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Contextualized Knowledge Services for Personalized Learner Support

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Abstract. In this demonstration we present our KnowSe framework, developed for observing, storing, analyzing and leveraging Contextual Attention Metadata, utilizing our ontology-based user interactions context model (UICO). It includes highly contextualized knowledge services for supporting learners in a personalized and adaptive way, by exploiting the learner’s user context.

Personal information management and search systems can be improved by taking into account the context in which information is used and produced by a user, namely the user context. While talking about context we specifically focus here on the information relevant to the interactions of the user with applications and resources (documents, emails, contacts, online content, clipboard content, etc.) on the computer desktop.

Recording the user context is a prerequisite for providing personalized knowledge services. We have thus developed context observation tools (so-called sensors) which record all low-level operating system and application events (keyboard strokes and mouse clicks) initiated by the user while interacting with her desktop [1]. For each event, corresponding to a singular interaction of the user with a given application and specific resources, we record all the information relevant to this interaction (window title, date, keyboard input, application name, document or folder name, content of document, etc). Multiple application specific sensors have been developed for Microsoft Office applications, Outlook, Internet Explorer, Mozilla Firefox and Thunderbird.

The contextual information recorded by sensors is sent as an XML stream to the context observation framework for processing and analysis. It is used to automatically populate our User Interaction Context Ontology (UICO) [2] which constitutes an ontology-based context model of the personal information management domain. This ontology is based on our conceptual model, the semantic pyramid [1], in which events are grouped into event-blocks (an event-block representing a sequence of interactions with a given resource) which are themselves grouped into tasks (a task representing a well-defined step of a process involving only one person). This ontology represents a key ingredient of KnowSe, by providing a coherent view on and a single access point to the data, stored in a triple store (more precisely a *quad store* featuring named graphs and SPARQL query possibilities).

To enhance the information provided by sensors, we use rule-based and information extraction techniques to automatically populate our ontology, by discovering new concepts, and deriving inter-concepts relations [2]. This allows us to make hidden information and connections between resources and people visible and usable. The UICO is thus constructed iteratively, by considering only the information relevant to the user. The populated UICO can be leveraged for providing the user with personalized and contextualized services.

Context-Aware Information Retrieval Service. Compared to a classical desktop search tool, this service provides further benefits by (i) searching through any kind of resource referenced in the UICO and not only documents, (ii) providing resources from both the personal and the organizational knowledge bases, and (iii) expanding a text-based query with contextual information.

Pro-Active Context-Aware Information Delivery Service. By analyzing the current working context of the user, this service can provide her in real-time with resources relevant to her work. This is done by both (i) expanding text queries and (ii) utilizing concepts and relations recently added to the UICO as a starting point for spreading activation on the graph-based representation of the UICO. Furthermore search results are ranked based on resource usage and inter-connectivity of UICO instances.

User Context Visualization Service. To make the vast amount of information stored in the UICO exploitable by the user we have developed specific visualization techniques for displaying connections between resources, applications and user actions (graph views), as well as the usage history of resources in applications within tasks.

Besides the services we present in this demonstration, we have developed an Information Need Discovery Service, in order to detect and fulfill some user needs. We are also currently developing an Automatic Task Detection Service based on machine learning algorithms (which has already shown a 90% accuracy for task recognition), to be able to support the user with task-based information delivery, task guidance, task automation or task-specific skills training.

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References

1. Rath, A.S., Weber, N., Kröll, M., Granitzer, M., Dietzel, O., Lindstaedt, S.N.: Context-aware knowledge services. In: Workshop on Personal Information Management, CHI '08. (2008)
2. Rath, A.S., Devaurs, D., Lindstaedt, S.N.: UICO: An ontology-based user interaction context model for automatic task detection on the computer desktop. In: Workshop on Context, Information and Ontologies, ESWC '09. (2009)

A Technical requirements

The demo presenter will bring her own laptop. A good internet connection would be appreciated. If it is known beforehand that this is not possible, local installations of all tools can be made available.

B Target audience

First, we would like to address people who are interested in experiencing how contextual attention metadata about the user's interactions with applications and resources are captured from their own interactions with the computer desktop. Second, we would like to reach researchers who utilize or plan to use user context information to enrich learning management systems in order to enhance the learner's experience. Third, we intend to address experts in the field of contextual attention metadata to show and discuss our ontology-based user context detection approach and its advantages for exploitation in various technology enhanced learning applications.

B.1 Audience Interaction

Our demonstration includes not only a presentation but also allows the audience to interact with our prototype. They are able to walk through the described scenario or create their own ones.

C Demo Storyboard

Our demo storyboard is available online at the following location:
<http://purl.oclc.org/NET/knowse/ectel2009demo>