Design and Use of Machine Learning Techniques Using DSS Model

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Abstract

The basic goal of every school is to provide its pupils with the most advanced knowledge and abilities possible. Understanding which pupils need more help and then providing that help is crucial to achieving the desired outcome. Lack of accuracy, poor analysis of the defining qualities, and an insufficient database provide challenges and impediments for information systems that cannot reap the full benefits of EDSS. In order to better the prediction process, it is essential to do a thorough literature research and gather the best predictive methods. The purpose of this research was to apply machine learning techniques to develop a classifier for predicting economics majors' long-term performance. This work uses machine learning to present a DSS model built on top of a knowledge base that can be used to assess students' progress during the semester. This paper applies data mining to the college student information management system, mines student evaluation information data, employs data mining technology in the design of student evaluation information modules, and uncovers the factors that affect student development and the various relationships between them. The foundation for effective education is predictive testing of students' knowledge and data-informed pedagogical choices.

Keywords: *Computer Science, AI, Student Information Management, Educational Knowledge Base System (EKBS).*

1. INTRODUCTION

There is no universally accepted definition of "artificial intelligence." Artificial intelligence (AI) is often depicted in the popular media as a machine that can perform a wide range of cognitive tasks, including problem solving, language comprehension, medical diagnosis, autonomous vehicle navigation, chess, painting impressionistic ripoffs of van Gogh masterworks, and keeping cars from veering off the road. An intelligent system, or AI, is a computer program designed to execute operations typically requiring human intelligence. Since defining intelligence presents its own set of difficulties and is annoyingly tautological, artificial intelligence is typically understood today to be the study of how to design and build machines that can successfully navigate and adapt to their surrounding natural and artificial environments. Workflow architectures and multimedia apps that are compatible with today's embedded devices are also standard. Because of the programming parts, the project's design has risen to prominence and now takes precedence over hardware. As far as the location of the system and the authority figure are concerned, be confident that everything is normal. In the field of computer science and engineering at Seoul National University, a workshop staffed by certified engineers has been developed as a new teaching method. Through the use of artificial intelligence (AI), the model ensures numerous crucial characteristics, including the ability to learn, optimize, and repair itself. Although such a system would be useful everywhere, it presents certain design issues. Real-world applications of intelligent design are challenging, given the software's constraints.

2. LITERATURE REVIEW

Subhasree Pal et.al (2022) The current paper sheds light on how soft computing in India can be used to effectively and efficiently address various unwelcome situations and real-time problems in teaching-learning platforms, in-classroom ambience, prediction of students' performance and success, and probability of their retention. For every youngster, a classroom is the location where they will lay the groundwork for their future. Consequently, a wide range of concepts are intrinsically linked to effective classroom management. In cases when a traditional method of diagnosis has failed, Soft Computing has shown to be the most effective and efficient means of identifying the issue and developing a workable plan of action. The field of study known as "Soft Computing" is built on the premise that the faculties of thought—including cognition, reasoning, and

ratiocination—are useful in solving the kinds of issues that arise in a traditional classroom setting. It's a toolkit for optimizing classroom instruction via the use of machine learning, genetic algorithms, artificial neural network analysis, fuzzy logic, etc. The foundations of every educational system are the climate in which learning takes place, the learning environment in which information is planted, and the teaching and conduct of the instructor, which are analogous to the warming rays of sunlight that aid in the synthesis of knowledge. There may be solutions to the problems that may be found in soft computing.

Faizal Khan et.al (2021) The SLS is a tool for assessing a learner's familiarity with and mastery of a certain topic. Now more than ever, because to advancements in technology, individuals of all skill levels, from complete novices to seasoned professionals, may benefit from SLS. Artificial soft computing approaches have been employed inside the learning architecture in recent years to create a productive educational setting. For the purpose of enhancing the educational process as a whole, this article conducts a comprehensive investigation of soft computing applications. There is also discussion of the architecture of various soft computing strategies and how they relate to the E-learning and m-learning approaches that are now in use. This research provides a model based on Artificial Intelligence (AI) for learning methodologies, and investigates the use of soft computing to give users with observations and allow them to prepare, utilizing tools designed particularly for obstacles in learning. In this work, we explore how soft computing might be used as a tool to improve the efficiency with which learning procedures are managed.

Olaf Zawacki-Richter et.al (2019) Artificial Intelligence in Education (AIEd) is a new area of study in the field of education technology, as shown by a number of recent studies conducted on the topic throughout the world. Even though it has been available for almost 30 years, educators are still unsure of how to take pedagogical advantage of it and how it might genuinely affect teaching and learning in higher education. Using a systematic review approach, this work aims to summarize the literature on the use of AI at universities. Based on predetermined inclusion and exclusion criteria, 146 articles were selected from the original 2656 identified for the years 2007-2018. Descriptive findings reveal that Computer Science and STEM fields account for the bulk of disciplines represented in AIEd articles, with quantitative approaches dominating empirical research. The findings highlight four areas of use for AIEd in academic support services and institutional and administrative services: 1. profiling and prediction; 2. assessment and evaluation; 3. adaptive systems and personalization; and 4. intelligent tutoring systems. Weak connections to theoretical pedagogical views and the necessity for deeper research of ethical and educational methods in the implementation of AIEd in higher education are reflected upon as the conclusions are drawn.

Félix A. Castro Espinoza (2018) Growth in eLearning and b-Learning (Blended Learning) has been especially strong in the field of higher education and training due to the positive effects that technology has had on almost every aspect of modern life. Its universal accessibility stems from its natural capacity to bridge geographical and cultural gaps, spread information, and lessen the financial burden of education. Regarding its future function, the academic community is split. By 2019, it's expected that e-Learning would constitute 50 percent of all higher education throughout the globe. While proponents claim that this is the future of education, critics point out that it is a fad, that there are high dropout rates, and that the widespread adoption of these programs, along with their possible poor quality, will eventually lead to their decline. A consensus may be found, however, on two related aspects. One hand, there's the mountain of data and proof that e-Learning systems like Learning Management Systems (LMS) provide. This is the foundation of the automatable component of the process. E-tutors and e-trainers, on the other hand, play a crucial part as quality assurance authorities in the virtual classroom. These are constantly taxed by the requirement to analyze material in storage, provide quick and useful feedback to students, and handle many unique circumstances and casuistics requiring decisions. Thus, the present reporting and monitoring mechanisms available on most e-Learning systems are either inadequate or excessive. The suggested thesis seeks to innovate at the intersection of Information and Trainer, where most recent LMS innovations have focused.

Tuomi, Ilkka (2018) This study summarizes the present development of artificial intelligence (AI) and its possible effects on the educational system. It provides the conceptual groundwork for future-oriented labor, research, and activities that meet the possibilities and problems posed by recent breakthroughs in AI. Although the report's intended audience is policymakers, its findings will be of use to those working in the field of artificial intelligence (AI) technology as well as those investigating the potential effects of AI on the economy, society, and the future of education and training.

3. OVERVIEW OF SOFT COMPUTING TECHNIQUES

There are two primary computing paradigms in theoretical computer science. There are two types of computing: hard and soft (SC). In contrast to SC's ability to cope with and process circumstances characterized by uncertainty, imprecision, partial truth, vagueness, and ambiguity, hard computing focuses on clear, discrete, or binary data or situations. SC is the branch of AI that focuses on giving computers the ability to scrutinize, understand, and interpret material that is inherently ambiguous or unreliable, much as a human would. In order to handle real-world problems, experts turn to SC methods, which include the utilization of complicated information processing. The capacity to make decisions on par with humans in real-world settings is the main advantage of adopting these methods. Fuzzy logic, artificial neural networks, rough sets, genetic algorithms, ant colony optimization, particle swarm optimization, k-means clustering algorithms, and many more are all examples of soft computing methods.

4. EDUCATIONAL KNOWLEDGE BASE

Machine Learning

This section provides a high-level explanation of the machine learning approaches used in this investigation. Machine learning capabilities were unquestionably added to computers. Training data, collected from a variety of sources, was used. The reliability and amount of the data acquired will indicate the quality of this model. Cleaning, randomizing, and simulating the connection between concentrations is recommended for data used in machine learning training. In order to build a more robust model than one based just on principles, machine learning excels at response prediction via the use of an artificial learning algorithm rather than human evaluation.

Educational Knowledge management

Knowledge management in education refers to the dynamic system of components, processes, and linkages among human resources, facilities, technology, information, and knowledge workers. These collaborations take place in a "environment" that may either foster positive or negative patterns of information management behavior. The study of organizational km, with an emphasis on IT, often follows a methodical and evidence-based process. Humanist, technostructural, and awareness and environment cultural impacts inside the business and knowledge management system are all investigated and studied at the same time using a systemic approach. Therefore, we need a more precise definition of KM. "an integrated, regular, targeted, and ongoing socio-technical function to promote, capture, gain, generate, organize, store, retrieve, share, distribute, transfer, reuse, and evaluate experiences, knowledge and assets (tacit and explicit) to achieve competitive advantage by improving the quality of knowledge and knowledge processes," as defined by the Institute of Knowledge Management.

Educational decision management

Decision making is often regarded as the pinnacle of managerial functions. Many areas find great interest in problems of policymaking, such as curriculum administration. Most people who make choices about schools and education do it based on superficial information or gut instinct. Choices are made between possible courses of action in order to achieve an end result.

Educational expert system

One definition of an expert system is a computer program designed to mimic human performance in a certain domain. When one or more human specialists should be contacted to address a problem or explain doubt, it employs a human knowledge base to do so. Expertise-based systems, or specialized systems in general, rely on human knowledge to solve problems that often need human inventiveness.

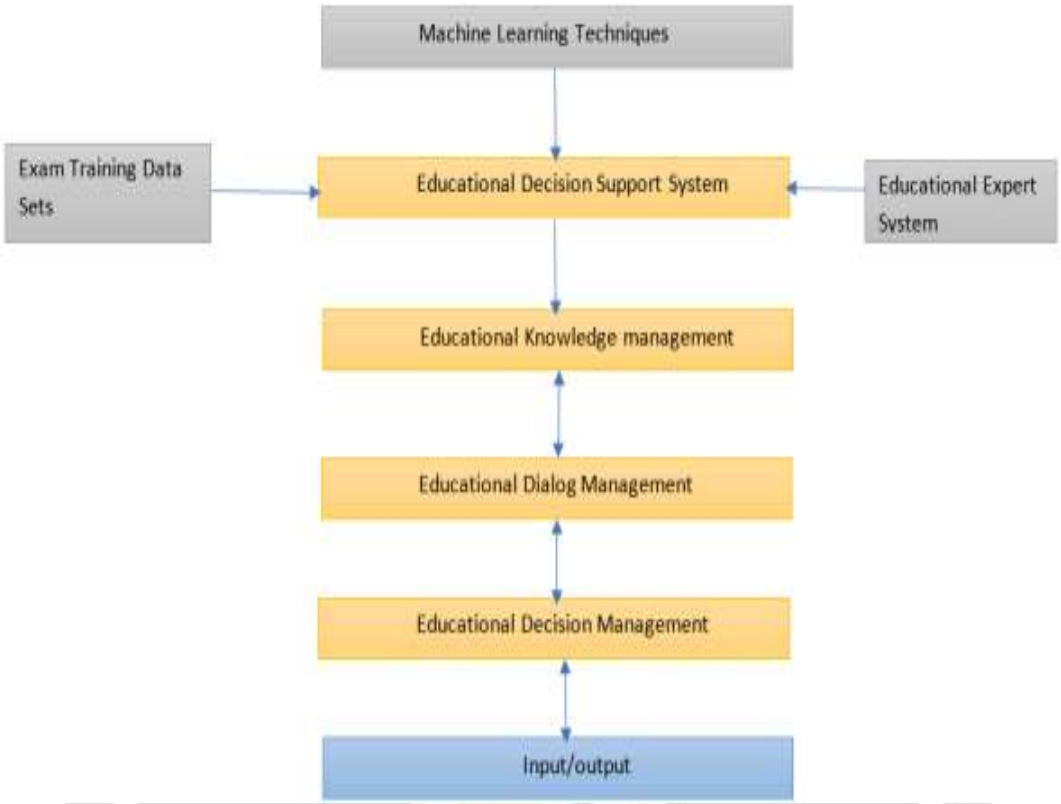

Figure 1 Educational Knowledge base

5. DESIGN AND IMPLEMENTATION OF STUDENT INFORMATION MANAGEMENT SYSTEM

Creating and analyzing systems. The computing approach is based on the density of the data, which is one of them. Cluster analysis is able to successfully split a set of data into numerous more dense clusters by calculating the distance between each set of data and the cluster center and finding the cluster with the shortest total of distances. When evaluating student performance, the data in the middle of a cluster represents the average score for that group, as determined by the cluster analysis method. Each cluster assigns a central score based on how it divides the scores into its constituent groups. Among the criteria used to determine a student's final grade, these fundamental marks stand out as among the most important. As can be seen above, the score division based on cluster analysis is no longer the absolute score division, but the relative score division. As a result, student assessment is more reliable. In order to meet the needs of the system as a whole, the design team used a structured design approach, breaking down the requirements into subfunction modules. This technique of design is not only easy to read and understand, but it also makes it simple to query mistakes when designing and debugging. It is simpler to implement the system's new features and enhanced capabilities when this design approach is used. Student data, student status data, performance data, and reward and punishment data are the four main categories tracked by the system. Modules are broken down further into smaller sub-modules in order to implement interrelated features. Figure 2 depicts the detailed function design.

(1) Establishing a system to store individual files for incoming first-year students, as well as allowing for their inquiry and update, are all part of student information management. A new student's file will include information such as their name, ID number, date of birth, gender, and course schedule. Incorrectly registering new students, for example, or updating personal information such as a student's home address or phone number are examples of the types of student data that may be queried and modified.

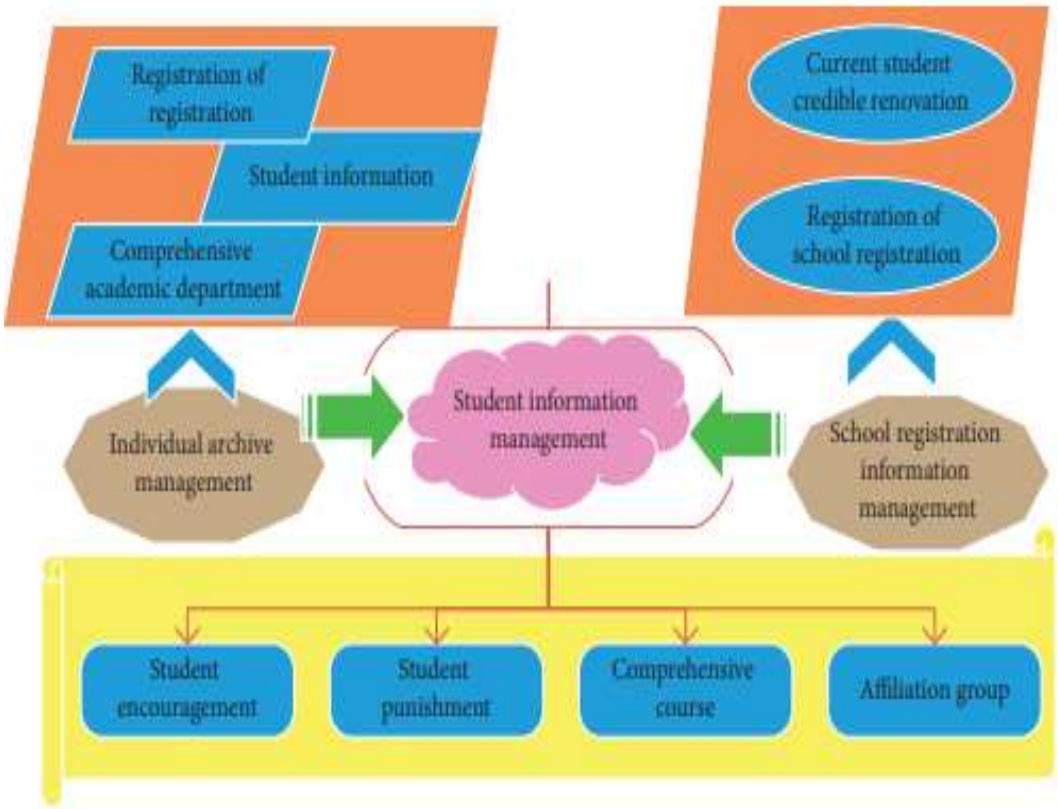

Figure 2: System structure block diagram.

(2) To maintain student status information primarily means to keep track of when a student's status has changed. Modifying student information queries (such as by adding, updating, or removing data) is mostly done so that new student data may be kept up to date. To complete the process of managing and maintaining student data, we may now add, delete, and query the student basic table.

(3) After every exam, administrators must register and query scores.

(4) Management of student reward and punishment data serves primarily as a means of recognizing and rewarding superior academic performance and sanctioning underachievement.

Using a Fuzzy Genetic Algorithm for Analyzing Student Performance in a Clustering Setting. The primary indication of whether or not students have retained what they have studied and the most crucial component of any student information database is the students' own performance on assessments. Therefore, teachers have spent a lot of time and effort researching how to assess students' marks in a scientific, accurate, and fair way. Student performance assessment has evolved from a single five-point system and a hundred-point system to a more frequently utilized hierarchical system as the education reform continues to progress. This is particularly true since the credit system teaching management system became the mainstream.

Selecting and analyzing the accomplishments of 180 students is done so that the application impact of the aforementioned enhanced algorithm in the student success data mining system can be better explained. Those with a score of 90 or more are considered excellent, those with a score of 80 or more are considered excellent, those with a score of 70 or more are considered medium, those with a score of 60 or more are passed, and those with a score of less than 60 are considered fail. There are 180 students in the class, and the grades they receive are Excellent, Good, Intermediate, Pass, and Fail. Figure 2: The Obtained Results.

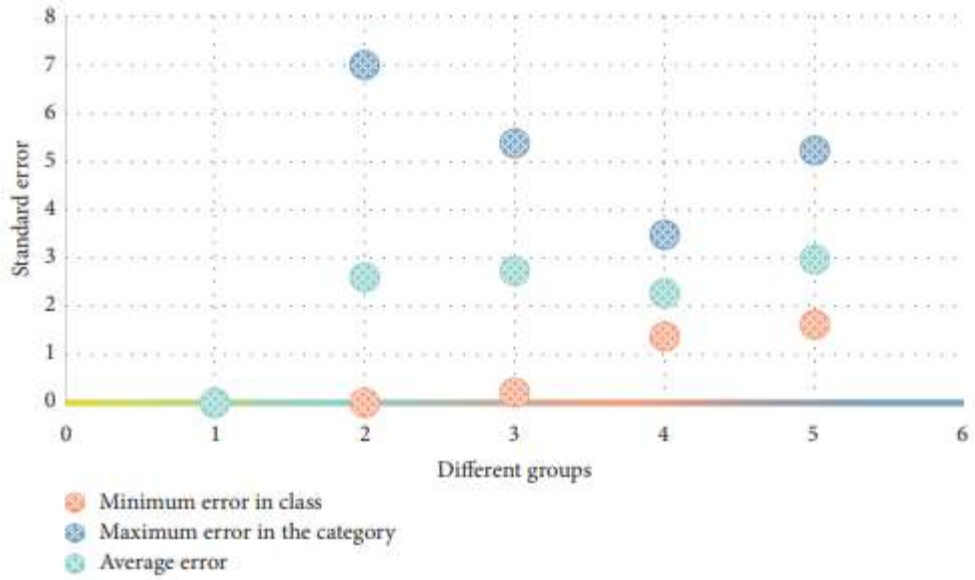

Figure 3: Grading students' performance according to the traditional method

6. DATA ANALYTICS IN EDUCATION MANAGEMENT INFORMATION SYSTEMS (EMIS) AND THE EVOLUTION TO LEARNING MANAGEMENT SYSTEMS (LMS)

Information for educational planning and management is collected, stored, processed, analyzed, and disseminated using an EMIS (Education Management Information System). Educators at the state, district, and school levels, as well as those responsible for compiling national data, rely heavily on it. In response to federal and state test-based accountability rules, many schools and districts are focusing their reform efforts on Data-Driven Decision Making (DDDM) applied to student achievement testing data. Using the troves of information available from EMIS, AI algorithms may implement data-driven reforms in the classroom.

Members of the education community at all levels can collaborate more effectively on managing and administering the system, creating workable and cost-effective plans, crafting responsive policies, and keeping tabs on and assessing student learning with the help of an EMIS that has been thoughtfully designed and is properly implemented. To the extent that data in a given country are comprehensive, trustworthy, routinely gathered, and can be aggregated and disaggregated, AI-enhanced EMIS will be in a better position to automatically analyze the data and provide data dashboards at both the school and national levels. In the long run, EMIS might potentially pave the way for the creation of algorithmic methods of predictive decision-making. A growing number of countries, both developed and developing, are interested in upgrading their existing EMIS from a school-based aggregated administrative data management system to an integrated and dynamic learning management system that can effectively support real-time decision-making in every aspect of education sector management.

To better serve the educational needs of the UAE's approximately 1.2 million students across 1,200 schools and 70 universities, the UAE's Ministry of Education has implemented a cutting-edge data analytics platform. Information gleaned from international tests like PISA and TIMSS as well as local surveys and surveys of instructors, students, and parents are all part of this data analytics system (Leading Countries of the World, 2018). The Ministry of Education in the United Arab Emirates (UAE) has a data analytics department tasked with creating machine learning algorithms to aid in strategic assessments of the country's educational system.

In addition to high-income nations, middle- and low-income nations are investigating the possibilities of EMIS with artificial intelligence. In Kenya, for instance, a group of governmental and private groups have teamed together to provide the iM educational technology initiative to the country's youth. When schools use sQuid's digital attendance system, they get a trustworthy and deep understanding of student data trends, as well as the opportunity to easily monitor attendance in real time. Teachers and a field team may utilize the sophisticated analytics employed to monitor and report class and school attendance to identify students who have a hard time showing up to class regularly. Students and educators alike may access educational materials in a variety of forms on the sQuid platform. Students have access to a variety of resources, including the adaptive math tutor

Maths Whizz, as well as novels set in Africa, the first children's encyclopedia, and revision aids that are matched with school curricula.

Even though they are only getting started, nations like Bhutan and Kyrgyzstan want to develop student-tracking-based integrated education information management systems that will allow for individualized instruction and better overall school and sector administration. This paves the way for the incorporation of AI-enhanced learning analytics into their systems.

Through its school mapping program, UNICEF Innovation is collaborating with academic institutions and business firms to investigate the potential of Deep Learning (DL) algorithms. Their research demonstrates the efficacy of DL algorithms for a variety of tasks, including the recognition of schools in satellite images.

7. CONCLUSION

Predicting how well students will do is also important. Extensive investigation led us to the conclusion that different student datasets provide results with varying characteristics. The goal of this study is to look into the future with an eye toward designing an undergraduate exhibition and framework that will serve as a unique warning system for the field of higher education. The goals of this analysis are to evaluate the way these information mining techniques were presented and to check the accuracy of the assumptions made about the likeliness of an understudy position.

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