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WEB BASED EDUCATIONAL SOFTWARE FOR ARTIFICIAL NEURAL NETWORKS

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ABSTRACT: Artificial Neural Networks (ANN) is an important data processing algorithm for students, researchers, scientist, mathematicians, academicians and engineers which is inspired by human brain and human brain's learning methods. Complex nature and mathematical structures of ANN makes it difficult to learn. Due to this reason, new methods have to be employed to teach ANN. In this study, we design and develop web based educational software which combines advantages of examined works to teach artificial neural networks with the support of multimedia course content. In addition, relevant studies such as Neuro-Lab, EasyLearnNN, NeuroFuzz and related most popular professional commercial tools such as MATLAB, Statistica, Mathematica, NeuroSolutions, JOONE are also examined. Developed software will help researchers from students to scientist to train, test an ANN model and understand fundamentals of ANN.

Key words: Artificial neural networks, simulation, web based

INTRODUCTION

ANNs are physical celled systems which imports, stores and uses experimental knowledge [1]. A neural network is a massively parallel distributed processor made up of simple processing units, which has a natural propensity for storing experiential knowledge and making available for use [2]. On the other hand, ANN is a computer program which simulates biological neural networks. ANNs through these features can solve optimization, classification, prediction, pattern recognition, associative memory and control problems effectively and easily [3-5].

Therefore ANNs are increasingly including in the Curricula of many engineering lessons at graduate and undergraduate level. But beside these problem solving skills, because of complex and mathematical nature ANNs are very hard to understand systems and algorithms for students which are also studying in engineering. Moreover, ANNs evolves during their design and training phases because of dynamic structure [6]. Traditional teaching approaches like classroom-teaching, books, lecture notes cannot help properly students to learn basics and working mechanisms of ANNs. At this point computer based teaching approaches like simulation software's provide an easy to use and understand environment to visualize working mechanism, designing and training phases of ANNs by students.

RELATED WORKS

MATLAB is a high level technical computing language and environment which is including a lot of tools for developing algorithm, analyzing data, computing complex mathematical formulas. Beside these tools MATLAB has also an ANN tool which named Neural Network Toolbox that providing environment to work with ANN. It supports a lot of most popular ANN models and related learning algorithms.

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Statistica is a kind of statistic and analyze software which has many different integrated tools. Also Statistica has a tool for ANN like MATLAB. This tool provides easy to use environment to work with many wide used ANN models. Beside this, it helps users to design and develop suitable ANN models for solving their own problems.

NeuroSolutions is graphical neural network development tool that enable users to create ANN model for a particular user data. It has a lot of advanced input, attribute selection techniques like Genetic Optimization, Greedy Search, Back-Elimination, learning procedures like Levenberg-Marquart algorithm. It also supports programmers who are implementing their own application with Windows-based DLLs or source code.

Mathematica is another software that using by students and professionals for design and develop their own ANN models. This software also supports most common ANN models like MLP, SOM and Hopfield Network.

JOONE is open source development software which is designed by Java programming language. It is composed by a core engine, GUI editor and distributed training environment. It can be extended from programmers by implementing new modules to add new ANN models and relevant learning algorithms.

NeuroFuzz is an internet based ANN simulation tool [7]. So users can access it with a popular web browser from anywhere. The tool aims to teach working mechanism and fundamentals of ANN by give tasks to users and allow them solve problems with support of graphical features.

Internet based simulation software EasyLearnNN which including most popular ANN algorithms like MLP, SOM, LVQ, was developed to use in education of ANN [8]. Working environment in the software that used design and develop ANN, represent all parts of ANN with a colorful graphical interface to allow students to use software in an intuitive and enjoyable way.

Neuro-Lab is a software-based environment to teach ANN was designed for support exploratory education in the artificial intelligence courses [6]. It allows users to change all properties of a network by graphical interface and trace how outputs are changing.

Yapay Sinir Ağları Eğitim Materyali is an educational tool for ANNs which is implemented with object oriented approach [9]. The tool has modules to add layer, neuron and select activation function, related learning algorithm. It allows users trace every step of training and test phases. Users can learn and gain experience of ANN with Effective and exploratory learning techniques by this software.

Although some of mentioned before are quite professional software's, most of them are not suitable for educational purpose because of these have complex design, distractive interface, a lot of irrelevant knowledge and features. On the other hand some of these are really effective to learn working mechanism and fundamentals of ANN. But we aims to design and develop software which is combined advantages of different related software's and help users to learn ANN properly.

METHOD

The software was developed in a modular way and these modules were put in learning and simulation panels.

3.1. Simulation panel

This panel is includes simulation, graphics and animation, data set import and examine modules.

Users can easily add data sets to learn or test of ANN by using data set import and examine modules. Developed system supports widely used file formats like .csv, .xls, .txt and .xml. Also it is considered difference punctuations. For example some countries use "." but some of them use "," to show decimal numbers. The other considered thing when implementing the system is converting class outputs to numerical values.

Users can use ANN simulate module which is the most important part of the system for understand working mechanism of an ANN. At this module, users can change parameters which is necessary to train a network, trace how the network acts. Simulate module and an example can seen in Figure 1.

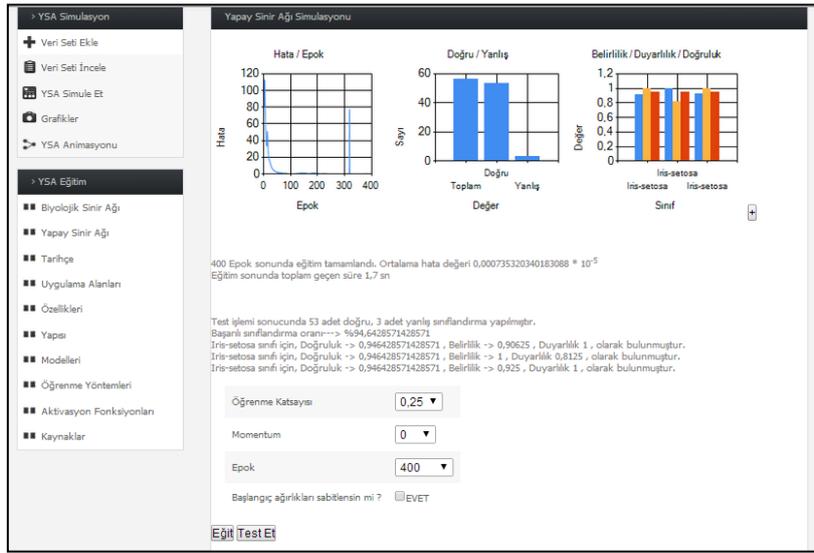


Figure 1. ANN Simulate Module

There is three different graphics top of the module, so users can trace training and test phrases. The graphic named Error / Epok is used for show error of the network epok by epok. True / False shows the results according to the test phrases. The last graphic named Performance graphic shows each class's determinacy, sensitivity and accuracy values.

Training of an ANN is a process occurs with the updating weights between neurons but it is very important to choose the initial values of the parameters during training phrase because the effect of parameters related to the output cannot predict before. Due to dynamic nature of ANN, the effect of parameters related to the output parameters can vary. Therefore, it is not easy to teach ANN by classical techniques. The system allows users to change parameters like learning rate, momentum, epok count by using controls in the module understand. How the network acts in different learning rate and momentum values easily can be seen by students like in the Figure 2. and Figure 3.

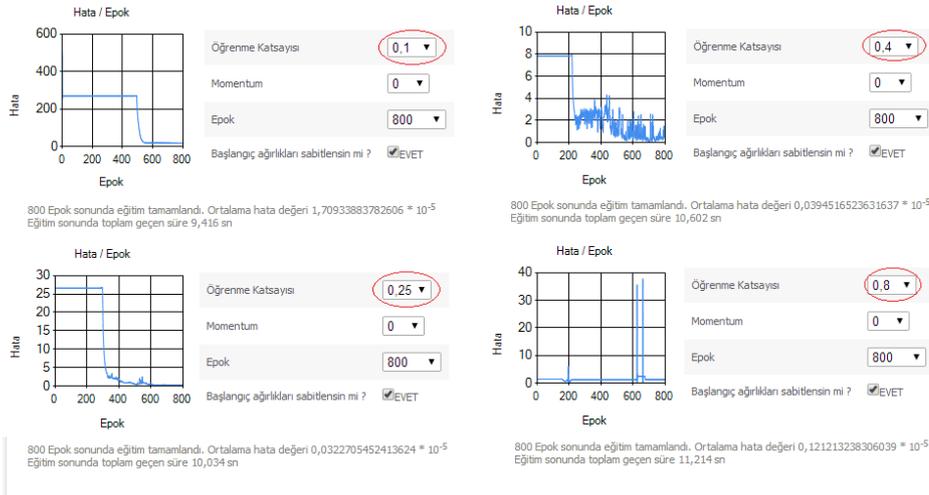


Figure 2. Results according to different learning rate values

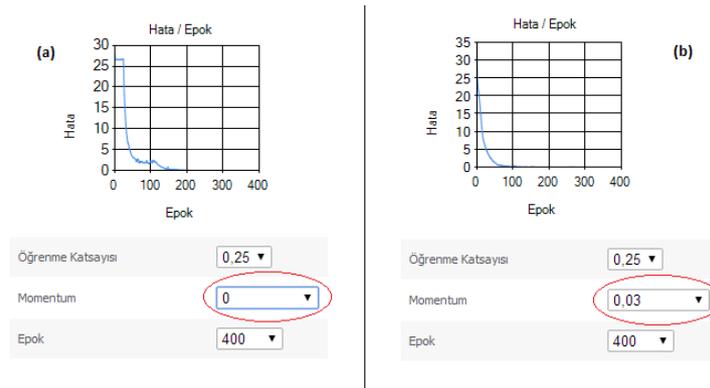


Figure 3. Results according to different momentum values

Users can easily save trained network and outputs, access these data's by graphic module.

Animation of a simple ANN can be watch in the animation module. So users can learn effectively by using both simulation and animations.

3.2 Education Panel

Users can access a lot of document from basics to training of ANNs to learn foreknowledge.

CONCLUSION

We designed easy to use, modular infrastructured, multimedia supported such as flash animation, web based educational software for ANN which can be accessed from anywhere at any time in the world. Developed software uses web 2.0 technologies such as XML, AJAX. It is used for two semesters in artificial intelligence lessons given at Çavdır Vocational High School in Turkey. %95 of these students thinks an educational tool is really useful to understand ANNs properly. According to %90 of these students, the developed software helps students to understand basics of ANNs easily and effectively.

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