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A Framework to Enhance Classification Accuracy for Web Learning System

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***Abstract*— In this research paper, a framework for cognitive based adaptive Web Learning System is presented. It focuses on users' cognitive learning process and activities, as well as the technology support needed. This research paper applies Data mining algorithms and Neural Network-based classification algorithms. To develop an effective Web Learning System, learner's cognition and cognitive load should be considered. Individualized web learning system is necessary to improve the learning activities. Particle Swarm Optimization has many advantages then the other Genetic Algorithm. Particle Swarm Optimization has more effective classification accuracy than the Genetic Algorithm. The proposed research work was tested with the exiting Data Mining algorithms and evolutionary algorithms like Parallel Multi Layer Perceptron, Genetic Optimized Parallel Multi Layer Perceptron, and Particle Swarm Optimized Parallel Multi Layer Perceptron, to predict and to enhance the classification of learners. Combination of Multi Layer Perceptron, Genetic Algorithm and Particle Swarm Optimization gives better classification accuracy then other methods. PSO PMLP (Particle Swarm Optimized Parallel Multi Layer Perceptron) Neural network algorithm has two betterments then the existing PMLP.**

***Index Terms*— Web Learning System, Cognition & Cognitive Load, Neural Network, Genetic Algorithm and Particle Swarm Optimization**

I. INTRODUCTION

WEB Learning System develops the interest to learn more among the learners. To attain the maximum learner benefits, this research helps to develop a good framework for Web learning system. The framework proposed in this research paper utilizes cognition and cognitive load for representing a dynamic cognitive learning process to support students' effective learning, efficient tutoring. This research is conducted in a Web-based Learning environment with the help of Data Mining classification techniques and Neural Network classifiers. This research framework focuses on the concepts such as Web Learning System, Data Mining, Classification, Neural Network Classifiers, Genetic Optimization, Particle Swam Optimization and importance of its research requirements.

This frame work explains the processing steps, implementation and diagrams of proposed Parallel Multi Layer Perceptron, Parallel Multi Layer Perceptron with Genetic Optimization (GO PMLP) and Parallel Multi Layer Perceptron with Particle Swarm Optimization (PSO PMLP) techniques.

Web Learning Systems are widely used by users with different preferences, needs and experience. The diversity of learner population and users' complex preferences gives a new challenge for predicting their behavior and needs. Thus, more attention needs to be focused to the discovery of user communities' in Web Based Learning environment and dynamic learning environment; personalized support for users becomes more important. In order to achieve optimal efficiency in a learning process, individual learner's cognitive learning style should be taken into account. Due to different types of learners using the Web Learning Systems, it is necessary to provide them with an individualized learning support system [1], [2]. A framework of cognitive based adaptive Web-based Learning Support System (WLSS) is presented by focusing on users' cognitive learning process and activities, as well as the technology support needed. Cognitive learning theory supports the strategy of learner-centered mode [3].

KDD (knowledge discovery in database) is a useful Data Mining technique for searching and extracting valuable hidden unknown and potentially useful information from large databases. KDD draws on techniques from machine learning, statistics, expert system and visualization. Techniques related to Data Mining include logical analysis, statistics, and Artificial Intelligence technology [4]. This technique helps to analyze data to obtain the relevant and useful information and determine the relations among them and to build correlative models in all kinds of domains. It is very popular in the real world applications like on line and virtual learning environment. In an online learning platform, it can assist learners in all kinds of learning environments, presenting students' online assignments, searching students' learning behaviors, and providing guidance to achieve their learning objectives [5].

Classification is a data mining technique that assigns items in a collection to target categories or classes. The goal of classification is to accurately predict the target class for each case in the data. Classification is the most commonly applied Data Mining technique. This approach frequently employs decision tree or Neural Network-based classification

algorithms. The data classification process involves learning and classification. In a Learning environment the training data are analyzed by classification algorithm. In classification, test data are used to estimate the accuracy of the classification rules. If the accuracy is acceptable the rules can be applied to the new data tuples. The classifier-training algorithm uses these pre-classified examples to determine the set of parameters required for proper discrimination [6]. The algorithm then encodes these parameters into a model called a classifier.

A. Neural Network Classifiers

Neural Network is a set of connected input/output units and each connection has a weight present with it. During the learning phase, network learns by adjusting weights so as to be able to predict the correct class labels of the input data. Neural Network has the remarkable ability to derive meaning from complicated or imprecise data and can be used to extract patterns and detect trends that are too complex to be noticed by either humans or other computer techniques [7]. These are well suited for continuous valued inputs and outputs. Neural Network is best at identifying patterns or trends in data and well suited for prediction or forecasting needs.

B. Optimization

Optimization refers to the art and science of distributing insufficient recourses to the best possible way [8]. Artificial neural networks process information by the same way such as biological nervous systems and brain for optimal decision making. The method of processing information and architecture of artificial neural network is superior to conventional techniques of optimization problems.

C. Genetic Optimization

Genetic Optimization is an evolutionary approach which aims to improve the solution to a problem by keeping the best combination of input variables [9]. ANN is the best tool for classification and regression. The parameters of the ANN are optimized with genetic approach to enhance the classification accuracy. When the ANN is combined with genetic approach, is known as hybrid model which is performed better than the conventional ANN [10]. The Genetic approach often works with a form of binary coding. If the problems are coded as chromosomes, the populations are initialized. Once the population size is chosen, the initial population is randomly generated. After the initialization step, each chromosome is evaluated by a fitness function. According to the value of the fitness function, the chromosome associated with fittest individuals will be reproduced more often than those associated with unfit individuals.

D. Particle Swam Optimization

PSO algorithm converges rapidly at the start of global search, but becomes slow around global optimum [11]. In contrast, gradient descending method achieves faster convergent speed around global optimum, and simultaneously has higher convergent accuracy [12]. Combination of MLP with GA and PSO shows good results for cognitive methods. PSO has some advantages over other optimization techniques such as GA. It is easier to implement and there are fewer parameters to adjust and it has a more effective memory capability than the GA. PSO PMLP (Particle Swarm Optimized Parallel Multi Layer Perceptron) neural algorithm consists of two enhancements over the existing PMLP. One is applying Particle Best value (Global Best value in the PSO PMLP) and another one is Particle Swarm Optimization of the learning rate and momentum Classification based on user's preferences.

II. RESEARCH METHODOLOGY

The objective of this research paper complying with the aim of the research work is as follows:

- To propose a Framework for classifying the users' preferences with the use of evolutionary classification approaches thereby enhancing the classification accuracy.
- To propose methodologies to implement the framework to improve the Web Learning System.

III. A FRAMEWORK TO ENHANCE CLASSIFICATION ACCURACY IN WEB LEARNING SYSTEM

In this research, the parameters such as cognition and cognitive load are investigated principally. Investigations are carried out to study the efficiency of decision tree algorithms namely, Naïve Bayes, Random Forest, Random tree, J48 and CART. The corpus, comprising of data from both general cognition and cognitive load, is used as the input for the classification algorithms. The Random Forest and Random Tree give better results.

Further studies are conducted to investigate the classification accuracy based on Neural Network approach namely Multi Layer Perceptron (MLP). The classification accuracy of the neural algorithm proves to be better than the existing accuracy levels with decision tree classifiers. Hence, a framework comprising three classification algorithms is proposed to enhance classification accuracy [13].

The cognitive attributes are used as the training input for the decision tree induction algorithms namely Naïve Bayes, Random Forest, Random Tree, J48, CART and the Neural Network approach, MLP. It is observed from the results that, the Neural Network approach MLP gives enhanced classification accuracy when compared to other classifiers.

This methodology based new frame work is capable of enhancing the classification accuracy of user preferences in a Web Learning System [14]. The below frame work based on various Neural Network classification techniques such as PMLP, GO PMLP and PSO PMLP provides enhanced classification accuracy of Web Learning System [15].

A. Framework for Classification of User Preferences for Web Learning System

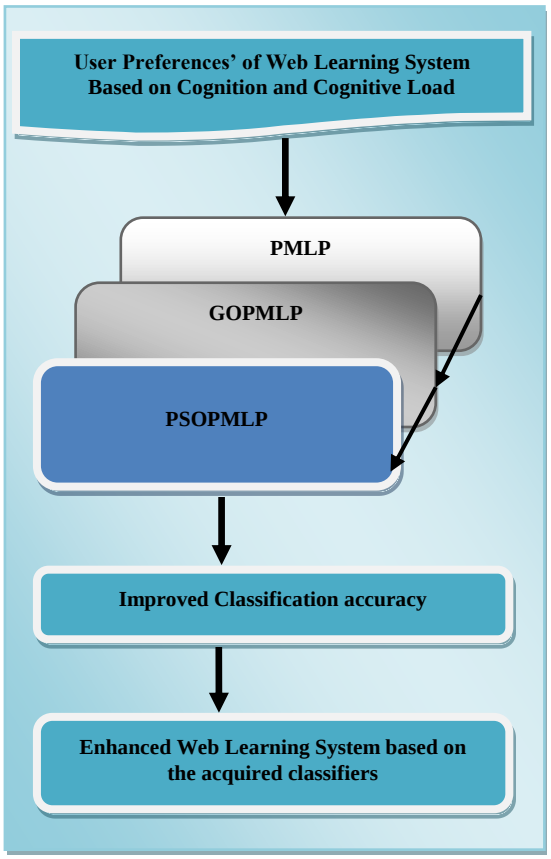

Fig. 1: Framework for Web Learning System

B. Parallel Multi Layer Perceptron (PMLP)

Firstly, in this research paper, the cognitive attributes are used as the training input for a novel Parallel Multilayer Perceptron (PMLP) algorithm. In this algorithm, the network is divided into blocks of adjacent neurons and each is allocated to a processor. This approach to parallelization attempts to take advantage of the locality that exists between adjacent neurons. Parallelizing the hidden layer reduces the complexity of the connection which in turn also reduces the number of iterations. Gaussian and bipolar sigmoidal are the activation functions used in the proposed network.

C. Parallel Multi Layer Perceptron with Genetic Optimization (GO PMLP)

Secondly, an algorithm to enhance the classification accuracy of the proposed PMLP through genetic optimization is proposed [16]. Genetic algorithm (GA) is based on biological evolution, which uses selection and reproduction operators to search for global optimum for a given problem. The intrinsic step involved in GO PMLP is that the learning rate and momentum are optimized with genetic optimization.

D. Parallel Multi Layer Perceptron with Particle Swarm Optimization (PSO PMLP)

Thirdly, the Particle Swam Optimization MLP (PSO PMLP) algorithm is proposed to improve the classification accuracy [17]. PSO is a swarm based optimization method based on flocking behavior of birds, evolving an optimal solution for a problem. The parameters for PSO PMLP and GO PMLP are same. The essential step involved in PSO PMLP is the optimization of learning rate and momentum. The significant improvement in the classification accuracy, while implementing GO PMLP & PSO PMLP, is identified for the cognitive behavior and load. Fig. 1 and Table 1 show that the proposed three Neural Network based algorithms enhance the classification accuracy when compared to existing classification algorithms.

Table 1: Classification Accuracy of Proposed vs. Existing Algorithms

Data Mining Algorithm	General Cognition	Cognitive Load
J48	76%	67%
Naïve Bayes	67.07%	49%
CART	74.39%	64%
Random Forest	73.17%	75%
Random Tree	74.39%	69%
MLP	75.6%	72%
PMLP	92%	76%
GO PMLP	92.68%	85%
PSO PMLP	95.12%	94%

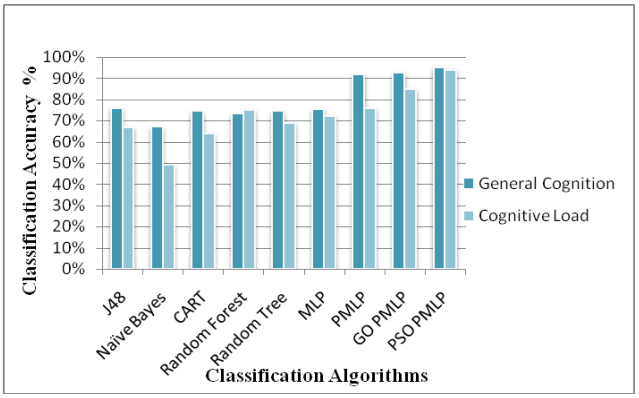

Fig. 2: Classification Accuracy of Proposed Algorithms vs.Existing Algorithms

Based on the above results, improvement of the classification accuracy for the user preferences data set is evident.

IV. CONCLUSION

This research work suggests the framework for the classification techniques to predict the user preferences, classification accuracy and also to enhance the Web Learning System. It proposes a framework to develop the dynamic and user friendly Web Learning System. Classification techniques such as the combination of Neural Networks, Parallel Multi

Layer Perceptron, Genetic Optimized Parallel Multi Layer Perceptron and Particle Swarm Optimized Parallel Multi Layer Perceptron, enhances the classification accuracy. This research clearly concludes the application of various classification techniques to forecast the user preferences which enhances the classification accuracy in the Web Learning System.

REFERENCES

[1]. Marian Simko, Michal Barla, Maria Bielikova, "ALEF: A Framework for Adaptive Web-based Learning 2.0'', International Scientific Conferences on The World Computer Congress, pp.1-12, 2010.

[2]. Shaharuddin Md Salleh, Zaidatun Tasir, Nurbiha A Shukor "Web-Based Simulation Learning Framework to Enhance Students' Critical Thinking Skills", International Educational Technology Conference on Procedia - Social and Behavioral Sciences, Volume 64, pp. 372-381, 2012.

[3]. Mustafa, K. O. C. " Individual learner differences in web-basedlearning environments: From cognitive, affective and social cultural perspectives", Turkish Online Journal of Distance Education-TOJDE, Volume 6, Issue 4, pp. 1257-1261, 2005.

[4]. Abdullah H. Wahbeh, Qasem A. Al-Radaideh, Mohammed N.Al-Kabi, Emad M. Al-Shawakfa, "A Comparison Study betweenmData Mining Tools over some Classification Methods" International Journal of Advanced Computer Science and Applications, Special Issue on Artificial Intelligence, pp. 18-26, 2011.

[5]. Alan Jolliffe, Jonathan Ritter, David Stevens, "The online Learning Handbook: Developing and using Web-based Learning", Higher Education Supplement, Kogan Page Ltd, 2001. ISBN 0 7494 3208 X.

[6]. Thomas Janicki, "Development and Evaluation of a Framework for Creating Web-Based Learning Modules: A Pedagogical and Systems Perspective", Journal of Asynchronous Learning Networks, Volume 5, Issue 1, pp. 58-84, 2000.

[7]. Hong jun Lu, Rudy Setiono, Huan Liu, "Effective Data Mining Using Neural Networks", IEEE transactions on knowledge and data engineering, Volume 8, Number 6, pp. 957-961, 1996.

[8]. G. Saravana kumar, P.K. Kalra, "Optimization by Neural Networks", Quarterly Scientific Magazine of IIT Kanpur, Volume 6, Number 3, pp.87-91, 2004.

[9]. D. Montana, "Introduction to the Special Issue: Evolutionary Algorithms for Scheduling", Evolutionary Computation, Volume 6, Number 1, 1998.

[10]. Cristobal Romero, Sebastian Ventura , Carlos De Castro, Wendy Hall, Muan Hong Ng , Hong Ng, "Using Genetic Algorithms for Data Mining in Web based Educational Hypermedia Systems", Proceedings of AH2002 workshop Adaptive Systems for Web based education, pp. 137-142, 2002.

[11]. Qinghai Bai, "Analysis of Particle Swarm Optimization Algorithm", Computer Science and Informatics, Volume 3, Issue 1, pp 180-184, 2010.

[12]. Maria-Iuliana DASCALU, "Application of Particle Swarm Optimization to Formative E-Assessment in Project Management", Informatica Economica, volume 15, Number 1, pp 48-59, 2011.

[13]. Ailing Qiao, Lina Sun, Nan Wang, "The Design of Web-Based Learning Activities A Case Study on Learning Activities Design from Mainland China", Second IEEE International Conference on Computer Science and Information Technology, pp. 126-129, 2009.

[14]. Mona Alkhattabi, Daniel Neagu, Andrea Cullen, "Information Quality Framework for e-Learning Systems", Knowledge Management & E-Learning: An International Journal, Volume 2, Number 4, pp. 340-362, 2013.

[15]. Biplab Kanti Das, Saurabh Pal, "A framework of Intelligent Tutorial System to incorporate adaptive learning and assess the relative performance of adaptive learning system over general classroom learning", International Journal of Multimedia and Ubiquitous Engineering, Volume 6, Number 1, pp. 43-54, 2011.

[16]. Gwo-Jen Hwang, Peng-Yeng Yin, Tzu-Ting Wang, Judy C.R.Tseng, Gwo-Haur Hwang "An enhanced genetic approach to optimizing auto-reply accuracy of an e-learning system" Computers and Education, Volume 51, pp. 337-353, 2008.

[17]. Kuok King Kuok, Sobri Harun, Siti Mariyam Shamsuddin, Po-Chan Chiu, "Evaluation of Daily Rainfall-Runoff Model Using Multilayer Perceptron and Particle Swarm Optimization Feed forward Neural Networks", Journal of Environmental Hydrology, Volume 18, pp. 1-16, 2010.

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