An Overview of Health 2.0 and Semantic Web

Marika. Apostolova-Trpkovska, and Lejla. Abazi-Bexheti

Abstract—The Semantic Web can be thought as an extension of the present web, as an additional layer of data beneath the visible layer of human-readable information. This paper aims to establish a clear overview of Health 2.0 and Semantic web terms and delineate literature that is specific to the fields. In addition, this paper is summarizing the existing literature and identifying key research themes, as well as underdeveloped research areas covered in this paper. Also we will face the most important features of web 2.0 with their use in health care (Health 2.0) and future web tendencies that can be used in health care sector.

Keywords—e-Medical services, Semantic web, Health 2.0, Web 2.0, Ontology.

I. Introduction

HEALTH care continues to evolve among technological advances, integration of the computer applications and management of information in their systems and protocols. Diseases and health care have a social dimension that shapes most of the views on key health actors [1].

The phenomenon of people (patients or health workers) who make decisions about the "health activities" depends on other people's similar experiences in the past or certain recommendations, form part of our daily "social navigation" [2]. Over the centuries, health care and treatment of the disease has always been considered as a problem that affects both sides, patient as individual and health worker. Recent technological advances bring us shift to a different concept and paradigm moving from "localized expert" to "global expert" through the idea of collaborative evidence-based approach, which uses aggregates of information as basis of individual patient care [3].

Lots of information that are used, are based on the Internet, allowing patients and healthcare professionals to become more aware of diseases and their treatments ([4], [5]). More and more the impact on this ability for exchanging information leads to a user guided treatment [6]. This evolution has been recently called "Health 2.0", where patients have the information they need and they can make rational decisions about health care.

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Current innovations in the field of ICT systems and services mark a notable shift from "Information Society", which is characterized by a huge effort for searching information that largely depend on the availability of pre-defined and standardized data in a "knowledge society", which is a society based on knowledge as a value. ([7], [8]) This essentially highlights the cognitive progress and involvement of every individual. Not only that fasts and constantly modifies the way people work, but also the way in which educational processes are designed and practiced.

In 2008, the World Wide Web Consortium (W3C) (http://www.w3.org/) established a group called Health Care and Life Sciences Interest Group - HCLS IG) (http://www.w3.org/2001/sw/hcls/). The aim is to develop and support the use of semantic web technologies to improve the collaboration, research and development, innovation, as well as the adoption in the domains of health care [9]. Some of the anticipated applications include efficient searching and retrieving information. Even more important is the ability to create personalized searches of the information [10].

However, it can be said that the true forerunner of the concepts and technology Web 2.0 is the paradigm of programming Web services and Service-Oriented Architecture. Current web services are dealing with huge amount of contents generated by the users as it is in Flicker or Delicious, incorporating a technique called folksonomy [11]. The folksonomy is taxonomy created by the user, where the users provide short keywords (tags) for its posted contents. The tags are not chosen from some fixed or pre-defined categories but generated by themselves. Users can assign their decentralized keywords to their content. It is important that the semantics of diverse information systems is self-evaluative because there are no restrictions on who and what types of information can be placed. Users have absolute control of organizing the resources, thus making the system self-sustainable and extremely flexible [1].

II. Review of the State in the Appropriate Area

Health 2.0 is a relatively new term for the overall medical care, which is supported by the electronic processes and communication. In practice, the term covers a full range of services which are on the boundary of medicine, health care and information technology:
- Electronic medical records for patients
- Telemedicine
- Health Informatics for public use
- Management of medical knowledge and education
- Virtual healthcare teams

- Mobile Health: includes the use of mobile devices for data collection for/from patients, bringing health information to doctors, researchers and patients, monitor vital signals of patients in real time and directly providing health care (via mobile telemedicine).

The terms Health 2.0, as well as the nearby term Medicine 2.0 are terms that connect the opportunities of the eHealth and Web 2.0, are more intensively covered in scientific papers. A study in 2005 showed that Google searches gave 15 correct diagnoses out of 26 cases. Concise definition of the Health 2.0 health care would be interactive health care, which is characterized by the possibility of extremely rapid exchange, classification and tabulation of individual health information with the intend to improve health care systems, experiences and results. The objectives of the use of Web 2.0 in healthcare include:

1) Informing patients and healthcare professionals, using RSS, podcast (multimedia audio and video content streamed), blogs and advanced search tools, semantic web and ontology
2) Introduction of social networks for collaboration patient-patient, doctor-patient and doctor-doctor
3) Education of the health care entities with the use of the modern educational techniques
4) Cooperation and exchange of experiences
5) Managing and living with an illness (patients are informed of the diets, lifestyles, etc.)

In the original proposal of the World Wide Web in 1989 [12], it was not easy to predict that it would become so widespread. Contrary to initial expectations, the Web has turned into an application that gradually takes primacy in other applications such as E-mail, Usenet news groups and IRC. While the number of websites and web pages related to medicine is constantly increasing, it becomes impossible an individual to remember all available website addresses or URLs for seeking a specific data on the Internet for some medical information. Search engines aim is to provide faster browsing of large amount of Web pages based on the required words. Search so far suffers from several shortcomings, especially acute when it comes to medical data, including checking the origin and authenticity of the source data, unsuccessful distinction of true information against false advertising sites etc. After many attempts and different algorithms for ranking pages, a new generation of search engines is starting to adapt the model of the semantic ontology in categorizing their data in order to provide faster and more relevant results.

Because search engines are computer applications, their search results are bound to be calculated and specific, based on mathematical formulas for searching through text. In this way, the results can match the given words or phrases, but the meaning is completely lost. For example when searching for the word "Cold" (cold and / or cold) will return a lot of links to web page for treating colds and on the other side information about weather or cold drinks, among others. The researchers suggest [13] that in circumstances where there are too many results obtained, users usually search the first few pages, and then either accept as true what they will find there or they stop the searching.

The most practical method of dealing with this problem is to help computer to "understand" the meaning of any information, using the relations between related objects. Semantic Web attempts to answer this issue by grouping the information in the ontology databases that are logically organized, formal and well-defined version of the taxonomies [14]. This means that the user can search for information about the disease called 'Cold, and get more relevant results. Several Semantic Web based search engines already exist ([15], [16]). Medical ontology exists, but is often associated with strict Latin medical terms that do not correspond to patients' everyday communication.

Users are accustomed to the quality of textual search engines where they have to write the keywords which they believe are related to their search. These keywords are compared to the index of the search engine and afterward a list of results is produced, usually sorted by relevance or attendance.

Semantic Web based search engines are trying to redefine this procedure. They may still require the user to write text, but they would require matches with those keywords of the ontological elements. With this the results are more logically relevant, rather than the ordinary relevance of the keywords [17]. This is feasible because Ontology organize the elements based on the logical relationships derived from the meaning of the element.

As time passes, the standardization of ontology will play a significant role in the categorization and information exchange. Scientists will be able to compare their research faster and precise with others because of the specific nature of ontological definitions. Everyone can benefit from the advantages of semantic annotations, for example, searching for music that sounds like their favorite band or movie based on their favorite movies [18].

Since the early 1990s the web pages have become available to the public and many users have become interested in creating personal websites through which they will present themselves, their businesses or their interests. Some companies have started to provide free limited web space on their servers in exchange for advertising on top of every page. In this way, Web "citizens" started interacting with each other, connecting their websites, exchanging virtual "prizes", comments and post their personal thoughts, ideas, pictures or even songs. Separated from commercial websites, personal websites had their own life, organized into communities or by themselves, publishing articles and news of interest to this new "global village."

At the end of the 1990s, users began to call their personal websites "blogs", a blend of the words "web" and "log", which led to the creation of a new trend in web culture [19]. This eventually led to the creation of the first "online social network" in the early 2000s, a term popularized as "Web 2.0" by Tim O'Reilly of O'Reilly Media [20]. Social networks took

advantage of all the well-known web technologies, but rather to offer free web space, they encouraged users to attach all their information and materials in their standard profile page.

Friendster, MySpace, Facebook, Linked In and other well-known social web giants have become very popular because they responded to the needs of people to be in touch with their friends or contacts, together to participate in activities, groups or games. Many companies, such as YouTube, Flicker, Delicious and others, followed the social paradigm by adding mechanisms to increase the participation and cooperation of the community. Healthcare accepts the advantages of social networks and allows more similar services to the users, such as site PatientsLikeMe [6].

What all of the above web sites have in common is that they categorize their data using folksonomy. This term dates from 2004 [13] and comes from words 'folks' and 'taxonomy'. Basically it defines how to use keywords to describe the content of a data object. Blog articles, photos, videos and audio files stored around the Web were marked by the use of words that users, who attach them, choose to describe. These words must or must not be related to the content, depending on the perception (or mood) of the person who attach them. It can be an extremely fast way to label data, but due to the lack of standards, many tags are unclear, incorrect or simply wrong.

When the Social Web would eventually merge with the Semantic Web, the users will be the first to benefit from this. After the agreement of the semantic, data sharing would be easy and instantaneous. Labeling data may take longer in terms of setting keywords, but examination techniques could be used to speed up the process.

Recently folksonomies have become increasingly popular on the Internet as part of the social tagging systems such as delicious or image markers such as Flicker. They are generally considered as classification systems derived from practice of common creation and management of the tags in order to label and categorize resources [21]. Such systems not only provide an easy to use interface through which people freely tags web resources, but also they are enabling to share them over the Internet. These tags are random strings and are known as folksonomy tags and they present the potential source of meta data created by the users. Folksonomies are open and therefore they quickly react to the changes of the way how users describe the objects. Al-Khalifa [22] showed that the folksonomy tags correspond closer to the human thinking than those ones that are automatically extracted from the texts. Ontology created by these tags can directly represent the opinion of the users for finding a way how to describe the web resources, with intend to be more easily accepted by others, than the Ontology extracted from texts [23]. Thus for, some papers are focused on extracting Ontology from Folksonomies. For example, Mika [24] concentrated on tags with extended / closer relations using the theory of sets. Zhou [25] applied the techniques for grouping the tags and building their hierarchical structure. However, these works focus only on the hierarchical structure, and they do not have general

supervision of extracted ontology from the user's point of view. In other words, they are careless for ontology to be more acceptable and compatible with the users. Because the ontology provides a common vocabulary for users to model the domain, we believe that it is necessary and useful to construct Ontology from the point of view of the user (for example, taking into consideration how people think and use concepts).

III. CONCLUSION

Web 2.0 has various features such as Tagging, Blogs, Social Networks and Communities that are used in Health 2.0. The health field is adjusting more of this technology to facilitate health care service. There is a huge number of promising upcoming web tendencies that can be utilized in health care. Web 2.0 has an important part in allowing patients who would be able to exploit its means and features to access online health services, information and communities.

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