A Multi-Stage Fuzzy Model for Assessing Applicants for Faculty Positions in Universities

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ABSTRACT

Assessing applicants for faculty positions in universities involves many issues. Each issue may involve a judgment based on uncertain or imprecise data. The uncertainty in data may exist in the interpretation made by the evaluator. This issue might lead to improper decision making. Modeling such a system using fuzzy logic will provide a more efficient model for handling imprecision. This article presents a fuzzy system for modeling the assessment of applicants for employment at academic universities. This system will utilize a multi-stage fuzzy model for measuring and evaluating the applicants. Utilizing fuzzy logic for applicants’ evaluation will help administrators in choosing the best candidates for faculty positions. The fuzzy system was developed using jFuzzyLogic Java library. The reliability of the proposed system was proved by evaluating real-world case studies to prove its effectiveness to mimic human judgment. Moreover, the developed system has been evaluated by comparing it with a traditional mathematical method to prove the credibility and fairness of the proposed fuzzy system.

KEYWORDS

Employment Assessment, Fuzzy Logic, Imprecise Data, Multi-Stage Fuzzy Modeling

1. INTRODUCTION

Improving performance evaluation is a critical issue for academic institutions. The goal is to achieve a fair evaluation in selecting a candidate for an academic position that will ensure having a qualified faculty member (Patel et al., 2014) (Guruprasad et al., 2015). Administrators need to implement effective assessment process with high reliable criteria to evaluate candidates for academic positions at universities (Sheykhi et al., 2012). Selecting the proper instructor has a great role in building a better educational system (Guruprasad et al., 2015) (Jyothi et al., 2014) (Trstenjak & Donko, 2013), because instructors have the best impact on student performance (Khan et al., 2011). However, common instructor measuring methods use conventional calculations and statistical techniques based on crisp values that might have judgment based on imprecise data (Trstenjak & Donko, 2013) (Ramli & Arbaiy, 2006). Implementing conventional methods may not guarantee the best way to evaluate human skills and performance (Ramli & Arbaiy, 2006), since it incorporates linguistic terms and imprecise data that may result in uncertain and vague results (Guruprasad et al., 2015).

Fuzzy logic has been selected to model many complex and vague systems it mimic the human way of thinking (Patel et al., 2014) since. Moreover, fuzzy systems have proven to provide reliable and DOI: 10.4018/IJIIT.2019010103

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consistent results (Ramli & Arbaiy, 2006). Fuzzy logic proved its efficiency in many applications, in (Sasirekha & Swamynathan, 2017) fuzzy logic was adopted to improve the accuracy of environment monitoring systems that are used in weather controlled laboratories. The fuzzy rough sets were utilized in (Anitha & Acharjya, 2016) to make a system for customer’s choice prediction.

Fuzzy logic allows for flexibility in building system components. It is easy to add or remove an input to a system without affecting other system components. A new output can be generated easily too. Various membership functions with different ranges could be applied and rules can easily be generated for an application (Ramli & Arbaiy, 2006). In the academic field, some applications have used fuzzy logic to measure students’ performance and evaluating faculty performance for promotion, assessment; etc. (Guruprasad et al., 2015) (Khan et al., 2011) (Shaout & Al-Shammari, 1998). Fuzzy logic has helped administrators in universities in the decision process of selecting instructors. It was used to measure their ability, skills and adequacy, which are uncertain and imprecise information that can be better captures by fuzzy modeling (Jyothi et al., 2014). However, fuzzy logic was not used in the decision of selecting new faculty positions in universities.

In this research, fuzzy logic has been used because it proved to be more credible in assessment evaluation than conventional evaluation techniques (Trstenjak & Donko, 2013). The research proposes a multi-layer rule-based fuzzy system to evaluate applicants’ suitability for academic positions in universities. The evaluation is based on assigning rank to each applicant based on specific criteria. The system goal is to solve the uncertainty problem in crisp systems by employing fuzzy linguistic values. The proposed system is flexible, objective and provide credible evaluation.

The rest of the paper is organized as follows: Section two, presents a state of the art in using fuzzy logic to evaluate either student or teacher performance. Section three discusses the current method for assessing applicants at a particular University. The research problem for the proposed fuzzy system is explained in section four. Section five presents the fuzzy system implementation steps. The system evaluation is presented in chapter six. Section seven discusses the result of the proposed system and finally, section eight presents conclusion.

2. LITRATURE REVIEW

This section presents the state of the art of using fuzzy logic in performance evaluation applications for academic institutions.

Fuzzy logic has been introduced by Zadeh in 1965. Fuzzy has been used to solve problems with vague nature that may not be solved using standard mathematical models (Trstenjak & Donko, 2013). Fuzzy Logic is defined as the logic of data approximation where inexact data may exist. Fuzzy has been used in modeling systems that have the ability to imitate human reasoning and the capability of producing precise outputs even in case of imprecise inputs (Shaout & Al-Shammari, 1998). A fuzzy system consists of four components (sub-systems) as shown in Figure 1. An input data fuzzification sub-system, a knowledge base (rule-base) sub-system, a fuzzy reasoning sub-system (decision-making mechanism) and finally defuzzification.

Many successful research has been performed which has incorporated fuzzy logic in various fields like engineering, financial, business, etc. (Trstenjak & Donko, 2013) (Subbotin, 2014). However, few researches have been done to incorporate fuzzy for academic performance evaluation (Jyothi et al., 2014) (Shaout & Khalid, 2014). In Davari et al. (2017) fuzzy logic was utilized to provide a more reliable system, to evaluate teachers and their teaching effectiveness. They have employed fuzzy triangulation number to examine self-assessment of 86 Iranian beginners and experienced English language teachers to analyze the self-assessment questionnaire. Fuzzy numbers showed their reliability and validity in evaluating the teachers’ knowledge and skills. Meenakshi in his research (Meenakshi et al., 2012) tried to improve performance evaluation system by employing new factors/ criteria in employee evaluation. A multifactorial evaluation system based on fuzzy have been used to produce a reliable assessment.
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