Web-based Dynamic Learning through Lexical Chaining: A Step Forward towards Knowledge-Driven Education

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ABSTRACT
In this paper we report on our experience using a linguistic technique, called lexical chaining, in assisting the dynamic hierarchical learning of sequentially accessible information for both human and software agents.

Categories and Subject Descriptors
K.3.1 [**Computer Use in Education**]: *Collaborative learning-Computer-assisted instruction*

General Terms
Algorithms, Management, Design, Standardization, Languages

Keywords
Lexical chaining, Dynamic e-learning, Ontology population

1. INTRODUCTION
With advances in ontological assisted Web-based learning methods, the new trends e-learning 2.0, aims to improve the quality of knowledge-driven education through social interactions and collaborative media. Ontologies by capturing knowledge from the domain of interest and providing a common conceptualization for human and software agents play a crucial role in success of this technology. By changing the knowledge, ontologies need to be incrementally updated to provide valid information for the human/agent learner. In our research we have used, the Lexical chaining method [1] to (semi-)automatically construct and populate ontologies by extracting relevant terms and relations from a structured or unstructured text corpus. It facilitates various educational activities such as word sense disambiguation [2], Text summarization [3], Intelligent spelling checking [4], and Detection and correction of malapropisms [5].

2. LEXICAL CHAINIG METHOD
In order to derive information and knowledge from text the Lexical chaining algorithm reads a text corpus and places words in related chains based on semantic similarity using a reference dictionary such as WordNet (http://wordnet.princeton.edu/). Then using an agent based framework [6] the related ontologies – which provide the underlying knowledge for the learners - can be dynamically populated and validated using a Description logics reasoner (RACER). As an example, our experiment focused on medical education and patient information leaflets to populate the medical subset of the FungalWeb Ontology. Consider the following patient information:

Patient A, a white male, nine years old, has recently found multiple, widespread scaly red patches on his abdomen, chest, face, and arm. The physician diagnosed his disease as "Rosacea" and prescribed antibiotics.

Using the lexical chaining algorithm described at [3], one can distinguish several possible chains such as:

{Patient A, nine years old, male, white, his, abdomen, chest, face, arm}, {Multiple, widespread, scaly, red, patches}, {Physician, diagnose, disease, Rosacea, prescribed, antibiotics}

The chain of words together indicates a topic related to particular concept in the related ontology. Different algorithms may generate different chains. For the evaluation some criteria such as reiteration, density and length of the chain [7] can be considered.

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