Improving E-Learning with Neural Networks

*Parminder Kaur, **Kiranjit Kaur, ***Gurdeepak Singh
*Computer Science Department, Khalsa College for Women, Civil Lines, Ludhiana
**Computer Science Department, Mata Sahib Kaur Girls College,Gehal, Ludhiana
***Civil Engg. Department, Guru Nanak Dev Engg. College, Ludhiana
parminder157@gmail.com, gill_kiran2004@yahoo.com, klergs@yahoo.com

Abstract
E-Learning is the latest emerging technology in the field of innovative teaching and learning. It provides a virtual class room with all the facilities of conventional and advanced methods of teaching. The success rate of implementation of e-learning technology can be vastly improved by the use of neural networks. Using neural networks the registered students can be classified on various factors viz. learning abilities, goal of study etc. and hence be provided suitable integrated environments for study. Neural networks can further be used for evaluation purpose. This paper discusses through a model how neural networks can be used to improve the e-learning environment.
Keywords: E-learning systems, Neurons, Neural networks.

Introduction

E-Learning uses modern educational technologies to implement an ideal learning environment through integrating the information technology into curriculum, which can embody the learning styles of students' main-body function, reform the traditional teaching structure and the essence of education thoroughly. Although the current E-Learning systems have many merits, many of them only treat advanced information technology as simple communication tools, and release some learning contents and exercises in the network.

Artificial Neural Networks in the E-Learning

The successful implementation of E-learning systems depend a great deal on whether these systems can provide an adaptive system with an adaptive interface to the learners depending upon various factors like their learning abilities, professional background, learning goals etc. To provide these features, it is necessary that the e-learning systems should be able to classify the learners. Neural networks can be effectively used for classification. This paper discusses how this can be done through a neural network model.

The data base that is the object of the present study contains data collected throughout a period of one year, taken from the tests that have been given to the rural and urban students. The courses which represent the assessment objective are engineering. The students have been assessed online with a questionnaire containing 25 questions, realized according to the teaching principles with a standard degree of question difficulty. Each assessment was registered at the end in a unique database.

E-Learning presents statistic data regarding the assessment activity for each student during the period of an online course. The students have the right to try to answer twice for each question, the final answer having two possibilities: correct or wrong (incorrect) answer. The maximum score that can be obtained at this test is of 20 points, for the 20 questions, all the questions having equal values. It has been registered for each question the number of attempts, the rightness of the answer as well as the time necessary to give the answer. Next we are going to study the means of adjusting the data existing in the database offered by E-Learning, containing answers to the questionnaires given by 108 students in order to extract the information using a prediction model. A series of classifying parametric items will be presented in order to compare the performances on the real database of the online assessing system. This study allows observing the way in which the data mining techniques can be applied for identification valid, novel, potentially useful and understandable patterns in database. The error rates are used to compare the performances of each implemented classifying indicator.

The main problem is to discover a set of features in order to be able to classify the students. In this situation we will be able to build a predictor that would shape each student after giving the online test. With this instrument it is possible that a student be better helped in order to efficiently use the system resources. The most difficult phase is the one of efficient pre-processing of the data for classifying.

For the training and testing of the classifying indicators, the data must be divided in distinct data bases, as it follows: for the training of the classifying indicator, with a part of the main database a new database is created which is called training database, and for testing the results of the classifying indicators, the rest of the unused database is created in the testing database. The way in which the database is divided is important, as it represents an improvement criterion for the classifying indicator. In the present situation, the method of subdividing the n-fold database has been used. This implies dividing the database in approximately equal n subsets. Training of the classifying indicator will be done n times, each time leaving one subset for testing. In a limit case, if n is equal to the number of students, the method is also known as Leave One Out. The bigger the n, the better the classifying result. To test this hypothesis it has been used a validation of the classifying indicator with n=2 and with n=7. The data selected to create the two subsets are randomly chosen and is independent. In the case of n=2, the database is divided in two subsets equal in dimensions (54 students in the training database and 54 students for the testing database). In the case of n=7, the database is divided in 7 subsets (with 15 students for each), every subset being used in turn as a testing database. As a consequence, the training base will be 85.71% from the database, and the testing/ checking base will be 14.29% from the database. Watching the results achieved, it can be noticed that for a bigger n, the error rate is smaller. Thus, for the rest of the study, the technique of validating the classifying indicators with n=7 will be used. Improving the classifying indicators, in the case of the two neural classifying indicators, there is a series of ways to choose the architecture. The architecture is created starting from the number of features for the input and the number of classes where the database is distributed. If the number of features is equal to 5 (there are not used techniques for dimension reduction), both neural networks will have the input layer composed of 5 neurons. To simplify the problem, the students are divided in the three classes, according the grade. Thus, the neural networks will have output layer composed of three neurons. In conclusion, the parameter that needs to be selected for architecture improvement is the number of neurons of the layer hidden between the input layer and the output. Selection of the best number of neurons is done as follows:

1) It starts from a hidden layer which is composed of a number of neurons equal to the biggest layer of the network (in the present situation, the input layer , equal to 5 neurons) and the performances of the classifying indicators are assessed (the error rate);

2) Gradually a neuron is added to the hidden layer and the performances of the classifying indicators are re-assessed;

3) The optimum number of neurons of the hidden layer is achieved when the error rate is minimum or has no significant fluctuations.

Network training is done by reaching a stopping criterion represented by the maximum number of iterations (epochs=300) or a minimum error value (0,100). The results for improvement of the neural networks for different class divisions, the configurations with the optimal number of neurons in the hidden layer have been evaluated. In the case of an error rate which is identical for several configurations, the one having the smallest number of neurons in the hidden layer was considered optimal.

From the result analysis made, it can be noticed that big error rates are achieved in the case of a greater number of classes. This is justified by the fact that the problem the neural network intends to solve is much more complex. This implies training a network whose architecture would allow discrimination in the data hyperspace of some regions with different shapes and dimensions. By using the neural networks we can have the best configuration from the error point of view. They also allow improvement of the performances along with the growing of the database by retraining, thus including the new information collected from the subsequent students. This shows the dynamic character of the model.

3. Conclusions

The model presented in the paper depicts successful implementation of neural networks to enhance e-learning systems. Thus by using neural networks, the e-learning systems can be made more dynamic by allowing personalization of the learning environment to suit the needs of the learner. In future, the neural networks can be used to build intelligent e–learning systems which can provide assistance during the instructional process deployment to the learner and can assume the role of the teacher in the classroom.

References

- Advanced Distributed Learning, Case study: U.S. Navy Apprentice Technical Training School, Alexandria, 2009 [http://www.adlnet.gov]
- Brain, Cornell Aeronautical Laboratory, Psychological Review, v65, No. 6, 386-408.
- Discovery and Data Mining, in AAAI/MIT Press, Menlo Park, CA., p. 5, 1996
- He Kekang. E-Learning Essence- information technology into curriculum. E-education Research, 2002,105(1):3-4.
- Roceanu, V. Popescu, Metrics and requirements in Learning Management System, in The Journal of Computer Science, 1 (2), 232-243.
- M.F. Matei, ANOVA in the educational process, U. P. B. Sci. Bull., Series C, Vol. 70, No. 3, p. 121-129, 2008
- Ma Xirong., H. S. (1990): Intelligent Tutoring Systems: an overview, Artificial Intelligence Review, 4, 251-277.

- S. Elena, Using Artificial Neural Networks In E-Learning Systems, U.P.B. Sci. Bull., Series C, Vol. 72, Iss. 4, 2010
- Sleeman & J. S. Brown ,The communication of knowledge, Morgan Kaufmann Publishers Inc., San Francisco, CA, USA.
- Wang Jijun. Emotion deficiency and compensation in distance learning. Chinese network education, 2005
- Wenger, E. (1987): Artificial intelligence and tutoring systems: computational and cognitive approaches.