calculus, and graphs, if-then rules. The knowledge base is a representation of the knowledge of an expert (domain expert). The knowledge base contains facts about objects within a scope of knowledge. Thus the knowledge base forms a source of intelligence and will be used by the inference engine for reasoning and decision-making. In the knowledge engineering series, building a knowledge base takes the stage of knowledge acquisition which can be carried out manually, automatically or semi-automatically[6].

2.1 Open Knowledge Base Connectivity (OKBC)

OKBC (Open Knowledge Base Connectivity) is a protocol for accessing the knowledge base (KB) in the Knowledge Representation System (KRS). OKBC aims to become an interface between various types of KRS. OKBC is the successor to the Generic Frame Protocol (GFP), originally intended for systems that could be viewed as frame representation systems. GFP was initiated from a review of KRS written by Peter Karp.

OKBC provides a set of operations for generic interfaces that refer to KRS. The OKBC interface layer allows specific freedom in each application (quirks) of a particular KRS software. It allows the development of common tools (such as graphical browsers and editors) that operate on multiple KRS. Implementations of OKBC exist in several programming languages, including Java, C (client implementation only), and Common LISP, and provide access to the knowledge base both locally and over the network.

2.2 OKBC Knowledge Model

The OKBC knowledge model is an implicit representation formulation on which all the operations provided by OKBC rest. It acts as an implicit interlingua for knowledge communicated via OKBC, and systems using OKBC translate knowledge in and out as the interlingua requires. OKBC's knowledge model supports an object-oriented representation of knowledge[7]. It is assumed that the universe of discourse consists of all entities in which knowledge is expressed.

2.3 Generic Frame Protocol (GFP)

The Generic Frame Protocol (GFP), developed at SRI International and Stanford University, provides functions that support generic interfaces that support frame representation systems (FRS). The OKBC interface layer permits the application of idiosyncracies independent of specific FRS software and allows the development of software that operates over multiple FRS [Chaudhri, 1997]. Although there are significant differences between FRS implementations, many common properties describe a generic model of frame representation and define a set of access functions to interact through FRS. Various systems and knowledge bases have applications or tools written to access this functionality.

2.4 Knowledge Representation for the Web

The World Wide Web (WWW) currently consists of about 300 million static objects that provide various information. It becomes a matter of finding and excavating it. This problem will become more serious as the web grows. Artificial intelligence has a strong tradition of developing methods, tools and languages to organize knowledge and information. Therefore,

applying the techniques, they have to overcome these problems is normal. However, applying artificial intelligence techniques directly to natural language documents is not promising.

2.5 Knowledge Representation for the Web

The World Wide Web (WWW) currently consists of about 300 million static objects that provide various information[8]. It becomes a matter of finding and excavating it. This problem will become more serious as the web grows. Artificial intelligence has a strong tradition of developing methods, tools and languages to organize knowledge and information[9]. Therefore, applying the techniques, they have to overcome these problems is normal. However, applying artificial intelligence techniques directly to natural language documents is not promising.

2.6 Knowledge Representation for the Web

Currently, several semantic markup languages can be added to web pages using W3C (World Wide Web Consortium) technology, namely HTML (Hyper Text Markup Language), XML (eXtensible Markup Language), and RDF (Resource Description Framework).

2.6.1 HTML (HyperText Markup Language)

HTML <META>-tags it was the first attempt to represent semantics in web documents[10]. Its intended use is limited to declaring global properties that apply to the entire document, for example;

```
<HEAD>
<META NAME=äuthor" CONTENT="Frank">
</HEAD>
```

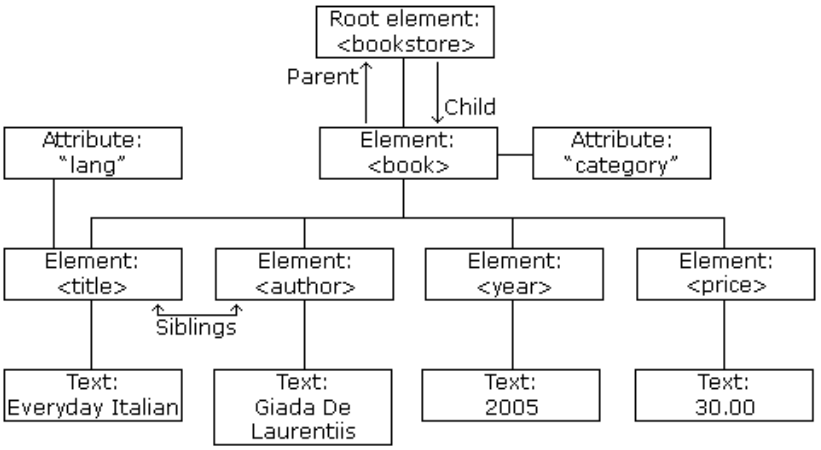
This indicates that the author of the entire document is *Frank*.

2.6.2 XML (eXtensible Markup Language)

One result of the development of semantic structures on the web is the development of the XML markup language. XML allows web page builders to use their own set of markups. These tags can be chosen to reflect a particular domain of semantics rather than just layout.

```
<BODY>
This page is written by
<AUTHOR>Frank van Harmelen</AUTHOR>.
<LOCATION>
His tel.nr. is <TEL>47731<TEL>,
room nr. <ROOM>T3.57</ROOM>
</LOCATION>
</BODY>
```

XML allows us to structure web pages as a tree structure, where information providers can select labels representing as much of the document's semantics as needed. The tree structure for the above XML code is shown as follows.



Picture 1. XML code tree structure

Although XML allows the use of as many tags as possible, provided they are nested properly in the document, it is still possible to define the limits of the set of tags that can be used in a document. This is described in the Document Type Definition (DTD), which is expressed in formalisms such as the grammar allows ordering and nesting of tags that are allowed in documents.

2.6.3 RDF (Resource Description Framework)

XML provides semantic information by defining the structure of the document. XML defines a tree structure for documents, and the different leaves of the tree have well-defined tags and context information that they can understand. Thus, the structure and semantics of the document are intertwined. RDF (Resource Description Framework)k defines the structure of the document. Without making any assumptions about the structure of the document. It is an XML application (its syntax is defined as XML) designed to add meta information to web documents.

The RDF data model provides three types of objects: resources, property types, and statements:

1) A resource is a referable entity with an address on the WWW (with a Uniform Resources Identifier). Resources are elements described with RDF statements[11].
2) Properties define binary relationships between resources and atomic values provided by primitive datatype definitions in XML[12].
3) The statement sets for the resource a value for the property. Thus, statements provide the actual characterization of web documents[13].

3. Findings

The knowledge base developed in this case study is for a newspaper. There are several possible uses of this knowledge base, namely:

- List of published articles, indicating the time of publication, type of article[14]
- Information from standard columns of newspapers, such as sports, lifestyle, business[15]
- Employee information
- Advertising information

There are several types of applications that use this knowledge base, for example:

- System for retrieving, organizing and answering queries about articles that have been published[10]
- Systems for analyzing advertising revenue or pricing[16]

- A system for reviewing the organization of employees to ensure that reporters are balanced between editors and that each column in the newspaper has its person in charge[17].

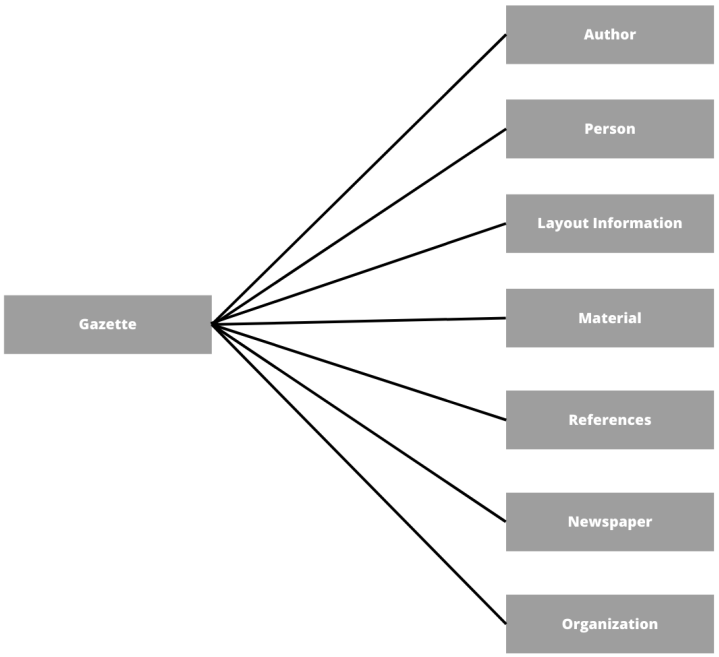
3.1 Knowledge Engineering Methodology

The approach used in ontology development is iterative. It begins with an overview of the ontology, then revised and refined and finally refined in detail. Here we will emphasize the basic rules (fundamentals) in designing ontologies which will be referred to several times, namely:

- There is no right way to model a knowledge domain–there are always many alternatives- The best solution depends on the application to be implemented.
- Ontology development is usually an iterative process
- Concepts in the ontology should be close to objects (physical or logical) and relationships (relationships) of the knowledge domain[18]. It is usually a noun for objects and a verb for relationships in sentences describing domains[19].

3.2 Determination and Class Hierarchy

There are several approaches to preparing ontologies, such as top-down, bottom-up, or a combination [Uschold and Gruninger, 1996]. This time the approach used is top-down. A top-down approach is an approach that begins with the general concept of the knowledge domain and then specifies the concept[20]. For a newspaper case study, the general concept is a newspaper and is then translated into author classes, materials, layout information, libraries, newspapers, organizations, and people.



Picture 2. Main Class Hierarchy

Furthermore, each class describes its respective subclasses into:

- For the author class to be

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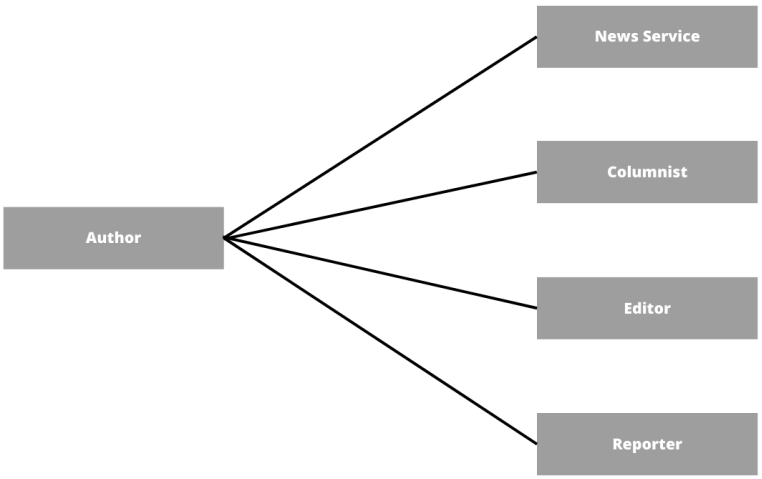
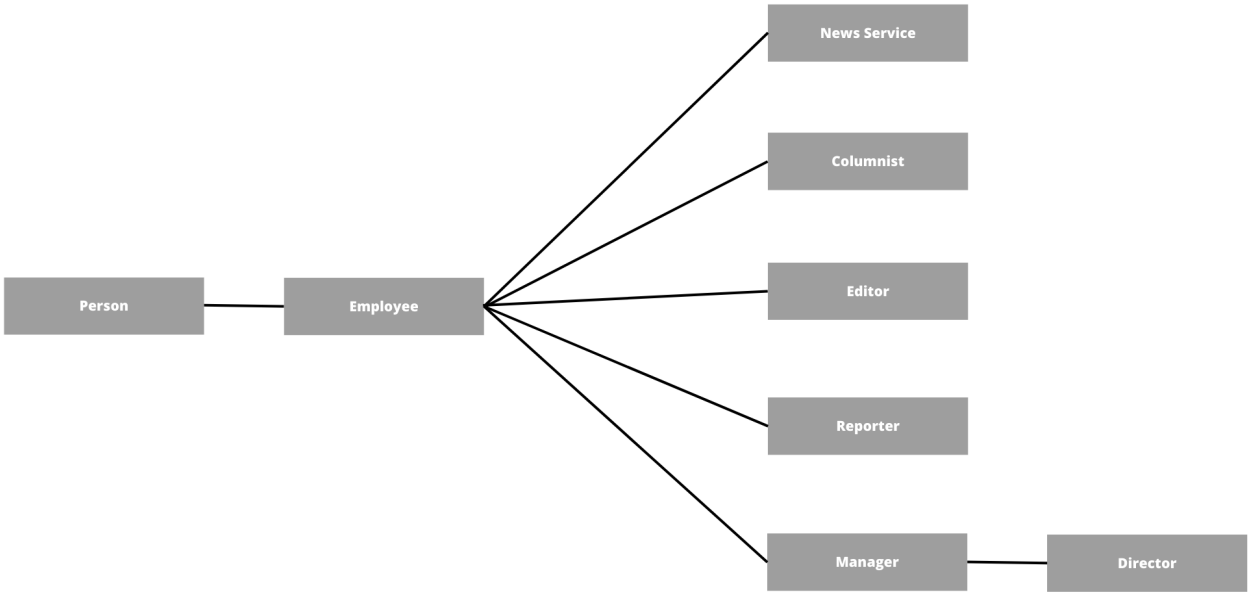


- To class people to be



Picture 3.People Class Hierarchy

- For the layout information class to be

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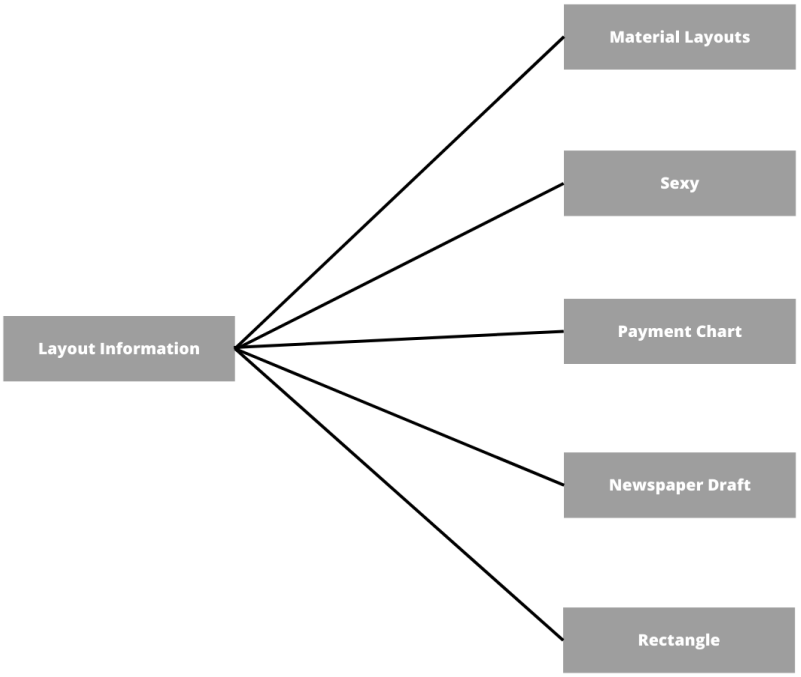
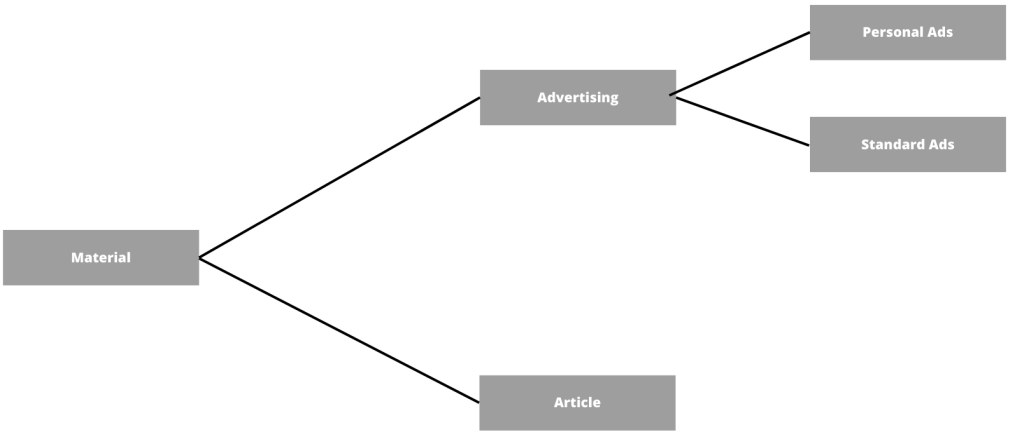
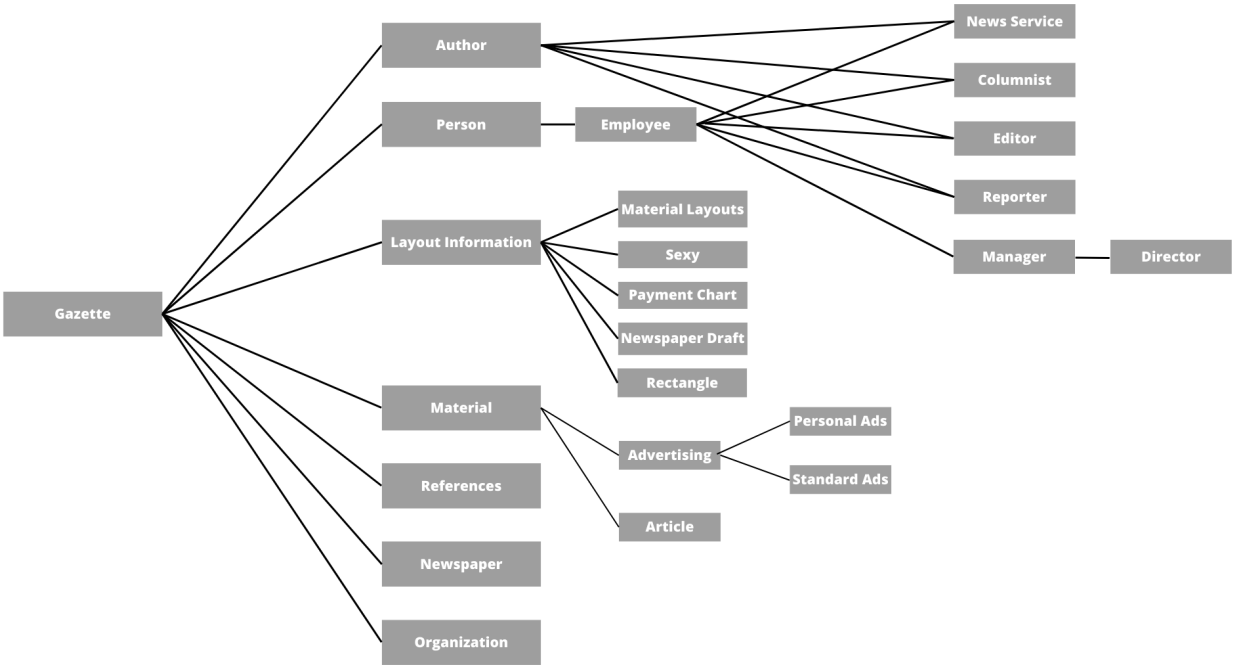


Picture 4.Layout Information Class Hierarchy

- For the material class to be



In relation to the whole class hierarchy is as follows:



Picture 5.Whole Class Hierarchy

4. Conclusion

Based on the above research, Knowledge Base Reuse with Frame Representation in Artificial Intelligence Applications is a beneficial technique in accelerating the development process of artificial intelligence systems. This technique allows the reuse of knowledge obtained from other systems, thus reducing the time and cost of developing a new system.

Frame representation allows knowledge to be stored in an organized structure, thus facilitating its reuse in other applications. This technique can be used in artificial intelligence to build more intelligent and efficient systems and reduce the need to build systems from scratch.

However, the success of Knowledge Base Reuse with Frame Representation depends on the accuracy and quality of the knowledge stored in the base. Therefore, it is necessary to perform regular maintenance and update of the knowledge base to ensure the quality of the accumulated knowledge. Knowledge Base Reuse with Frame Representation is a very beneficial technique in developing artificial intelligence systems. By utilizing it, companies can speed up the development of new designs, reduce development costs, and improve the efficiency and performance of artificial intelligence systems.

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