Preface

As it is known, much has changed in the past five years. At this point, sensitive and dynamic aspects of the society make it very adaptive to any changes that may occur. Changes in standards of the daily life highly depend on many different factors and may be sociological, economical, or technological. Technological changes can be easily adapted to by society by enabling people to feeling the adaptation as “keeping the trend.” If we focus on the details of our daily activities, we can easily see the effects of changes among technologies and become aware of some revolutionary developments and improvements that may be hidden for us. We are in a rapidly changing world and trying to keep ourselves adaptive to the changes, especially after the era of modern knowledge society.

When we think about functions of the modern knowledge society, it can be clearly expressed that the society always needs innovative and effective approaches to keep reaching to the desired information in a fast and efficient way to make it easier to share information with anyone. In time, all these needs have caused revolutionary changes in many fields. In this sense, education is one of the most remarkable fields, and it has a key role in enabling individuals and preparing them for the conditions of the knowledge society.

The education field has a natural feature, which takes it into a great interaction with the developments in both communication and computer technologies. Today, Internet has a big impact on educational activities, and many educational institutions employ this technology in order to perform their teaching-learning processes in more effective and efficient ways. Improvements in computer technology also make it possible to design advanced educational approaches and make it possible to experience educational processes in cases of time and zone limitations. From this perspective, Distance Education and its techniques like e-learning and m-learning are widely used by educational institutions in order to make it possible to receive education and instruction.

Distance Education has many advantages that make it a durable approach, but when we focus more on the complex and chaotic style of human behavior, it is always a vital need to make the related educational approaches/techniques adaptive. Because any behavior in Distance Education activities can affect the whole educational flow and cause negative outputs at the end, the related behaviors, which can be determined via advanced intelligent, mathematical-logical algorithms should be taken into consideration to change some conditions and adjust them according to the human factor. All of these explore an important academic and scientific interaction between the Artificial Intelligence and Distance Education.

The objective of this book is to introduce Artificial Intelligence-Based Distance Education works and applications that are employed to overcome the related problem expressed above and improve teaching-learning experiences during educational processes. By explaining and introducing the related works/applications, readers who are interested in the related fields (Artificial Intelligence, Distance Education, E-Learning, etc.) will be enabled to improve their knowledge about the literature and the developments
in it. Furthermore, the book also aims to explore a research concept that we call “Intelligent Distance Education.” This concept includes many different scientific studies associated with combining Distance Education and Artificial Intelligence. The development of Intelligent Distance Education applications or systems is a greatly improving interest area.

The prospective audience of the book, *Artificial Intelligence Applications in Distance Education*, will be scientists, engineers, researchers, and academicians, as well as anyone interested in both Artificial Intelligence and education (more specifically Distance Education).

This book includes 14 chapters about research works that have been performed based on both Artificial Intelligence and Distance Education. The content of the related chapters are overviewed briefly in the following paragraphs.

**CHAPTER 1**

In today’s world, intelligent systems play an important role in improving humankind’s life standards and providing effective solutions for real-world-based problems. In this sense, such intelligent systems are the research outputs of the Artificial Intelligence field in Computer Science. Today, in many fields intelligent systems are widely used to obtain effective and accurate results for the problems encountered. At this point, education is one of the most remarkable fields in which lots of Artificial Intelligence-oriented research works are performed. When we consider the education field in terms of the latest technological developments, we can also see that the e-learning technique and more generally distance education approach are highly associated with the applications of Artificial Intelligence. Therefore, in this chapter the author explores the trends within the interaction between Artificial Intelligence and Distance Education. The chapter is a brief report on current trends of applications of “intelligent distance education” solutions. It also provides a short focus on the future possibilities of the relation of Artificial Intelligence and Distance Education.

**CHAPTER 2**

In Digital Libraries (DLs) as an innovative community environment, knowledge is nutrition, and the environment for knowledge sharing is the essential condition. As the knowledge is the heart of digital libraries, it is imperative for them to promote the innovation activities embodied by teaching and scientific research through an efficient knowledge-sharing environment. In digital environment, the role of knowledge has become even more significant. Moreover, DLs perform many knowledge-based activities, and by nature, the knowledge-sharing process is embedded in DL systems. These modern knowledge management environments need modern technologies in order to perform properly for end users and online researchers. Therefore, the aim of this chapter is to provide a model for global knowledge networking with utilizing digital libraries and artificial intelligence. The specific objectives are to describe a framework of digital libraries and concepts of Knowledge Management (KM). The chapter finds some significant overlaps between DLs and KM and integrates the knowledge-sharing process with DLs and artificial intelligence. The integration of KM and knowledge sharing can add value to develop a global knowledge networking process model so users around the globe can make use of this knowledge transmission.
CHAPTER 3

Increasing student numbers lead to new needs in the education sector. New systems are needed due to expert numbers that are insufficient in specialties, such as instructors, directors, and advisors. Type, goal, and specialty of intelligent systems programmed to satisfy this need are being developed with each passing day. The aim of this chapter is to develop an intelligent system that provides support with schedule, academic orientation, choice of profession, and career planning to students. To make a regular schedule for students would generally cause an inappropriate program, which is hardly followed by students in case they were indiscriminately prepared without any information about students’ characteristics. Instead of this method, it is the point to be familiar with the academic success, study, resting, and even meal time of the student, and to know which lessons are studied on which days and to make an appropriate schedule for studying. According to the teachers, it is time-consuming and difficult to perform this method for all students. Within this scope, an intelligent system preparing a study schedule is developed considering the students’ characteristics and study habits.

CHAPTER 4

Higher education in accounting has witnessed, in time, a massive development, a fact that has required the identification of the most efficient training methods based on competencies so as to meet the new professional challenges. Computer-based training represents a didactic method that improves accounting education. This chapter presents some elements regarding e-learning in accounting and how the educational software can include artificially intelligent elements that may humanize the dialogue of the teacher-computer, like pedagogical agents. The authors present the main ideas of how they designed and developed a multi-agent system that has been incorporated into an educational soft that was tested and validated within an experiment with the students from the specialization of Accounting and Management Information Systems of the Vasile Alecsandri University of Bacău, Romania.

CHAPTER 5

One of the most important functions of distance learning systems is determining the student knowledge level and performance clearly. In traditional education systems, students can be assessed in single-stage via tests and homework studies, which consist of multiple-choice questions. However, this method cannot provide accurate results since it is not able to evaluate student knowledge level and question difficulty level. In this chapter, a system and software structure that can determine student knowledge levels, topic difficulty level, and question difficulty levels according to instant student answers for the exam is introduced. In forming student knowledge levels, content monitoring and test data taken from distance education vocational school were used. In this way, more accurate results have been obtained. The fuzzy logic technique has been used to determine (classify) student knowledge levels and topic difficulty levels clearly. In order to determine next questions adaptively, the stored questions have been classified with division clustering methods, and the most suitable questions for the related student knowledge level have been found by using the nearest neighbor algorithm.
CHAPTER 6

Information and communication technologies have led to new developments in education. Time and place independent education has emerged. Furthermore, different characteristics and huge numbers of individuals have made the use of new technological methods inevitable. In this context, distance education has become a popular education method to meet the emerging needs, increasing satisfaction, and learning performance of students. Mobile technology, intelligent systems, and Three Dimensional (3D) animations also provide enhancements in this field. In addition, distance education systems should be selected and developed properly for target students and environments. For this purpose, the assessment of prominent studies provides a road map for new research. In this sense, this chapter evaluates intelligent distance education studies in literature. Furthermore, it proposes a novel Artificial Neural Network (ANN)-based distance education system for Mehmet Akif Ersoy University. This ANN-based system can be implemented on Mehmet Akif Ersoy University infrastructure with agent. The proposed system consists of a learning management system, Web conferencing system, and an ANN agent. The agent’s inputs that are already stored in Mehmet Akif Ersoy University’s distance education databases can be easily retrieved. This agent provides reusability of course content and Web conferencing records.

CHAPTER 7

In the context of Chaos Theory and its applications, forecasting time series of a chaotic system is an attractive work area for the current literature. Many different approaches and the related scientific studies have been introduced and done by researchers since the inception of this working area. Newer studies are also performed in order to provide more effective and efficient approaches and improve the related literature in this way. On the other hand, it is another important research point to ensure effective educational approaches for teaching Chaos Theory and chaotic systems within the associated courses. In this sense, this chapter introduces a Web-based, intelligent, educational laboratory system for forecasting chaotic time series. Briefly, the system aims to enable students to experience their own learning process over the Web by using a simple interface. The laboratory system employs an Artificial Intelligence-based approach including a Single Multiplicative Neuron System trained by Intelligent Water Drops Algorithm in order to forecast time series of chaotic systems. It is possible to adjust parameters of the related Artificial Intelligence techniques, so it may possible for students to have some knowledge about Artificial Intelligence and intelligent systems.

CHAPTER 8

Computers have been used in educational environments to carry out applications that need expertise, such as compiling, storing, presentation, and evaluation of information. In some teaching environments that need expert knowledge, capturing and imitating the knowledge of the expert in an artificial environment and utilizing computer systems that have the ability to communicate with people using natural language might reduce the need for the expert and provide fast results. Expert systems are a study area of artificial intelligence and can be defined as computer systems that can approach a problem for which an answer is being sought like an expert and present solution recommendations. In this chapter, the definition of expert systems and their characteristics, information about the expert systems in teaching environments, and especially their utilization in distance education are given.
CHAPTER 9

During a typical e-learning process, there are many different factors that should be taken into consideration to keep the stability of the process or improve the process to get more effective results. Nowadays, employing Artificial Intelligence-based approaches is one of the most popular ways to improve the process and obtain the desired objectives rapidly. In this sense, there are many different kinds of scientific works in order to improve the related literature. However, ensuring control among the performed Artificial Intelligence-based e-learning process is a critical point because there is sometimes a misunderstanding about employing intelligent e-learning process that running intelligent educational tools or materials does not always mean the related e-learning process will improve greatly. In order to ensure that there should be some managerial procedures focused on some aspects of the process, this chapter aims to introduce a managerial model that can be used for especially Artificial Intelligence-supported e-learning content flow in order to improve the educational process. The suggested model is usable for the educational institutions, which focus on especially Artificial Intelligence-oriented e-learning solutions, research works, and educational activities.

CHAPTER 10

The chapter presents a case study of using data mining tools to solve the puzzle of inconsistency between students’ in-class performance and the results of the final tests. Classical test theory cannot explain such inconsistency, while the classification tree generated by one of the well-known data mining algorithms has provided reasonable explanation, which was confirmed by course exit interviews. The experimental results could be used as a case study of implementing Artificial Intelligence-based methods to analyze course results. Such analyses equip educators with an additional tool that allows closing the loop between assessment results and course content and arrangements.

CHAPTER 11

In recent years, the amount of software developed to be used in the fields of computer-assisted teaching, e-learning, and distance education, and their quality levels have greatly varied. In order to meet the increasing demand for effective and suitable coursewares at an optimum level, the most convenient method is believed to be that these coursewares should be developed by teachers themselves, and a considerable number of quality studies focusing on these coursewares should be conducted to improve educational processes in general. At this point, the studies and projects benefitting from the advantages of artificial intelligence-based approaches are becoming frequently available in the related literature as an innovative trend. The current chapter deals with the design and development of an “expert system shell program” on the basis of certain specific goals and needs mentioned in the literature. The main objective of the study is to assist teachers in developing their own courseware by using this particular program. The shell program developed within the scope of this study was tested on a group of people that consists of teachers from different fields of teaching and education levels, and its effectiveness was evaluated through certain methods.
CHAPTER 12

Blended Learning is a learning model that is enriched with traditional learning methods and online education materials. Integration of face-to-face and online learning with blending learning can enhance the learning experience and optimize seat time. In this chapter, the authors present the teaching of an Algorithm and Programming course in Computer Engineering Education via an artificial intelligence-supported blended learning approach. Since 2011, Computer Engineering education in Suleyman Demirel University Computer Engineering Department is taught with a blended learning method. Blended learning is achieved through a Learning Management System (LMS) by using distance education technology. The LMS is comprised of course materials supported with flash animations, student records, user roles, and evaluation systems such as surveys and quizzes that meet SCORM standards. In this chapter, the related education process has been supported with an intelligent program, which is based on teaching C programming language. In this way, it has been aimed to improve educational processes within the related course and the education approach in the department. The blended learning approach has been evaluated by the authors, and the obtained results show that the introduced artificial intelligence-supported blended learning education program enables both teachers and students to experience better educational processes.

CHAPTER 13

Intelligent Tutoring Systems have proven their worth in multiple ways and in multiple domains in education. In this chapter, the proposed Agent-Based Distributed ITS using CBR for enhancing the intelligent learning environment is introduced. The general architecture of the ABDITS is formed by the three components that generally characterize an ITS: the Student Model, the Domain Model, and the Pedagogical Model. In addition, a Tutor Model has been added to the ITS, which provides the functionality that the teacher of the system needs. Pedagogical strategies are stored in cases, each dictating, given a specific situation, which tutoring action to make next. Reinforcement learning is used to improve various aspects of the CBR module: cases are learned and retrieval and adaptation are improved, thus modifying the pedagogical strategies based on empirical feedback on each tutoring session. The student modeling is a core component in the development of proposed ITS. In this chapter, the authors describe how a Multi-Agent Intelligent system can provide effective learning using Case-Based Student Modeling.

CHAPTER 14

Clustering student data is a central task in the educational data mining and design of intelligent learning tools. The problem is that there are thousands of clustering algorithms but no general guidelines about which method to choose. The optimal choice is of course problem- and data-dependent and can seldom be found without trying several methods. Still, the purposes of clustering students and the typical features of educational data make certain clustering methods more suitable or attractive. In this chapter, the authors evaluate the main clustering methods from this perspective. Based on the analysis, the authors suggest the most promising clustering methods for different situations.
CHAPTER 15

Most of the distance educational systems consider only little, or no, adaptivity. Personalization according to specific requirements of an individual student is one of the most important features in adaptive educational systems. Considering learning and how to improve a student’s performance, these systems must know the way in which an individual student learns best. In this context, this chapter depicts an application of evolutionary algorithms to discover students’ learning styles. The approach is mainly based on the non-deterministic and non-stationary aspects of learning styles, which may change during the learning process in an unexpected and unpredictable way. Because of the stochastic and dynamic aspects enclosed in learning process, it is important to gradually and constantly update the student model. In this way, the student model stochastically evolves towards the real student’s learning style, considering its fine-tuned strengths. This approach has been tested through computer simulation of students, and promising results have been obtained. Some of them are presented in this chapter.

CHAPTER 16

With the outstanding improvements in technology, the number of e-learning applications has increased greatly. This increment is associated with awareness levels of educational institutions on the related improvements and the power of communication and computer technologies to ensure effective and efficient teaching and learning experiences for teachers and students. Consequently, there is a technological flow that changes the standards of e-learning processes and provides better ways to obtain desired educational objectives. When we consider today’s widely used technological factors, Web-based e-learning approaches have a special role in directing the educational standards. Improvements among m-learning applications and the popularity of the Artificial Intelligence usage for educational works have given great momentum to this orientation. In this sense, this chapter provides some ideas on the future of intelligent Web-based e-learning applications by thinking on the current status of the literature. As it is known, current trends in developing Artificial Intelligence-supported e-learning tools continue to shape the future of e-learning. Therefore, it is an important approach to focus on the future. The author thinks that the chapter will be a brief but effective enough reference for similar works, which focus on the future of Artificial Intelligence-supported distance education and e-learning.

This book offers a great opportunity for the scientists and researchers in the field of Artificial Intelligence and Distance Education to disseminate their original, quality, novel, and innovative research work findings and obtained results to the global research scholars.

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