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ANALYSIS OF SOFT COMPUTING APPLICATIONS IN EDUCATION MANAGEMENT

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Abstract— **This research paper talks on different soft computing applications in education management. Since two decades, there has been an increase in the research being carried out on how to administer education and educational institutions. It is because of this trend, that a lot of universities around in the world including in developing countries such as India have started MBA education management as well as Master of Education Management programs. Artificial intelligence (AI) and Soft computing (SC) methods are being applied in different areas of our daily life for solving real-life problems. This paper evaluates available literature and discusses applications of various soft computing techniques in education management and recognize future research opportunities in this area.**

Keywords—**Genetic Algorithm , faculty evaluation, forecasting in education, Fuzzy Logic, Artificial Neural Network, Swarm Intelligence**

I. INTRODUCTION

Education management is an area that involves the administration of education and academics. An education administrator needs training of appropriate tools and methodologies in order to help and enable them to assess and manage educational activities. This can be achieved at all educational levels (i.e. elementary, secondary and university levels), since it involves people management in order to administer and facilitate academic activities. Detecting how students should learn and secure knowledge is the problem since last decade [1]. Nowadays two teaching methodologies are in practice - the traditional based and e-learning [2].

The technology helps both the students and teachers to interact and collaborate with each other more efficiently [3]. Artificial intelligence methods have been applied in different areas of education. It helps in student evaluation, grading, enhancement of education in the greater levels of the individualized learning and academic progress[4]–[7].Development of numerous educational applications and websites happened because of development in the technology. Many soft computing (SC) methods and artificial intelligence techniques have been applied in the field of education management [8].

In this research paper, there are six sections. Section 2 will provide an analysis of soft computing methods. Section 3 will discuss the adopted research methodology used for this research study. Section 4 will briefly discuss what education management is. Section 5 will analyze and discuss the various applications of soft computing techniques in a number of education management tasks and processes. The last section will focus on the limitations of this study and long with future research opportunities and conclude the paper.

II. OVERVIEW OF SOFT COMPUTING TECHNIQUES

Generally in computer science, there are two major types of computing paradigms. The first is hard computing and the other is soft computing (SC). Hard computing deals with crisp, discrete, or binary data or situations whereas SC deals with and can handle situations with uncertainty, imprecision, partial truth, vagueness, and ambiguity [9]. SC is the field of computer science and artificial intelligence [10] which enables the computer to have human-like intellectual skills to examine, learn and analyze vague and uncertain data [11], [12]. SC techniques are used to solve real-life scenarios using complex information processing [13]. The major benefit of using these techniques is to achieve human decision-making ability to handle physical world situations. Nowadays different soft computing methods like fuzzy logic, artificial neural network, rough set theory, genetic algorithm, ant colony optimization, particle swarm optimization, k-means clustering algorithm, etc available.14].

III. RESEARCH METHODOLOGY

This research adopts a literature review-based qualitative research methodology to identify and analyze various uses of SC techniques in the area of education management. Due to limited financial resources, the literature was being searched

using Google Scholar database using several combinations of keywords such as "prediction / predicting student enrollment evaluation", "fuzzy logic education student", "soft computing education", "soft computing student" etc. After carefully analyzing the titles, abstract, and conclusion sections of each of the papers. After examining all the papers, some of them had restricted access through pay-walls, we were able to gather around 30 papers having direct applications application of SC in education management. This issue has also been focused on as the limitation of this research study.

IV. EDUCATION MANAGEMENT

Educational management is a field in which a collective group of professionals including the faculty, principals, and other educational authorities. Education management is also known as educational administration. Educational management professionals are found in the government sector, private companies, and non-profit organizations. The people working in educational management act as consultants, administrators, researchers, or policymakers in order to help in evaluating and developing ways to enrich and enhance the educational system at all levels [15]. There is a thin line between leadership and administration in the concept of education management. Educational supervisors sometimes face difficulty distinguishing between educational management, leadership, and administration. Regardless of their meaning, it is at times hard to maintain the equilibrium between high order tasks that are aimed to improve student, staff, and overall school performance (leadership), maintaining the current tasks (management) and other lower-order tasks (administration) [16]. Leadership and management are both prominent factors for a school in order to work efficiently.

V. APPLICATION OF SOFT COMPUTING IN EDUCATION MANAGEMENT

This section will discuss the application of SC in education management. This paper aims upon discussing the major areas of education management in which SC techniques have been applied. SC techniques like neural networks are used to evaluate the student course grading and evaluation and fuzzy logic for efficient learning and performance [8], [17]. Bayesian networks to represent and detect student learning styles, genetic algorithms in mathematical problems like shortest path evaluation used in automata, network and graph theory [1], [18]. Neural networks also enable the teachers to predict the student's GPA [19]. Another research has utilized decision trees along with neural networks to forecast student retention and degree compilation time [21]. The behavior of ant colonies and their property and capability of self-organizing themselves have been applied and can be further utilized in the areas of knowledge engineering, decision support systems as well as within a number of educational management processes. These services provide models of the distributed adaptive organization. These models are useful to solve difficult optimization problems. Some other uses of SC techniques in the area of education management have been discussed in the following subsections.

A. Fuzzy Logic

Fuzzy logic is the most common technique used for evaluation in education management. Student and teacher evaluation is important to maintain a balance between the two and to produce a higher level of outcome based on student achievement [23]. Nowadays New Fuzzy Expert System (NFES) has been developed in order to indicate the difference between a active and less active student. Its main objective is to modify the learning according to each student's pace. NFES has decision-making capability. It monitors each student's growth and defines the next step in training [23]. A students' learning assessment model has been created using fuzzy logic to evaluate students' academic performance by gathering the information and providing results to compare with the statistical output [24]. Researchers have also focused in evaluating a teacher's performance because teachers are the core of students' achievement [25]. By using fuzzy logic educators can assess a teacher more efficiently than the current procedures. A number of researchers have used fuzzy time series to predict and forecast student enrollments in higher education institutions [26]–[28].

B. Artificial Neural Network

Artificial Neural Networks have also been used for evaluation purposes. An Adaptive neuro-fuzzy Interference System (ANFIS) was developed to enhance the speed, reliability and flexibility which was lacking in previous systems [29]. It is a good combination of using fuzzy logic and an artificial neural network. This combination can produce good numerical outcomes to predict student performance. Once the student performance is evaluated neural networks can also be used to improve degree completion time. By evaluating the performance of students it is easier to distinguish between those that are at-risk and by providing correct counseling and training to those students will result in increasing graduation rates [21].

C. Genetic Algorithm

The genetic algorithm plays a significant role, as search techniques for handling complex spaces, in many fields such as artificial intelligence, engineering, robotic, etc. The genetic processes on the natural evolution principles of populations have been fairly successful at solving problems and producing an optimized solution from generation to generation. This is applied in students' quantitative data analysis to identify the most impactful factor in their performance in their curriculum. [31].

D. Bayesian Network

Using a technology while learning enhances the ability of students to grab the lecture. By Bayesian Networks it is easy

to discover which faculty should be assigned to use these technologies during their lecture as it requires skills [32]. Every student has his/her own learning behavior. A Bayesian network (BN) model was developed to detect different learning styles in students. The results were robust when compared with that of the existing model. This model helps in determining the students with high precision [1]. The bayesian model can differentiate between the changes from A to B more accurately. It is also efficient in recognizing the mistakes of the tutor during the assessment to avoid the same mistakes again and identifies productive practices that may be helpful in the future [33].

E. Swarm Intelligence

Swarm Intelligence (SI) studies the collective behavior of systems composed of many individuals interacting locally with each other and with their environment measuring the performance of an individual working in an organization is a must in order to produce higher results [4]. Practical swarm Optimization combined Neural network (PSOCNN) is a software-based on java programming and is implemented in four steps (collecting data, processing, selection, and output). Some of the data sets used were student performance, results, students' attendance, and other performances. It was observed that combining datasets into a single set, results in less number of errors and produces higher efficiency. In this model, high accuracy rate is obtained due to the use of PSO [34].

F. K-means Clustering

Higher learning of students is based on the learning methods of the lecturer. Students' academic performance reflects their academic careers. K-means clustering algorithm was used to evaluate students' performance with respect to their overall careers. For analysis, students' results were taken as a data set. The results of this model were compared with the local results and the difference was clear. This model also helped in refining some of the restrictions in the existing model. Therefore, a k-means clustering algorithm is a great tool for analyzing and monitoring the changes in students' performance [35].

VI . CONCLUSION & FUTURE RESEARCH DIRECTION

This paper has done a literature review regarding the applications of SC in education management. The major limitation of this research paper is that only Google scholar was being used to search for relevant literature due to the constraint of not having access to a number of pay-wall-based research papers being not available in the university library. It has been identified that a number of SC techniques have been applied in various areas within education management such as for forecasting student enrolment, student and faculty performance evaluation, forecasting student grade point average among others. But there is a lack of use of SC techniques in other areas within education management such as predicting and evaluating various teaching methodologies' effectiveness for teaching specific courses or for evaluating the use of technology and e-learning in the education environment. In future, a more comprehensive review of SC techniques in education management can be done, which may help in better identifying ways to use SC techniques in education management.

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