

Some applications of Fuzzy Logic and Artificial Intelligence to curricular problems.

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Extended Abstract

Knowledge is, or should be, the business core of universities and, generally speaking, of all educational institutions. Knowledge Engineering could be a key tool to model, analyze and improve some organizational problems of such institutions, because it addresses the general question of how to manage knowledge.

There are a lot of efforts about how to use Knowledge Engineering to improve the learning process; as an example, we can find many approaches about how to design tutoring systems, based on Artificial Intelligence, in order to offer virtual and personalized courses.

In this paper we refer to a different kind of applications. We address some organizational problems that are unique in their nature because they deal with knowledge management. These are common problems in educational institutions, but very hard to find in another kind of organizations. In this sense they are unique. These are curricular problems.

Specifically, here we present the following problems and how we have faced using Fuzzy Logic and Artificial Intelligence tools:

- a. Self-assessment. Since the last 3 decades, a general movement of local, regional and global accreditation processes has arisen. Every curricular program and every educational institution must get one or more accreditation certificate. Usually, the process includes a self-assessment stage, in which the program or the institution itself analyzes its own features. In this paper we show a self-assessment model based on a network, whose nodes are Computing With Words Systems, based on Fuzzy Arithmetics. As a result, decision makers have a compact sensitivity analysis that help them prioritize improvement actions.
- b. Professional profiling. A professional profile is the set of knowledges, skills and attitudes that a professional has or must have. Usually, professional profiles are defined through qualitative descriptions. In this paper, we show a quantitative model of professional profiles. The model is based on pedagogical concepts (Bloom taxonomy and CDIO syllabus) and has the structure of a tree graph. We use Aggregation Operators and Fuzzy Implications in order to summarize and compare different profiles.
- c. Curriculum coherence analysis. In few words, a curriculum is a structured set of courses. A curriculum has a set of learning objectives, but every course

have its own learning objectives. The curriculum coherence problem can be stated as how to assure that the curriculum objectives are fulfilled through the courses. In this paper we show how to use the quantitative model of professional profiles, presented in the previous item, in order to analyze the coherence of a curriculum.

- d. Curriculum knowledge modelling. A more detailed view of a curriculum reveals that it is a complex system. There are a lot of relationships between courses, because they are not isolated. Mainly, the relationships are based on the knowledge that is mastered in every course, but also they are based on skills and attitudes. In this paper we show how to represent such a complex system using Ontologies. As a result, new perspectives arise about the curriculum structure.
- e. Learning paths suggestion. Flexibility is more and more common in the curricula. One of the dimensions of flexibility allows students to decide which courses to take. In this context, every student may have his/her personalized learning path. Education institutions have the responsibility to give accurate and useful information to the students, so they can take informed decisions. Optionally, institutions can suggest personalized learning paths to their students according to their individual interest and needs. In the paper we show how to suggest personalized learning paths, as a result of an optimization problem. The problem is formulated using the models of the previous items and solved using Genetic Algorithms.

All these models and tools have been tested on the same program: the Electrical Engineering program of *Universidad Nacional de Colombia*, in Bogotá. However, they can be extrapolated to other programs, mainly in the engineering and science fields.