

Applying a Web Database Hybrid With Artificial Intelligence Techniques On New Employees

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Abstract

The Research aims at constructing a website specialized with employment in Iraqi universities by using(Dreamweaver CS8). The person who apply through this website are able to see the advertisement of job vacancies in all Iraqi universities and know the needed qualifications and documentations. all required documents will be sent to the central Jobs Site. After an interview with the applicant , The person in charge of the interviews , starts to fill the rest of the information that depend on the results of this interview. The stepwise regression method was applied to sort variables and leave more influential variables in the employment model. database was linked with the (MATLAB version 8.1.0.604(R2013a)) through (Server) is configured programmatically using the Toolbox databases in the (MATLAB version 8.1.0.604(R2013a)) , which facilitates the process of importing/Export the required data from/To the database , which represents the stepwise regression inputs and then to the hybrid neural network with expert system. The two networks (NARX) and (BP) are used to be trained according to pre-set rules and then choose the best network . the employment Results are exported to the website to show the results automatically. Finally all evaluation performance forms that are accredited in the ministry of higher education and scientific research in Iraq have been designed to evaluate the performance of the teaching staff members. These forms will be filled by the department manager in the college at the end of the year for the purpose to installation or not .

Keywords: JDBC ,Web Database, Intelligent Database, Back Propagation, NARX, Expert Systems, ,Stepwise Regression, E-Government

1. Introduction

E-Government implies "the use of information communication Technologies(ICT) by government bodies to give information and deliver services to the internet savvy citizens", It is an effort to reach out to the public by allowing the citizens to benefit and monitor the government activities to benefit from them, and bring transparency in the system. the system bring transparency It exists in various forms :

government to citizen(G2C), citizen to Government (C2G), Government to Government(G2G), Government to Business(G2B),and government to employees(G2E)[1][2]. The process of employment is considered of a very high level of importance because of the importance of the staff

which is considered the essential tool for the organization. It is also one of the supportive powers for the organization. The process of selecting the proper individuals for the vacancies needs a big effort and time from the decision maker, because the collect the needed information about the candidates and selecting the best among them especially if their number is huge in addition to their information. The process of application for a job needs from them the knowledge of where to apply and the qualifications and the requested documents. That demands more time from them to go to the organization to accomplish the process of the application.

The electronic employment is one of the E-government applications ,Therefore, it is important to create a system for central jobs in all Iraqi universities that depends on the artificial intelligence techniques and the distributed database.

The rest of the paper is organized as follows. Section 2 explains concept & Stages of employment. Section 3 describes Performance evaluation process; section 4 explains concept & the way of building web database; section 5 describe the artificial intelligent models were used in the central Jobs system in Iraqi universities; section 6 describes Intelligent Database; section 7 describes the stepwise regression method applying ;section 8 describes The Mechanism of linking the Database of Central Jobs Site in Iraqi Universities with the (MATLAB version 8.1.0.604(R2013a)); section 9 describes the practical part explains with details the system working stages that was designed depended on the artificial intelligence techniques &distributed database; in section 10 includes the conclusions

2. Employment [3]

We can identify employment as the managerial process that requires advertisement and attracting the human resources who are qualified to work in the organization. Then selecting the best of them and employ them in order to achieve the goals of the organizations., Stages of employment

1- Recruitment 2-Selection. 3- Employment

3. The Performance Evaluation Process

The Performance evaluation process can be defined as:- It is the process of evaluating the performance of all the employees during a certain period to evaluate the level an the quality of the work. This process is achieved to certify whether the performance is good or not. In all the fields, this performance may include the duties of the individual or his behavior.

3.1 Analyzing The Work and Evaluating the Performance

The standards of the performance is transform the requirements of the job into acceptable or not acceptable levels of the individual. These standards play an important role in linking the performance evaluation and analyzing the job as shown in the figure (1)

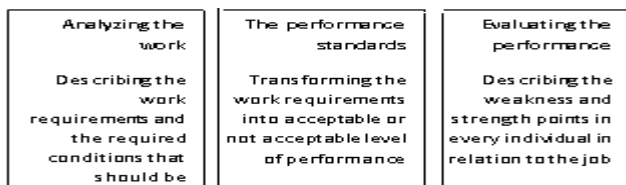


Fig.1 shows the relation between analyzing the work, performance standards and evaluating the performance

4. Web Database[4][5]

Today most of the databases are accessed through the Web browser. A web database gives the users ability to make his own databases or data storage without the need for a database tutor or a technical expert. A web database is an arranged list of web pages. The database bears an “alternative” for each web page. The creation of these alternatives is called “indexing” which is created in a different method. Web databases bear alternatives for anywhere from 1 million to several billion web pages.

4.1 Wamp Server

Wamp Server is a free to use open source project that installs and configures Apache, MySQL, and PHP on a Windows computer. With Wamp Server you don’t need to install the individual software components separately. Wamp Server will quickly and easily install and configure a complete personal Web server[6].

4.2 How Building a Web database

To build a Web database:-

“**first of all**, you need to define the problem or objective: how the database will be used and what information needs to be stored in it. In this case, we want to build a Web database for manipulating Internet multimedia resources.

Second, it is necessary to research the current databases, which are similar, good, or bad. It will be helpful for you to be able to imagine a good design for your database.

Third, design the data structures. You have to define each entity for making each table. multimedia database resource table.

Fourth, we have to construct relationships between tables (entities). We called data modeling. For the data modeling, we usually use E-R Diagram (ERD) for conceptual schema, which describes the relationships between each two entities such as one to one or one to many. In this case, we do not have to worry about the data modeling because there is only one entity in our database”.

5. Artificial Intelligence Methods

Artificial Intelligence (AI) is “the area of computer science focusing on creating machines that can engage on behaviors that humans consider intelligent. Applications of the AI important and enter into all areas of life” [7].

The fact that many artificial intelligence methods are derived from processes within nature or within human thinking makes them, in some way, familiar to persons applying them on their tasks.

(AI) techniques were used in the central Jobs system in Iraqi universities are :

Artificial neural network & Expert System

5.1 Artificial Neural Network Model:

First: Back Propagation Neural Network

The Back-Propagation (BP) algorithm was suggested in 1986 by Rumelhart, Hinton and Williams for setting weights and for that the training of MLP(Multi-Layer Perceptrons) [8].

the structure B.P is shown in figure(2).[9]

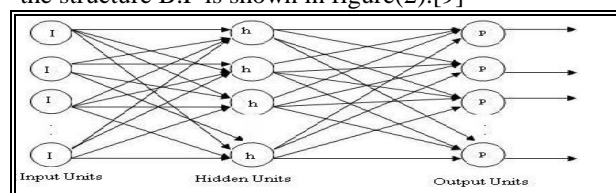


Fig.2 a Multilayer Network

the error between the desired signal and the network output of the BP algorithm propagates backward through the network. the output of the network is compared with a given target pattern After providing an input pattern, and

calculated the error of each output unit. The error signal is propagated backward, and a loop control system is closed thus proved. This weights can be modified by a gradient descent-based. A differentiable activation function is required In order to implement the BP algorithm, such as a continuous, nonlinear, monotonically increasing,. The logistic function equation (1) and the hyperbolic tangent function equation (2), and both are sigmoid functions That are the two most-used activation functions.

$$F(net) = \frac{1}{1 + e^{-net}} \quad (1)$$

$$F(net) = \frac{e^{net} - e^{-net}}{e^{net} + e^{-net}} \quad (2)$$

F(net) Represent :actual output.

To reduce the tendency to instability, add a momentum term(a) : a is the momentum coefficient , the range of a is ($0 < a < 1$), that was suggested by Rumelhart in (1986) usually around (0.9). The job of a will tend to shun fast fluctuations, but it may not always could even harm convergence. To improving learning process, Another parameter suggested is a learning rate h . Weight changes in B.P are relatively to the negative gradient of the error.

when a training pattern is presented ,this guideline specifies the relative changes that must happen in different weights. But, it does not stable the accurate magnitudes (magnitude changes are dependent on the learning rate)of the desired weight changes.. A large learning rate causes rapid learning, while lower learning guide to slower learning[8][9].

Second: NARX(Nonlinear Auto-Regressive with exogenous).

Neural networks are divided into two categories static and dynamic. Static networks don't have feedback elements and delays; they can compute the output directly by using the input within feed-forward connections. While the dynamic networks depend on the current or previous inputs, outputs, or states of the network , Dynamic networks may be difficult to train but are more powerful than static networks. As they have memory in form of delays or recurrent loops[10][11].

auto-regressive terms:- “the number of terms in the model that describe the dependency among successive observations, e.g. a model with two auto-regressive terms is one in which an observation depends on two previous observations” [12].

NARX: is “the recurrent dynamic network, consists of several layers that have feedback connections, based on the linear ARX which is employing in time series” [13].

The equation that defines the NARX model is as follows:
 “ $y(t) = f(y(t-1), y(t-2), \dots, y(t-n_y), u(t-1), u(t-2), \dots, u(t-n_u))$ ”

Where the next value of the dependent output signal $y(t)$ is regressed on previous values of the output signal and previous values of an independent (exogenous) input signal. You can implement the NARX model by using a feed-forward neural network to approximate the function (f).

There are many implementations for the NARX network. Such as using it in prediction, to predict the next value of the input signal. It can also be used for nonlinear filtering, in which the target output is a noise-free version of the input signal”.

The NARX architecture:

Fig. (3a) the actual output is available within the training, therefore you are able to create a series parallel architecture.

Fig. (3b) there is no feeding back for the estimate output but using the actual output instead of that This has two advantages :

First: the input is more accurate

Second: the resulting network has a purely feed-forward architecture[14][15]

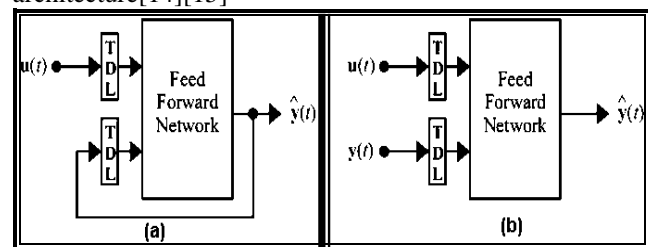


Fig. (3a): parallel Architecture Fig. (3b):Series parallel Architecture

5.2 Expert Systems

An expert system definition , is “ an interactive computer-based decision tool that users both facts and heuristics to solve difficult decision making problems, based on knowledge acquired from an expert” [16].

Or expert system definition Is “ software that uses a knowledge base of human expertise for problem solving, or clarify uncertainties where normally one or more human experts would need to be consulted. Expert systems are most common in a specific problem domain, and are a traditional application and/or subfield of artificial intelligence (AI) ” [17][18].

Appendix(3) show the step of hybrid neural network with Expert system

Inference engine : “ carries out the reasoning whereby the expert system reaches a solution”.

Explanation facilities : “ enable user to ask the expert system how a particular conclusion is reached and why a specific fact is needed ”.

User Inference : is “the means of communication between a user seeking a solution to the problem and an expert system” [19][20].

6. Intelligent Database(IDB)

It means combining the database management systems with the analytical and providing knowledge capabilities. This method makes the process to reach the big and complicated data easier and more efficient .

In other words: combining the normal database with the developed technologies of the artificial intelligence. This cooperation leads to promoting the efficiency of the searching process and the ideology these data are based on .

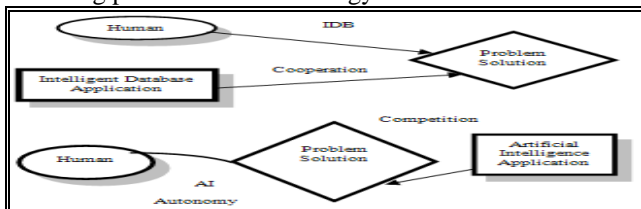


Fig.4: Intelligent Database

Through the figure above, we find:

- Strategy smart database applications through cooperation with rights and not caompete with him to solve the problems and reach solutions.
- Artificial Intelligence Applications strategy by competing with the human capacity to replace them

7. Regression

It is the illustrative method that shows the relation between the variables. It is used in estimating the value of one of the two variables if the other one is known.

7.1. Stepwise Regression

Stepwise regression is a systematic method for adding and removing terms from a multilinear model based on their statistical significance in a regression. The method begins with an initial model and then compares the explanatory power of incrementally larger and smaller models. At each step, the p value of an F -statistic is computed to test models with and without a potential term. If a term is not currently in the model, the null hypothesis is that the term would have a zero coefficient if added to the model. If there is sufficient evidence to reject the null hypothesis, the term is added to the model. Conversely, if a term is currently in the model, the null hypothesis is that the term has a zero coefficient. If there is insufficient evidence to reject the null hypothesis, the term is removed from the model. The method proceeds as follows:

1. Fit the initial model.

2. If any terms not in the model have p -values less than an entrance tolerance (that is, if it is unlikely that they would have zero coefficient if added to the model), add the one with the smallest p value and repeat this step; otherwise, go to step 3.
3. If any terms in the model have p -values greater than an exit tolerance (that is, if it is unlikely that the hypothesis of a zero coefficient can be rejected), remove the one with the largest p value and go to step 2; otherwise, end.

8.The Mechanism of linking the Database of Central Jobs Site in Iraqi Universities with the (MATLAB version 8.1.0.604(R2013a))

8.1 JDBC

JDBC (Java Data Base Connectivity) is “the basic API for accessing relational databases with the SQL language” [21], or JDBC, is “ a facilities similar to “CLI (Call-Level Interface) for allowing Java programs to access SQL databases”.

JDBC provides a Java API for updating & querying relational databases using SQL..

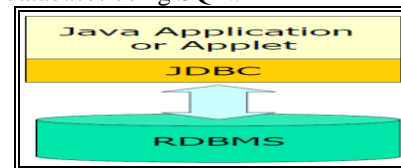


Fig 5 : JDBC Interface which allows Java code to execute SQL statements inside relational databases

“The concepts resemble those of CLI although Java's object-oriented flavor is evident in JDBC” [22].JDBC supplies “ a standard library for accessing relational databases” [23].

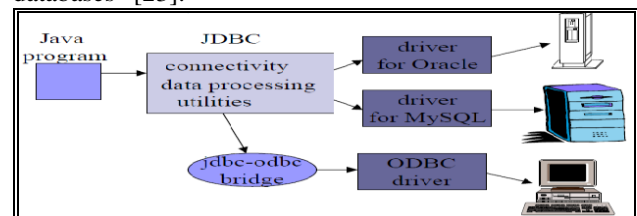


Fig 6.JDBC API

A JDBC connecting object is “quite analogous to a CLI connecting , and it serves the same purpose. we can applying the appropriate methods to a connection, place SQL statement to create statement objects, then link values to SQL statement variables to execute, and examine results a tuple at a time” .[24]

The steps approach to JDBC

1. “Load the driver”

2. "Define the Connection URL"
3. "Establish the Connection"
4. "Create a Statement object"
5. "Execute a query"
6. "Process the results"
7. "Close the connection"

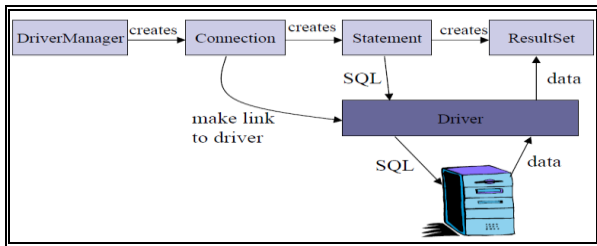


Fig 7: Diagram JDBC

8.2. The Algorithm of Server Connector With MATLAB'S Database Toolbox

The information that the applicant inputs are stored in the database that is connect with the (MATLAB version 8.1.0.604(R2013a)) through a server that is programmed by the database Toolbox in the (MATLAB version 8.1.0.604(R2013a)). This will simplify the import/export process of the data form/To the database .

The algorithm of server connector with MATLAB is:

- initial Database Server Parameter
- Database Server Location
- Database Username/Password.
- JDBC Parameters
- specified Connector With Java.

Set this to the path to your Dreamweaver Connector/J JAR

- Create the database connection object
- Check to make sure that we successfully connected

If Connection Successful

Fetch the Query symbol, market cap,
and last close for the required number
for job vacancies largest
market cap ETF

Else

print the error message

End

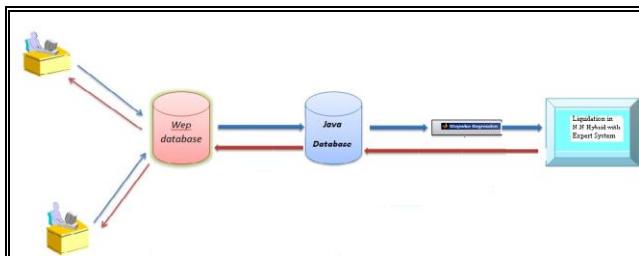


Fig. 8: linking the Web database with MATLAB version 8.1.0.604(R2013a)

9.1 The Central Jobs Site in Iraqi Universities

The main page for the Central Jobs site is show in appendix(2), the performance evaluation pages that will be activated after one year. After the applicant enters the Central Jobs Site and seeing the advertisements of job vacancies in all Iraqi universities and knowing the needed conditions, a person can enter the application page to fill the information & send the all required documentations as shown in appendix (3), Appendix(4). Every information entered is directly stored in its special field in the distributed database that was linked with website. the Table of a Application form is show in appendix (5).

The person in charge of the interviews with the applicants, starts to fill the rest of the information in The page of appointment interview candidates for employment that is accredited in the ministry of higher education and scientific research in Iraq, The Model of appointment interview candidates is show in Appendix (6).

The application form is useful in the following:

1. It provides the university with basic information about the individuals who apply for the vacancy. Those who don't have the needed qualifications can be eliminated.
2. these applications represent a reference that can be kept within the file of the applicant. It can be reviewed after person is employed
3. through the information recorded in the application model we can know his/her way of expressing him/herself and the way he/she arranges thoughts.

9.2 Stepwise Regression Result

The stepwise regression method was applied by using (MATLAB version 8.1.0.604(R2013a)) program to sort variables and leave more influential in the model. The criterion for adding or removing is decided by F-test statistic value and decreasing the sum of squared error. After the entrance of first variable to the model , the variable number is increased step by step ; other it is removed from this model. it will never enter the model again. Before selecting variables , the critical point, level of significant and the values of F_e (F-to-enter) F_r (F-to-remove) have to be determined first. Then the partial F value of each step has to be calculated and compared to F_e and F_r ; if $F > F_e$, it is considered to add variables to the model ; otherwise , if $F < F_r$, to remove variables from this model is considered. Using this method explained the hierarchy of the variables. It explained 85% of the difference in employment.

An evident increase in noticed in the value of F test is (545.626).

9. Practical Part

The results showed the proposed model efficiency in defining the relation among the independent variables and employment and as follows:

$$y = 3.842 - 0.5617 \text{ Age} + 0.030 \text{ MLFD} + 0.0204 \text{ Average} + 0.0180 \text{ specialization}$$

$$t = \begin{matrix} (-41.50) & (22.57) & (20.26) \\ (6.37) \end{matrix}$$

The above equation starts with (age) which is the most effective variable in employment and ends with (specialization) which has less effect on employment for the study samples; and remove the other variables from the model .

In the double-sided test the period of approval H_0 is $(\pm t_{v, \alpha/2}) \dots$ and $\alpha = 0.05$ H_0 will be refused if : $T \geq (t_{v, \alpha/2})$

$$T \geq 1.960$$

Or If: $T \leq (-t_{v, \alpha/2})$

$$T \leq -1.960$$

Therefore, the T value for the variable is Age (-41.50) That means it is located on the negative side and it is less than the table T which is -1.960. that means it is in the refusal area. In this way the H_0 is refused. We conclude that the variable (age) has an effect in employment.

The T values for the variables, (MLFD), (average), (specialization) are 22.57 , 20.26 , 6.37 respectively. That means they are located on the positive side which is the highest T value which is 1.960. it shows that they are located in the refusal area and in this case the H_0 is refused. We also conclude that the variable (specialization), (MLFD), (average) have an effect on employment.

9.3 Result Simulation

The Neural – Network Models are implemented using neural network toolbox that is available in MATLAB version 8.1.0.604(R2013a) program .

For the B.P network : B.P Neural Network Training is Show in Appendix(7), The simulation result of the testing is show in Appendix(8)

For the NARX network: NARX Neural Network Training is show in Appendix(9), The simulation result of the testing is show in Appendix(10)

The mean squared error (MSE) values of B.P Network is show in Appendix(11), And the mean squared error (MSE) values of NARX Network is show in Appendix(12).

9.4 The Evaluate New Employees

The new employees, who work for one year under test and after then the decision is made whether to installation them

or not and in order to evaluate the performance of the new employees who hold master and Ph.D. degrees. The all evaluation forms that are accredited in the ministry of higher education and scientific research in Iraq are designed to evaluate the performance of the teaching staff members . These forms fill by the department manager in the college in that university two of these forms are shown in the Appendix (13)and Appendix (14).

10. Conclusions

- The Central jobs site is available the information about the vacancy and its properties, conditions etc. It is also published for longer periods . This also enables the applicants for the vacancies to have pre-knowledge about all the details then he/she can decide whether to apply for the vacancy or not. This saves efforts and time for the university. In most cases, only those who think they have the requested qualifications and would be an active member in the university would apply. In this way the University would get the best members to among them. This process also enables the individuals to apply through and fill the form on the internet and also send all his papers and documents to the central Jobs Site. In addition to that by this site The performance evaluation process for the new employees under test are achieved to determine the efficiency of the new employee and to be sure that the university is choose the best employees and the most suitable applicants to fill the vacancies in the university.

- Using stepwise regression was explained the hierarchy of the variables where are add The effective variables on the model to the employment model for the study samples; otherwise , remove others variables from the model before entering variables to N.N hybrid with expert system.

- NARX Neural network has been used a pair of training (Input, and target), rather than what is using in this network when is using in Time series, where is the real output of the network is consider the Network entries in subsequent training for this reason the network performance has been improved to perform the process of recognition in the central jobs system in Iraqi universities.

The Performance Comparison of the NARX with B.P can be shown in Table 1

Table 1 :Performance Comparison of the two neural network

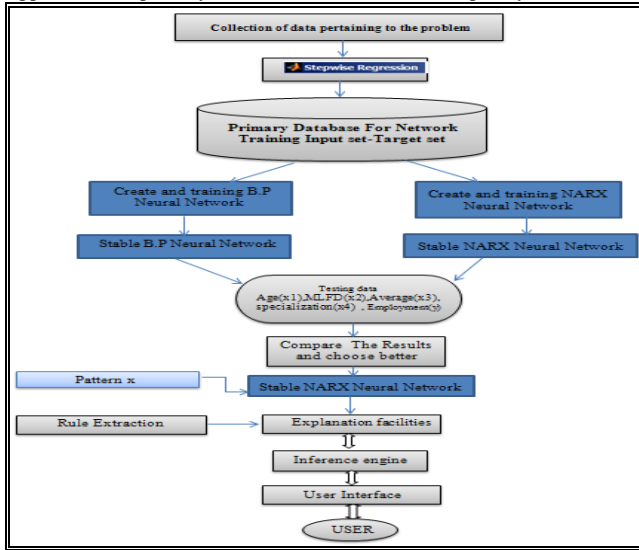
Neural network	MSE	Correlation Coefficient
NARX	0	1
B.P	0.033373	0.98508

the results of the NARX network are more accurate than the results of the B.P. network, so we can be using the NARX network in another important application, of nonlinear dynamic systems in Patterns recognition.

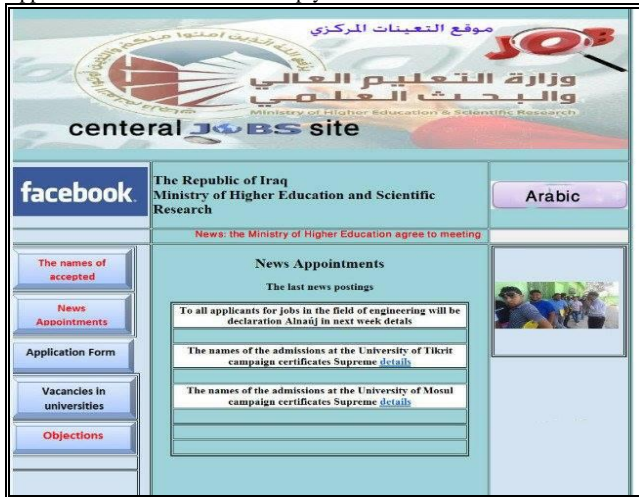
- Using the NARX Network hybrid with Expert system enabled the decision maker to select the candidates automatically according to certain standards (rules) that have already been set in the NARX network hybrid with Expert system without any outer pressure that negatively affect the process and that leads to selecting unqualified persons. As a consequence, it leads to negative effect on the work of the staff in the University These staff are considered a majority in achieving the competition factor for the University.

Appendixes

Appendix 1: steps of hybrid Neural Network with Expert system



Appendix 2: The Main form of employment website



Appendix 3: Application Form

Appendix 4: The documentations required form

Appendix 5: Table of Application form

Field	Type	Collation	Attributes	Null	Default	Extra	Action
<input type="checkbox"/>	prim	int(11)		No	None		
<input type="checkbox"/>	name	varchar(20)	latin1_swedish_ci	No	None		
<input type="checkbox"/>	gend	varchar(21)	latin1_swedish_ci	No	None		
<input type="checkbox"/>	university name	varchar(20)	latin1_swedish_ci	No	None		
<input type="checkbox"/>	departmen n	varchar(20)	latin1_swedish_ci	No	None		
<input type="checkbox"/>	job name	varchar(20)	latin1_swedish_ci	No	None		
<input type="checkbox"/>	spacial	varchar(20)	latin1_swedish_ci	No	None		
<input type="checkbox"/>	email	varchar(23)	latin1_swedish_ci	No	None		
<input type="checkbox"/>	unver name	varchar(23)	latin1_swedish_ci	No	None		
<input type="checkbox"/>	avrgc	float		No	None		
<input type="checkbox"/>	datee	date		No	None		
<input type="checkbox"/>	skile	varchar(25)	latin1_swedish_ci	No	None		
<input type="checkbox"/>	year jpb	varchar(20)	latin1_swedish_ci	No	None		
<input type="checkbox"/>	phonenum	int(11)		No	None		

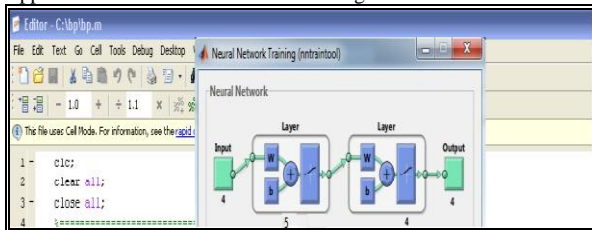
Appendix 6: The interviews Form

Model in the form of appointment interview candidates

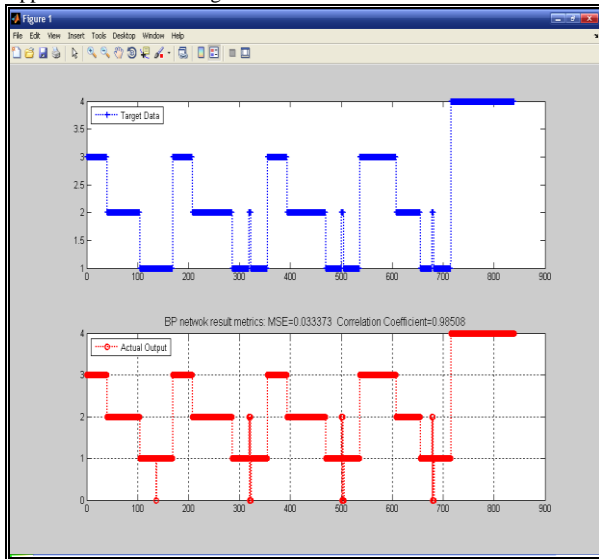
Name : _____
 Age : _____
 Gender : _____
 Marital Status : _____
 Certificate obtained by : _____ Weighted average _____
 sequence graduation : _____
 Is there a contract : _____
 Department, which will be the appointment : _____
 Functionality desired by : _____

Standards	Accepted	Medium degree	Good	Vary good	Excellent	Relative Importance
First: Score	1	2	3	4	5	
Qualifications						
The level of graduation						
Sequence graduation						
Previous experience						
The relationship between the job and the certificate						
Second: General Characteristics						
General appearance						
Equilibrium Profile						
Work style						
The ability to control						
Fitness						
DETAILS interfaces						
Total						

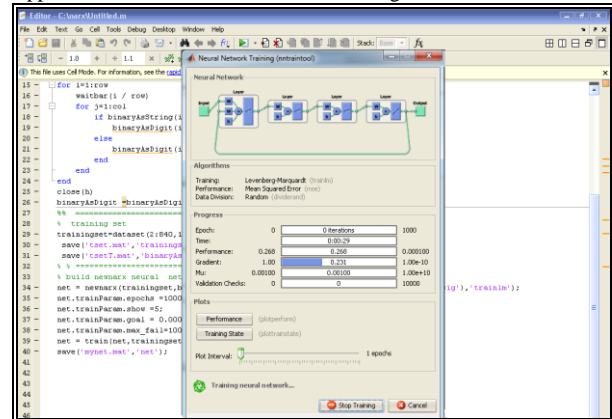
Appendix 7: B.P Neural Network Training form



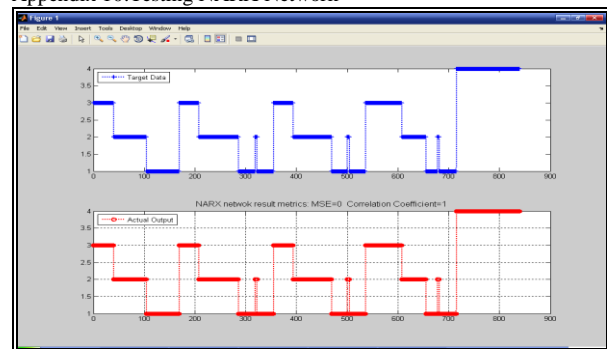
Appendix 8: result testing of B.P network form



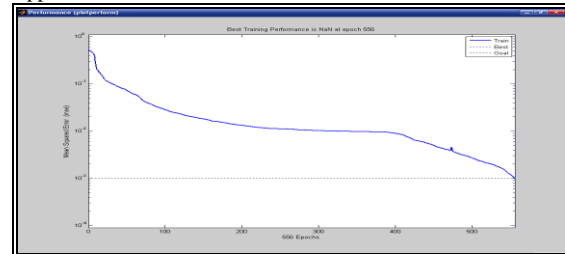
Appendix 9: NARX Neural Network Training form



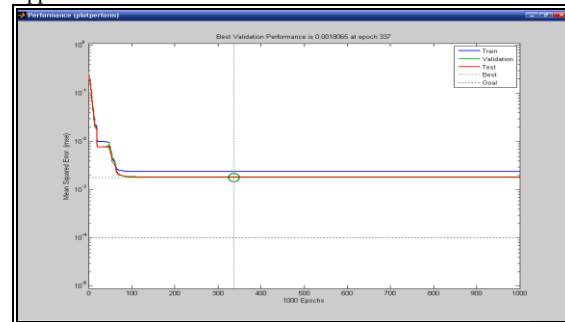
Appendix 10: Testing NARX Network



Appendix 11: MSE Value OF B.P



Appendix 12: the MSE Value OF NARX Network



Appendix 11: performance evaluation form1

System supervision and scientific evaluation
 Department Performance evaluation

Name : University Name :

College Name :

Gender:

Marital Status:

Certificate obtained by : scientific competece

scientific title

date of obtaining scientific title

Is there a Graduate

Are you studing Graduate

Are students rows ending demanding research

Appendix 12: performance evaluation form2

	Paragraphs	The upper limit of the degree	Very good and above	Good	Medium and down	Given class
1	Coping which scientific development					
2	Ability to deliver scientific article					
3	Ability To mänge the classroom and discussions					
4	Ability to assess students					
5	The extent of his contribution to the scientific development					

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