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Estimates of Activity in Software Product Design Phase, Using a Multi-layer Perceptron Neural Network Model

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Abstract—Estimates based software planning and design activities in the design phase of any project is the software. Estimates predict the actual activities of software development or maintenance activities required for the survival of the software. Product estimates include estimates of cost, time and size of the software product activity. However, this could be predicted more accurately and with fewer errors, will increase the success of a software product. Accurately predict the performance of a software product ensures that the users and the owners of the software product to have more confidence in product performance. The failure of the software product to be minimized. In this paper, Multi-Layer Perceptron neural network model for reducing forecast error up software product used. In this paper, Multi-Layer Perceptron neural networks have been implemented in the MATLAB environment. Multilayer Perceptron model of performance benchmarks in this article, the lowest range of relative error is Mean Magnitude Relative Error (MMRE). The data used in this article were taken from 41 standard project martin- lopez these 41 projects, 15 projects are selected randomly and For training and testing multi-layer perceptron of the 15 projects used and the results obtained from (MLP Multilayer perceptron) are presented and discussed.

Keywords—Estimate the activity of a software product, Multilayer perceptron neural networks, Estimate sizes, Time estimates, Estimated cost

I. INTRODUCTION

In the early days of computing , computers and low number of applications , often small projects and was a member .Applications will be catastrophic . As a result of this growth , the effect of errors in estimating the cost of additional software or worse. As a result, today the estimated costs of software projects is very important to find. Based mostly product work breakdown structure, activity and control products are accurately predicted. Work Breakdown Structure is a tree consisting of hardware, software, services and information that advances the production of military items, project engineering activities can be obtained and are fully specified project. WBS is a product that must be manufactured or produced and defines the display. The connection elements to complement each other and are determined to complete the product [1]. The failure of a software product largely due to failure of project management software product that includes estimates are imprecise. Accurately estimate the costs and time for both the manufacturer and the size of the software product to the consumer is of utmost importance. Appropriate activities and cost estimates for software products can be used for scheduling, monitoring and controlling the software products used.

Estimates predict the actual application work activities required to develop or maintain software. Estimates to calculate the activity of each individual activity required for software development in product breakdown structure is used.

When the assets of a software product is provided. So the work breakdown structure elements, each product must be done correctly., One of the methods that can be useful in estimating the activity of neural networks is. Artificial Neural Networks in order to increase the precision, accuracy and objectivity can be used to estimate the activity. Artificial neural networks as a branch of artificial intelligence technology in computer science has been accepted [2]. Artificial neural network is a technique that attempts to simulate the behaviour of neurons in the human brain that these techniques have been in use for several years in many cases. Among the features of artificial neural networks in the detection and estimation and forecast. The main advantage of using artificial neural networks is that the conventional methods to solve the problems that the technology is too complex algorithmic solutions and sophisticated solutions are used. These features are widely being used in estimation activities. Artificial neural network system for estimation of activity in the time, cost and size requirements. Another advantage of artificial neural networks to reduce the error in estimating the activity is anticipated product characteristics such as fatigue, exhaustion, and emotional status no effect on artificial neural networks [3]. There are many relations among the stored data, The first neural network model designed to learn the relationship between the data and to extract the hidden information of training data, and then to applying [3, 4]. Artificial neural networks are capable of learning and artificial neural networks can be trained before the original surgery. After training and testing artificial neural networks that use them.

In this paper, we tried multilayer Perceptron Neural Network model to minimize the prediction error, we estimate the activity of the software product that including estimates of the size, we can estimate the time and cost estimates.

II. RELATED WORK

Research studies to date using artificial neural network models to estimate the activity of a software product offered that in this section we will describe each of these studies. Researchers in [5] a new method to estimate the activity of a software product using artificial neural networks Radial Basis Function (RBF) are given. They expressed that other than the RBF neural networks such as Hopfield and cohenen the prediction error is less, Because the basic function of the RBF centre vectors are used, in each iteration of the RBF centre vectors greater accuracy and ultimately it will be closer to the target vector. The advantage of this method compared to other methods is that reduce the size of the software and also reduces the cost for a software product for a large scale project has been done. In other words, the method is suitable for large volume data sets. Researchers are also other methods [6] to estimate the activity of a software product using machine learning began. They use machine learning to minimize the error in predicting the activity of a software product have raised. In this method, the components of a software project closely and is trained using machine learning and so it has been found that the estimated time for a software product has been very little error. In another study [7], the researchers used a multi-layer perceptron artificial neural network to predict the cost of a software product are discussed. The input neurons consisting of the amount involved in the project, the amount allocated to cost and time is expected. In this study the hidden layer is used. Thus placing the hidden layer neurons to estimate the cost, time and dimensions can be used to accurately estimate the MLP neural network output can be observed in neurons.

In reference [8] to compare the regression method and artificial neural network are discussed. In this paper, the regression method as the primary method for estimating a software product is introduced. Achieved by using an artificial neural network approach has shown that with proper weighting of each of the estimated parameters, the error can be reduced.

III. ESTIMATING SOFTWARE PROJECT ACTIVITIES

Estimates based software planning and design of each project is. There are practical measures in the software industry. When planning the budget is too pessimistic, investment opportunity is lost. Software process activities predicted a realistic estimate of the work required in developing or maintaining software. The estimated monthly business activity to be used in the product. Estimate the activity of the software consists of three steps:

- Estimate sizes including the amount needed to produce is a software product.
- Time estimates include the monthly amount per person is required.
- The estimated cost includes the amount of the fee required for each section.

Project Management Software starts with a series of activities that the whole project is called. Before starting the project manager and team-working software that is supposed to be done, the resources required and the time from start to finish is required estimate[9].

The purpose of the Director of Planning, reasonable estimates of resources, cost and timing is these estimates are or limited timeframe at the beginning of the project or are updated regularly throughout the project.

Estimates to determine the best and worst case scenarios. Activity estimates in this paper the design phase of a software product to minimize the estimating activities of a software product at the time, expense and size of the used to be.

A list of resources needed to produce projects that are estimated using historical data. Lopez-Martin[10] is standard and includes 41 projects are shown in Table 1.

Table 1: Dataset used estimate the activity of the software

Number of project	MC	DC	LOC	DT
1	1	0.25	4	13
2	1	0.25	10	13
3	1	0.333	4	9
4	2	0.083	10	15
5	2	0.111	23	15
6	2	0.125	9	15
7	2	0.125	9	16
8	2	0.125	14	16
9	2	0.167	7	16
10	2	0.167	8	18
11	2	0.167	10	15
12	2	0.167	10	15
13	2	0.167	10	18
14	2	0.2	10	13
15	2	0.2	10	14
16	2	0.2	10	15
17	2	0.2	15	13
18	2	0.25	10	12

19	3	0.25	10	12
20	3	0.083	17	22
21	3	0.125	11	19
22	3	0.125	15	18
23	3	0.125	15	19
24	3	0.143	13	21
25	3	0.143	14	20
26	3	0.143	14	21
27	3	0.143	15	19
28	3	0.143	15	20
29	3	0.167	13	15
30	3	0.167	14	13
31	3	0.2	18	19
32	3	0.25	9	13
33	3	0.25	12	12
34	3	0.25	17	12
35	4	0.077	16	21
36	4	0.077	31	21
37	4	0.111	16	19
38	4	0.2	24	18
39	5	0.143	22	24
40	5	0.143	23	25
41	5	0.2	22	18

As can be seen in Table 1 to estimate the activity of three parts: the size, cost and time, there are four fields.

The first field McCabe Complexity (MC) is to mean that the complexity of the project for each project.

The second field Dharma Coupling (DC), which expresses the dependence of project. Methods Third Field Lines of Code (LOC) is to specify the size of the project will And the last field of the Standard Lopez Martin, Development Time (DT), which is expressed as the time required for the project.

According to Table 1 is that 41 projects of the 41 projects, 15 projects were randomly assigned to training and testing an artificial neural network model of multi-layer perceptron used.

Data required as input data, Multilayer Perceptron these 15 projects are being considered. Each of these fields to estimate the time of the estimate, the estimated cost of a software product that has the value specified for each project. In this paper, using a multi-layer perceptron artificial neural network approach, we can reduce the amount that.

IV. THE PROPOSED MODEL

Parallel adaptive artificial neural network is a network of non-linear computational elements called neurons, are formed. After each ANN into a set of neurons that have specific attire, has been established. The main part of an artificial neural network, neurons and connections between them. The neurons are interconnected processing elements that work in harmony to solve a problem together [3,4]. Artificial neural networks are capable of learning. The generalizability of learning through experience and ability to solve new problems caused by the superiority of this method over other methods. The model proposed in this paper to estimate the activity of a software product, is a multi-layer Perceptron Neural Network. Artificial Neural Networks are two types of single-layer and multi-layer. Single-Layer Perceptron neural network is only capable of learning linearly separable issues are that.

Multi-layer perceptron artificial neural network model [1] that can estimate the activity of the software product that is used in a non-linear problem. Multi-layer Perceptron neural network is composed of input layer, hidden layers and an output layer that in each number of neurons can be exist. In this paper, the output of each hidden layer transfer functions are used. To characterize the transfer functions of neurons used in solving various problems. In this paper, both the hidden and output layer transfer function logsig [1,4] used. Logsig reason for these two layers is the transfer function of the output layer is in the range of 0 and 1. Figure 1 show transfer function the logsig.

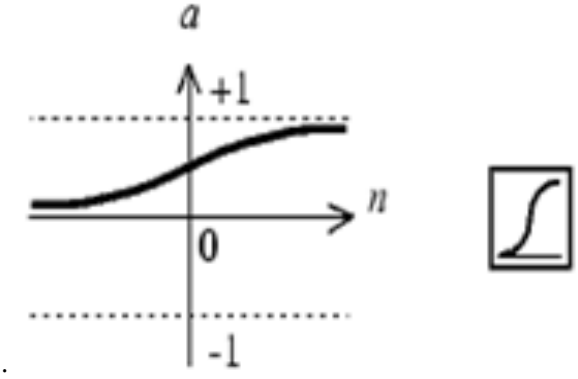

Fig. 1 transfer function the logsig

According to Figure 1, the logsig, between zero and one output neuron produces. This function is defined to determine which formula 1

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

In this paper the MLP neural network training to improve detection accuracy and correction weight back propagation algorithm (Back propagation) are used. Back propagation method to update the weights in the formula (2) is performed.

$$\Delta w_{ji} = \lambda \delta_j o_i \quad (2)$$

According to the formula (2), where λ is the learning rate and δ_j the output layer of the formula (3) is calculated.

$$\delta_j = o_j(1-o_j)(t_j - o_j) \quad (3)$$

The formula (3) new weights for the output layer. If the δ_j layer is hidden from the formula (4) is calculated.

$$\delta_j = o_j(1-o_j)\sum_k \delta_k w_{kj} \quad (4)$$

The formula (4) new weights for the hidden layer is calculated.

It should be noted that at the start of the implementation of the MLP, the weights matrix are initialized with random numbers. Firstly, because the input values of all the entries of the matrix weights is time consuming and also fixed weight matrix system may be stuck in a local optimum. So to avoid this matrix, the weights are initialized with random values as with any program of weight matrix is initialized with the new values and if you get stuck in local optimum for the first time in his second time out with the new values of local optimization.

In this paper the MLP neural network has 15 input regarding the randomly selected 15 projects from Table 1.

The purpose of this paper is to estimate the activity in the software design phase that includes three sizes of time and money using Multilayer Perceptron Neural Network, MMRE is an important measure to achieve[11]. Which MMRE a benchmark for evaluating the performance of software activities in three areas of cost estimates, is the timing and size. This criterion is defined to determine which formula (5).

$$\mathrm{MMRE} = \frac{1}{N}\sum_{i=1}^{N}\frac{|X_i - Y_i|}{X_i} \quad (5)$$

MMRE given MRE (Mean Relative Error) is calculated by the formula (6) is used to calculate the MRE[12].

$$\mathrm{MRE} = \frac{1}{N}\sum_{i=1}^{N}\frac{(X_i - Y_i)}{Xi} \quad (6)$$

Xi is the actual effort on the project I and and Yi working on a project i, is estimated.

Figure 2 Architecture of artificial neural networks used to estimate the MLP illustrates the activities of a software product.

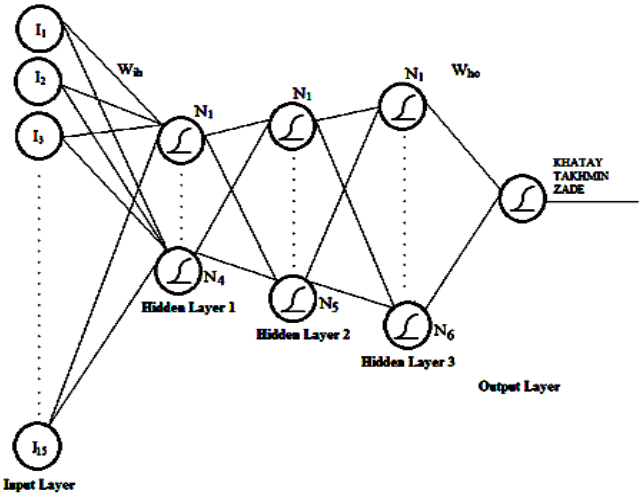

Fig. 2 the architecture used in MLP neural networks

According to the architecture (2), MLP neural networks has 15 inputs in this article, because table 1 because of the 41 projects, 15 projects have randomly selected 15 projects are input neurons. The number of neurons in the output layer is equal to 1 because the estimation error in the three sectors of activity software product cost, size and time, we examined. The goal is to achieve the lowest error in these three sectors. The number of hidden layers and the experimental method to obtain better results, 3 neurons e considered the first hidden layer, 4 neurons second hidden layer and 5 neurons in the third layer is considered. Also, according to Figure 2, the transfer function of the neurons in the hidden layer and output layer is logsig. Structure implemented in MATLAB environment on the newpr [1] that this function can be used to build a multi-layer perceptron.

Given that 15 random project to estimate the cost of operating the software product in three sizes, and chose, 75% of data for training and 25% of the 15 projects were selected for testing. Segmentation Table 2 shows data for the 15 projects for training and testing.

Tabel 2: number samples used for train and test

Type	**%**	**No. of sample**
Train	75%	11
Test	25%	4
Total	100%	15

According to Table 2, this classification is used to achieve optimal MMRE Table 3, MMRE to estimate the optimal software product shows up.

Tabel 3: achieved of MMRE to selection project

Project Num.	**Actual DT**	**Neural Network**	**MRE**
3	9	8.31	0.05
4	15	15.76	0.06
5	15	13.82	0.08
6	15	14.1	0.09
8	16	16.36	0.05
10	18	16.72	0.11
11	15	12.96	0.16
12	15	13.22	0.16
15	14	12.66	0.1
21	19	17.1	0.18
22	18	17.64	0.07
25	20	18.78	0.11
28	20	18.81	0.1
32	13	11.56	0.14
37	19	17.31	0.09
MMRE			0.10333

According to Table 3, the first field (Project NO) shows randomly selected projects. The second field is the Actual DT, Time needed for the development of 15 projects chosen according to Table 1, Actual DT that these projects are given a fixed standard Martin Lopez. The third field of artificial neural networked MLP illustrates the relation 15 projects will be selected that data from these 15 projects will be reduced when processing the input MLP Actual DT 15 projects will be selected. MRE fourth field indicates that the data in the third field is calculated by the MLP. As the estimation errors obtained from MRE field specifies the lowest it's been tried access to on three of MRE project cost, size and timing. Performance criteria in this model is the MLP that MMRE is calculated according to the MRE obtained.

So as MMRE obtained for estimating the activity of a software product for the design phase is the cost, size, and time, we see that the smallest error for 15 projects selected have been looking for.

V. RESULTS

The estimated operating activities needed to calculate each software project for development of software used is that Includes estimated in three sizes, and time is cost. A project management software product design phase starts with a series of activities that the whole project is called. Before starting the project manager and the software team work that is being performed, Resources that are needed and when it is required to estimate from start to finish. In this paper, we tried to use Artificial Neural Network Model MLP to provide a way to reduce the estimation error in the design phase of software product activities should be that MLP model to measure performance in this paper have been MMRE.

MMRE results that have been obtained to estimate the activity of a software product is equal to 0.10333. Things to do in the future is with the use of other models such as artificial neural networks, Radial basis function artificial neural network, error estimates can be paid up software product as well as artificial neural networks can be used to estimate the activity of the software product to compare to determine which are the lowest error estimates to predict the activity of a software product.

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