A Computer Model to Study Users' Information Behavior

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Abstract - *The purpose of this poster is to present a conceptual model and propose an ontology-based computer model to study human information behavior. A conceptual model based on the theoretical framework of the information behavior field was constructed and empirically validated. The ontology-based computer model proposed here combines concepts and ideas of learning theories and cognitive science. The core of this proposal is to use the users' profile to infer their choices and decisions on the Internet. Based on their personal characteristics, personality types, economic status, preferences, and habits we may infer some possible future trends. Deep knowledge of the core concepts underpinning this field provides us with a solid basis for constructing a model that reflects this information behavior. By working on an ontology-based model that mimics the cognitive structure or the previous knowledge, the system we propose may dynamically create new connections to itself, improving its capability to infer things about users.*

Keywords: Information behavior, ontologies, machine learning, predictive analysis, psychology, cognitive science

1 Introduction

A well-defined model of human information behavior allows us to infer users' choices and decisions, which, in turn, allows us to anticipate some of their needs and actions. The possibility of predicting needs, trends and possible future steps users will take helps companies provide better services, offer them products that exactly meet their needs, plan the inventory of goods and avoid overstocks of products. In summary, the model may contribute to the well-being of people in their daily life.

Every single aspect of people, such as education, social and economic status, age, movies they watch, songs they listen to, books they read, sports they practice, when taken together, says something about them and makes up their personal profile. The computer model we propose in this poster will collect and process these data in order to extract patterns [4] of human information behavior from them and will allow us to make simulations and inferences. It is important to outline that the model may infer people's decisions and actions based on their profile and infer people's profile based on their decisions and actions. The more iterations the model makes in both directions the more adapted and precise it becomes, improving its inferencing potential.

By exploring scalability, reusability, and knowledge sharing capabilities of ontologies [3] combined with Ausubel's meaningful learning theory, we propose a computer model based on a conceptual model already empirically tested and qualitatively proved. The benefit of using a computer model is the possibility of processing large amounts of data, which not only reinforces the previous knowledge represented as an ontology but also allows the model to add new concepts to itself simulating the meaningful learning process proposed by Ausubel [6].

Based on concepts used by cognitive science, the system will collect data by using a Web crawler (input) and store it in a structured database (long-term memory). With the data stored in the database, the system will feed the ontology (short-term and working memory) and process the data. As in any learning process, the system will focus on specific sources of data. In order to supervise the acquisition of new concepts and relationships, the system will check the consistency of data using certain specific criteria. The model will take decisions and make judgments based on its own inferencing capabilities, by comparing similarities and differences, relying on previous experience or examining the frequency of occurrences of the same relation.

Various studies have demonstrated that types of personality [7], together with other factors, such as age, income, and education, may shape users' behavior and guide their decisions [1][5]. Indeed, evidence suggests that types of personality are associated with the career. However, although some do examine the role of personality types, personal characteristics and external factors in the human Information behavior, none of these studies uses an ontology-based computer model to explore their effect of them on information selection and use.

One of the key ideas of the model proposed is Ausubel's theory of meaningful learning. Ausubel believes that learning of new knowledge relies on previous knowledge [9]. That is, the construction of knowledge begins with our observation and recognition of events and objects through concepts we already have. We learn by constructing a network of concepts and adding new ones to a previous structure.

2 The Conceptual Model

Figure 1 shows the conceptual model to study information security professional whose main concepts and relationships have already been empirically tested using questionnaires and interviews. The model may also be used to study any category of people. Although empirical results have shown some outstanding insights, their discussion is out of the scope of this poster.

In order to confirm these empirical results, it is important to conduct extensive quantitative research using a computer model to make simulations and get more generalizable conclusions.

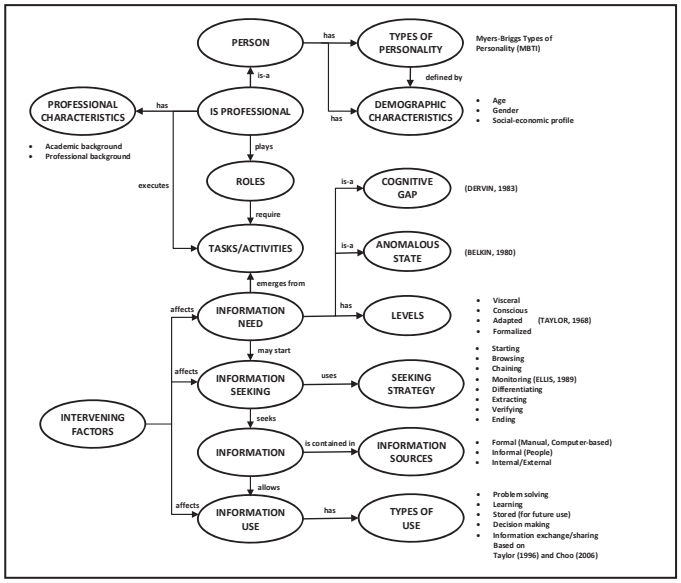

Figure 1. The Conceptual Model

3 The Computer Model

The computer model of the ontology is part of an architecture that emulates the way the brain stores and manipulates this structure to acquire information from the outside world to create knowledge. Three modules make up this architecture: a module of data acquisition (input), a module of storage, and a module of processing (output). This architecture will allow the computational simulation of the human information behavior, according to the theory of meaningful learning proposed by Ausubel.

Based on Ausubel's Meaningful Learning Theory and according to Novak's proposal [6], a concept map is something that resembles the cognitive structure of our brain. We learn by connecting new concepts to the previous structure. Each of these connections creates meaning and constructs knowledge. Our brain not only connects new concepts but also constantly rearranges these structures in order to create knowledge.

By using computer programming to construct ontologies dynamically, we create a non-static ontology structure, which the program might constant and dynamically change. As we add up new concepts to this structure, we are teaching this model new knowledge. If the system starts adding up news concepts to itself, the system is emulating the learning process.

The language selected to construct the model was *Python* [10]. The University of Paris, Sorbonne developed a *Python* library called *Owlready* 0.3 to construct *Web* ontologies.

To crawl data from the Internet, Russel [11] suggests some useful techniques. One of the techniques provided by the author introduces techniques for mining data on LinkedIn using an Application Program Interface (API). The author also provides techniques for other social networks, such as Facebook and Twitter.

There are still some key challenges to solve, including the supervision of the learning process or the process of adding up new concepts and relations to the previous structure. One possible solution is to measure the frequency of occurrence, which might indicate the existence of that relationship. Another solution is to use pattern recognition algorithms because every proposition or regularity (concept-relation-concept) is a pattern. Hence, new concepts and relationships will only be added to the previous structure or knowledge if they occur with a certain level of frequency whose value will be determined using statistical tools and techniques.

4 Conclusions

By being empirically validated, the conceptual model has been proved successful. The ontology computer model based on the conceptual one will lead to an understanding of the phenomenon by collecting and processing large amounts of data. This model makes it possible to find patterns of behavior focusing on the types of personality, peoples' profiles, context, and environmental factors.

The capability of predicting human information behavior may allow us to anticipate facts and prepare ourselves for facing future events. One of the noteworthy benefits associated with the capability of computationally simulating human information behavior is to provide them with better services and help them make the right choice and take the right decision. Several areas may benefit from this model. In marketing, redirecting or focusing marketing strategies, in cyber intelligence, by providing means to systematically and methodologically study hacking activities and preventing negative actions.

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