Patent Maps:
A Simplier Way to Search Patents in the Light of Prior Art

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Abstract— *A patent represents an exclusive right to make, use and sell an invention in a country. In order to make it valid, it is necessary to go through a series of verifications among which there is a search to establish if there is any public document which fully or partly describes the invention which is being patented. If such a document exists, it is called prior art. The search, whose purpose is finding of prior art for the patent in question, is not in the least simple. Patent Maps, presented in this work, can significantly facilitate the process of search for prior art among the patent archive.*

1. INTRODUCTION

A patent represents an exclusive right to make, use and sell an invention in a country. It is necessary that the potential patent goes through a very long and complex process of verifications during which is determined whether the invention is new in order to be accepted by Patent Office. If it would be accepted as a patent even it was not new, that would mean that the researcher got the award for the work which brought the public the things they were already aware of. If, during the verification, it is determined that the potential patent is not new, it is rejected.

In order to determine the validity of the potential patent, the first step is to determine which documents can be considered as a prior art against the patent's claims. These documents certainly fully or partly describe the invention and they fulfil the condition that they have been issued before the filling date of the application. However, the national laws concerning the patents are different from country to country, so public discussions do not have the characteristic of prior art in all countries.

So, the question of which documents can be considered as prior art is being raised? In the first place, these can be all the documents which are public, whether as publications (books, magazines, newspapers, Internet, PhD's, etc.), public discussions, accepted patents or some other public forms. We will not be looking into this problem any longer because this work is dealing with already accepted patents as prior arts.

Let us look at the Mind Maps now. Researchers claim that the Mind Maps save up to 50% in the human process of thinking and creating, they decrease the time spent for understanding of information for 90% and enable more comprehensive observing. Human brain is capable of accepting the coloured, multileveled Mind Maps, which are built on connections, much faster than the simple text. A machine certainly is not capable to accept information in this coloured way or speeding up its process of 'thinking', but the comprehensive graph which gives the Mind Map is possible to use.

The machine Mind Maps are better known by the name of Concept Maps.

2. CONCEPT MAPS

Concept Maps represent graphic structures used for organizing and presenting of knowledge. As such, until now, they have been mainly used for the advancement of learning process (better known as MindMap), making decisions and conclusions. The structure of such a map is shown in figure 1.

Judging by their name, Concept Maps are consisted of concepts which are framed with geometric structures, rectangles or circles, and the relation between them is represented by joining links. Every one of these links can be characterized by a word or a phrase which describes the type of a connection between concepts.

There are two types of links: role-oriented and class-oriented. Role-oriented links are all the links which have the semantic meaning of a predicate in a sentence. Their characteristic is that if the role disappears, i.e. the predicate is lost, the identities of objects do not change. Unlike the role-oriented links, class-oriented links actually show that the subordinated object belongs to the superordinated one and as such, the subordinated object cannot break the relation without losing its identity. We should, also, bear in mind that there is a larger number of role-oriented links in a Concept Map and that the
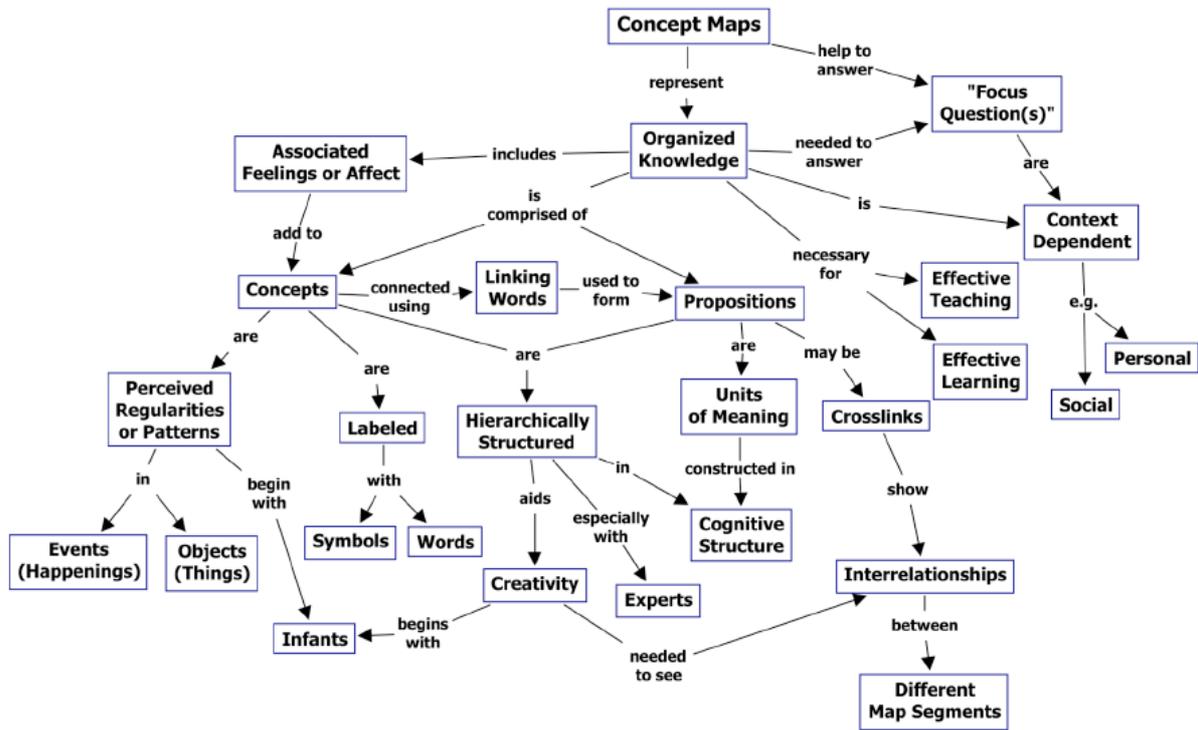
Figure 1: Concept Map Structure

probability that the object will lose its identity when breaking the relation is extremely small.

The fact that a Concept Map is hierarchically organized with the basic concepts in the root(centre) of the map is its very important characteristic.

Going through the map from its centre to its ends(branches), we can find more and more specific concepts. Each of these specific concepts can be the central concept in another Concept Map. This is the reason why new types of links are introduced, the links which play the role of the indicators of the main concept. These links are oriented from the instance of concept to the main concept and they can be thought as a kind of class-oriented links of a reverse direction with a difference that the instance can exist even when the Concept Map of the main concept does not exist.

In order to keep the records about the position of the concept inside a Patent Concept Map, the levels of layers are introduced. The basic concept which represents the root of a Patent Concept map is situated on a level zero. All the other concepts are situated on levels 1 till N depending on the distance from the central concept. The distance of the concept from the root of the Patent Concept Map is calculated as the number of links which can be found on the shortest direct relation between the central concept and the concept in question.

Cross-links are another type of links in Concept Maps which are used today. Cross-links are links which join concepts in different segments or domains of a Concept Map. These links are, also, role-oriented links. However, their characteristic is that they cannot be detected

automatically(by using a machine), but for this action, the intervention of a man is necessary and its effect depends on ability, knowledge and creativity of a person who intervenes. In our case, these links do not have any value when being used because they are intended for facilitating of memorizing in learning process which is not the issue discussed here.

So, the main reason for using Concept Maps when making a patent is the possibility of showing the complete content of the patent. From this moment on, we cannot call these maps Concept Maps owing to their original meaning. We will call them Patent Concept Maps, instead. We should, also, bear in mind that one patent is consisted of larger number of Patent Concept Maps, so that the whole group can be called a Patent Map.

3. AUTOMATIC GENERATION OF PATENT CONCEPT MAP

Automatic generation of Patent Concept Maps represents a problem in a way. We must not forget that the Mind Maps are created by a man himself based on his mental activities and they are adjusted to the individual who creates them and they are the result of a very subjective process. In order to avoid the subjectivity which is a complete failure looking from a scientific point of view, during the process of forming of maps, it is necessary to do that according to the universal principles which are void of subjectivity in any way. In the case of a patent, the individual-the creator of a map is a machine and through history we have witnessed many useless attempts of implementation of human behavior into machines. However, we must not forget the

bright examples when the attempts resulted in real sensation, which are the motive for this research. The potential solution of this problem lies in the usage of Natural Language Processing (NLP) software, i.e. The Stanford Parser as a representative.

The Stanford Parser is an NLP tool for automatic grammatical text analysis. This package is a Java implementation of probabilistic natural language parsers, both highly optimized PCFG and dependency parsers, and a lexicalized PCFG parser. At the beginning the sentences are directed toward the end where their grammatical position is given as well as mutual grammatical dependance of words in the sentence which is being examined. Its functionality is not completely ideal but the percentage of errors is very small. More details about parser can be found in 2 and 3.

So, in order to create the Patent Concept Map of a claim, it is necessary to process claim through parser. Based on the given result, the Patent Concept Map is formed like this:

The subject represents the central concept; the level of layer 0.

The object represents the lower-level concept; the level of layer 1-N.

The predicate represents a role-oriented link which joins the subject and the object which that predicate refers to.

The adjective represents a characteristic (type) of concept it refers to.

The adverb represents a characteristic of the role-oriented link whose label is the verb which that adverb refers to.

The articles are neglected.

The generation of the Patent Concept Map according to the rules given above is performed by a software, so called Patent Map Generator, expert system made in Java which is in the making. If it is necessary, it is possible to do the revision after the generation of the map.

This part can be broken in a as many sections and subsections as needed.

"Proposed instructions for cache injection support are hand-inserted into synchronization kernels and parallel applications. A detailed simulator of memory subsystem is developed. For each application, we compare the performance of base system and one or more systems that include cache injection. Experiments varied different memory subsystem parameters, in order to explore their influence on cache injection."

4. PATENT MAP STORAGE

There is no point in placing Patent Maps in graphic shape. The graphic pictures make it easier for a man to have a complete insight into a revision process, but they are not adequate means of keeping the data .

Apart from the graphic way, these maps can be very simply and efficiently showed and implemented by means of RDFS, the W3C standard for annotation of web resources with metadata. Since the data in RDF are presented in triplets, this way of showing the maps is completely adequate, taking into consideration the subject-predicate-object structure which can be found in the Patent Concept Maps. The additional advantage represents the RDFS type system which has the possibility of showing the types of roles (role-oriented) as well as specific types-characteristics of concepts. You can read more about this in 1.

However, we have not solved the problem of placing the maps by defining the shape in which the Patent Maps are placed. Considering great number of data, it is necessary to put similar maps on the same clasters which has the purpose of improving the efficiency of search and getting the information retrieval. There are many criteria based on which it is possible to do the classification:

The classification of maps based on the criterion of similarity of central concept;

The classification of maps based on the criterion of the group of authors;this criterion is a consequence of the fact that today certain research teams are dealing with researches in specifically defined areas with a small percentange of exceptions all over the world;

The classification of maps based on the criterion of scientific area which the patent belongs to;nowadays, this kind of belonging is sometimes very hard to determine considering the encreasing interweaving of different scientific areas.

We would certainly get the best result with the use of the hybrid criterion of classification with the emphasis on the classification based on the criterion of similarity of central concept. But, whichever criterion we choose, the hierarchical structure of patents and their references will not be harmed which is extremely important.

5. CONCLUSION

There is no doubt that showing of patents by means of Patent Concept Maps needs an extremely large space and a large number of processors which will perform parallel search, but this problem can be solved by simple usage of Grid Storage which can be found everywhere nowadays. The main request which should be fulfilled is the quality projected architecture because it guarantees efficiency.

The Patent Maps showed in RDFS are very useful for searching of patents with the purpose of determining whether any of them is a prior art against the patent in question. Further research will go in the direction of the construction of algorithms used for recognizing the structures inside the Patent Maps with the purpose of

advancing the search technique.

We can make a remark here that in order to use this kind of approach, all the patents which are placed in the patent archive must go through the process mentioned above so as to be available for the search. First, every patent must pass through a parser which would extract the relevant parts of a patent which would be transformed into the Patent Concept Maps further on.

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