## Fuzzy Integrated Ontology Model of Dynamic Learner Profiling

T. Sheeba, Reshmy Krishnan

Abstract: In the context of lifelong learning, learner profile has emerged as a feasible model that support and promote the provision of lifelong learning opportunities. Learner profile describes the attributes and outcomes of education in a learning system. It includes information on learner's gender, skills, education, interest, learning preferences, learning style, etc. This paper proposes an approach to construct a fuzzy based semantic learner profile in the promising technology of semantic web by using the concept of ontology and use it for the reasoning of learner preferences. The approach starts with the collection of learner's static and dynamic data. The dynamic data of learner particularly learner interest and learning style are extracted by weblog analysis and using algorithms such as semantic based representation using WordNet and modified decision tree classifier with strong rules based on Felder-Silverman learning style model. The retrieved data is then used to construct learner profile using ontology in which automatic learner profile updating is obtained using ontology based semantic similarity algorithm. Finally to achieve semantic retrieval from learner profile ontology, fuzzy concepts such as fuzzy linguistic variable and fuzzy IF THEN rules are applied. Fuzzy linguistic variable facilitate semantic retrieval and more specific classification from learner profile ontology and fuzzy IF THEN rules predict the learning preference of new students based on the forward chaining reasoning process implemented in the existing ontology model. The final representation of semantic fuzzy ontology based learner profile improves the performance of tasks such as classification, semantic retrieval and prediction of learning preference to the new learners. The case study is conducted for the real-time learners involved in studying the courses registered in Moodle Learning Management System. The experiments were performed with NetBeans IDE, Jena framework and Protégé 4.2 beta editor. The experiments confirm that the proposed learner profile is a good representation of the learner's preferences.

Keywords: Decision Tree, Fuzzy, Learner Profile, Learning Management System, Ontology, Reasoning, Semantic Web, WordNet

## I. INTRODUCTION

Nowadays, most of the universities all over the world are widely using online learning systems for education. The major challenge faced in these systems is that the learners are treated in the same way as the system does not know anything about the learners using the system. Also, more time is spent by the learners to find the learning contents suitable to their needs.

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To satisfy the learning needs of diverse learner's and to retrieve learning contents relevant to the learner's needs and requirements, a learner profile is profoundly necessary to reflect the diverse needs of the learner. A learner profile [1] represents a structure that contains information concerning the learners' background, interest, and preferences, etc. It forms the most suitable and good representation of learner's requirements which enhance the usage of learning content. One of the main aims of this paper is to explore the development of learner profile in the promising technology of semantic web and use it for the prediction of learner preferences. The semantic web technology depends on ontologies as a tool to model an abstract view of data for the purpose of transportable and comprehensive machine understanding. The ontology-based learner profile representation would improve the performance of different tasks such as information filtering, classification, etc.

However, the conceptual formalism supported by typical ontologies may not be sufficient to represent imprecise and uncertain information. The possible solution is to integrate fuzzy concepts in existing ontology in order to help users for making decisions on learner preference in a more precise way. This paper aims a new approach to improve the learner profile representation and use it for the learner preference. To do so, learners data (static and dynamic) are collected along with the WordNet semantic representation of learner interest; decision tree classifier for learning style based on FSLSM (Felder Silverman Learning Style Model); learner profile construction using ontology; automatic ontology updating and using fuzzy concepts, a combination of that, can suitably represent learner profile to consistently reflect both implicit and explicit learners details.

## II. BACKGROUND

There are several works proposing user profile construction in different areas. An ontology-based user profile model [2] is created based on the static profile properties of each individual user and demonstrated in two different applications of personal information management and adaptive visualization. The drawback of this model is that it does not include the dynamic and temporal characteristics of a learner. A new concept of ontology-based semantic similarity method [3] is proposed for automatic learning and updating of the user profile in a 'music' domain. The updating is done by comparing the similarity between user's profile items and new items using an importance measure combined with ontology-based semantic measure in order to add the most relevant items to the user profile. A fuzzy ontology [1] representing user's preference and interests from

learning objects is constructed automatically in AGORA platform e-learning using related degree of user-relevant

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