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Software Effort Estimation Using Enhanced COCOMO Model

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ABSTRACT

The efforts are to be estimated before beginning with the development of software. This technique is known as effort estimation. The proposed work includes estimating the efforts of software using hybrid technique involved in previous models. COCOMO is constructive cost model and is considered as the most accurate model for effort estimation. In this work a hybrid formula used that depends upon the values of cost drivers. The generated result will estimate closer efforts than COCOMO. There are 47 projects with defined values of cost drivers. The efforts of each model are being calculated and their MMRE is calculated. The result shows that the hybrid model is derived by using TLBO algorithm provides more accurate results than the other estimation models.

1. Introduction

In the area of software development, the main challenging issue is effective software project estimation. If there is no proper, reliable estimation provided in the software development, there will be no proper arrangement as well as control of the project. Even when all the important factors are considered, the software business is not useful in determining the project estimated. It doesn't utilize estimates for improving the development of software. When a project is underestimated the effects such as under-staffing, under-scoping the quality assurance effort, and missing the deadlines resulting in loss of credibility are seen [1]. When the applications try of estimate the estimation, there are equal chances of over-estimation of a project which can also result in providing loss to the applications. If a project is given more number of resources than it actually requires, the resources will be utilized by it. The cost of the product increases due to this reason, which will further result in deploying the estimations stated for the software. This will also result in limiting the resources of the company as they are wasted. The first step towards achieving an effective estimate is to provide an exact estimation for the software size which is be proposed [2]. Along with these formal descriptions of the needs for project estimation scope, the source of data might start. Various examples of the data present are the requirement specification of a customer, proposal request, and the specification of a system or software requirement. There can be additional details provided with the help f design documents for the chances that a re-estimation can be performed by the project at its later phases of the lifecycle. A formal scope specification must be given a chance at least once for avoiding initial project estimation. For the start an outline or a simple verbal description is enough. There should be communication regarding the level of risk and the uncertainty that could occur in the estimates [3]. When the results show more estimate, there should be a re-estimation done for the project. After receiving the size estimation of a product, it becomes very easy to estimate the effort of it. When the software development lifecycle of a project is defined only then the conversion from software size to total project effort estimation is possible. Further the designing, develop and test of the software are defined for project development. In addition to coding of the software there is much more to the software development project. The smallest part of the effort is basically the coding part. Software cost estimation model is a backhanded measure, which is utilized by software personnel to predict the cost of a project. The development of software product shifts depending upon the earth in which it is being developed. For projects with familiar environment it is anything but difficult to predict the cost of the project. The estimation model is valuable for exchange off between the developer and customer [4]. Organization can understand of what is achievable and deliverable to the customer. Constructive Cost model was developed by Barry W Boehm in 1981. It is an algorithmic cost model. Algorithmic cost model is developed taking into account relating the present project to previous projects. It depends on historical information. SEL is an automated costing system which is similar to the Rayleigh-Putnam Model. For the purpose of software project estimation, the SLIM Putnam software model, linear programming, statistical, simulation, and PERT techniques are utilized. Putnam has provided the name for certain collection of tools which were utilized in his company QSM Inc. which is known as SLIM (Software LIfecycle Management) [5]. Teaching-Learning-Based Optimization (TLBO) is a new meta-heuristic optimization algorithm. This optimization technique is used for the continuous non-linear large-scale optimization. Similar to the teaching and learning basic relation, this technology has its methodology. There is an impact on the optimization procedure according to the performances of learners. The teachers are a great influence on the outputs given in a class. It is basically a structure based system. There are various practical optimization problems to which this algorithm has been used for various real world applications which involve the mechanical design, planar steel frames, welding, etc. When in connection with the continuous function optimization, there were various methods executed by the TLBO algorithm [6]. This also has various disadvantages. There are limited benchmarks on which the algorithm is thus suitable to perform. There are limited function to which have dimensions that are also limited. The convergence rate a very big disadvantage for the TLBO

algorithm. While handling the higher dimension problems, the disadvantages are removed. The functions such as Rosenbrock are when involved, the performance of the method is degraded. For the purpose of achieving highest performance and solving this issue, a new mechanism is to be proposed.

2. Literature Review

Shailendra Pratap Singh, et al., (2017) proposed a new techniques are proposed to enhance the precision of cost estimation by altering parameters of COCOMO utilizing Homeostasis transformation based differential development (HMBDE) [7]. The proposed strategy includes one more vector named as Homeostasis transformation vector in the current transformation vector to give more transfer speed to choosing viable mutant arrangements giving a wide pursuit space to likely arrangement. Execution of proposed calculation is contrasted and programming cost estimation models. The outcome checks that our proposed HMBDE performs superior to anything COCOMO based DE and PSO calculation and other delicate figuring models.

Peyman Khazaei, et.al (2016) proposed that in the day-ahead power systems scheduling, system operators formulated and solved the unit commitment (UC) problem to determine ON/OFF status and power dispatch of the producing units. In the paper, the teaching-learning-based optimization (TLBO) technique, which as an evolutionary algorithm, was employed to solve the unit commitment problem [8]. The TLBO not just gave a solution bring down operating costs, additionally had a lower computation time. In addition, adequate spinning reserve was given to alleviate the effect of rapid load/generation changes because of unexpected disturbances.

Yu-Huei Cheng (2016) proposed that numerous single nucleotide polymorphisms (SNPs) for complex genetic diseases were genotyped by polymerase chain response restriction piece length polymorphism (PCR-RFLP). A feasible PCR-RFLP primer match was to be designed. Also there was a need to discover accessible restriction enzymes which could perceive the target SNP for PCR experimental purposes [9]. The experimental results which were achieved were made to compare with the GAMPD results. This would be helpful for enhancing the reliability of this proposed technique.

Chalotra et al. (2015) introduced that the target of momentum examination was applying Bee Colony Optimization (BCO) meta-heuristic way to deal with enhance the parameters of COCOMO model for enhancing software cost estimation [10]. BCO methodology a "bottom-up" way to deal with modeling where uncommon sorts of artificial agents are made by similarity with bees which are utilized to take care of complex combinatorial optimization issues. The proposed model validation was done utilizing Interactive Voice Response software venture dataset of an organization. The results acquired demonstrate that the proposed BCO based model can enhance the precision of cost estimation furthermore beat different models

David L. Gonzalez-Alvarez, et.al (2014) proposed that proteins are molecules that shape the mass of living creatures [11]. Various learning stages were used to enhance the knowledge (quality) of the population-based evolutionary algorithm. This algorithm is characterized as a group of individuals. So, adequate quality solutions could be achieved by providing enhancements to already existing techniques. Six instances composed of various related protein sequences were gathered from the PROSITE database. These were used to evaluate the performance of the proposed technique. The proposed technique helped in making predictions and also helped in improvement of quality of the solutions which were found by biological tools.

M. Ramakrishna Murty, et.al (2014) proposed a reliable, accurate and robust optimization technique plot for global optimization over constant spaces. A variation of the teaching factor TF in traditional TLBO algorithm is proposed in this paper. Numerical difficulties were observed in the constrained as well as unconstrained optimizations. Problems such as multi-modality, dimensionality and differentiability were found [12]. It was seen through the results evaluated that the proposed algorithm has enhanced the performance in terms of convergence which also includes the some changes in the teaching factor algorithm. For managing the complex numerical optimization issues, the TLBO algorithm involved with new teaching factor has proved to be efficient.

3. Research Methodology

The TLBO algorithm is the algorithm which is used for the optimization. In this research TLBO algorithm is applied to reduce MRE value of the COCOMO Model by estimating predicted efforts more accurately. The TLBO algorithm comprises of methods which help each individual to take in something different and to enhance himself. The base of this algorithm has be derived from a normal teacher-learner methodology of a classroom. The TLBO algorithm holds the basics of traditional learning methods that are seen in a teacher and a learner. There are two essential methods of learning involved in it. The first is to learn through the teacher. It is also known as a teacher phase. The second is the learning that is done through interaction with different learners. This is known as the learner phase. TLBO is a population based algorithm. The population comprises of the gatherings of students (learners). The diverse subjects offered to the learners are analogous with the distinctive design variables of the optimization issue. The results of the learner that are obtained are analogous to the fitness value of the optimization issue. The teacher is held to be the best arrangement in the whole population. The operation of the TLBO algorithm is clarified underneath with the teacher phase and learner phase [22].

a. Teacher Phase: This phase of the algorithm simulates the learning of the students (i.e. learners) through the teacher. A teacher passes on information among the learners in this phase. The teacher tries to build the mean result of the class.
b. Learner phase: This phase of the algorithm simulates the learning of the students (i.e. learners) through association among themselves. The information gathered by the students can also be from the examinations or interactions with other students. A learner will learn new information if alternate learners have more information than him or her.

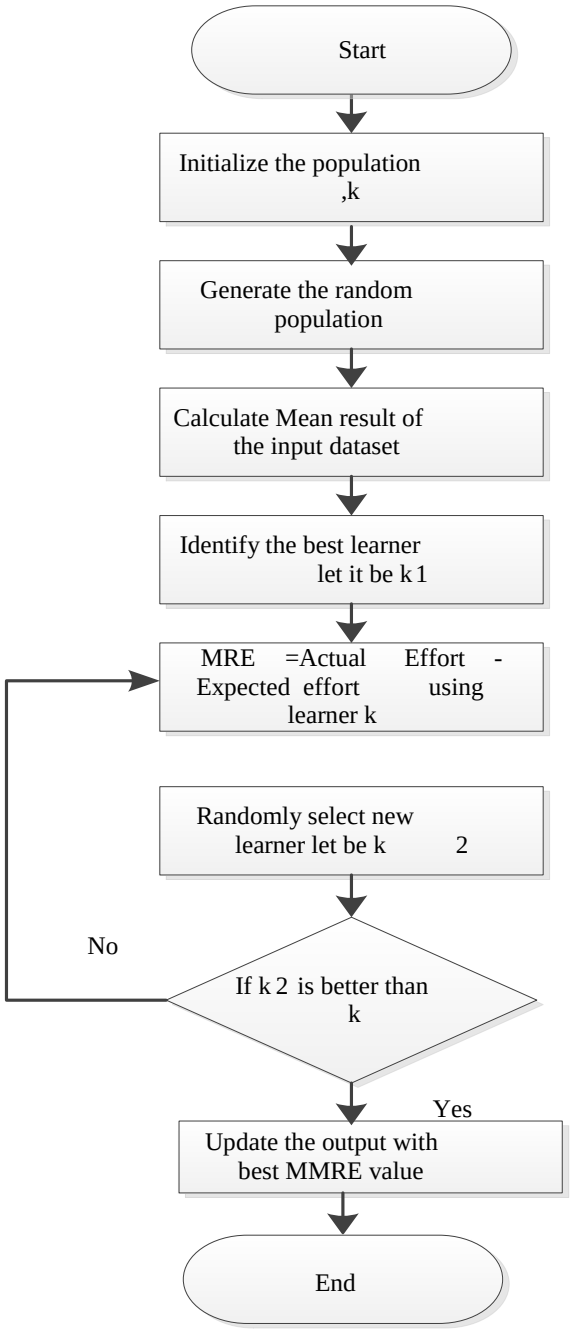

Figure 1: Proposed Flowchart

Following are the steps which followed to implement proposed work

1. In the first step the dataset is loaded which of ivr in which 21 projects are given and correspond to each project their KLOC value is given.
2. In the second step the KLOC value is considered as the initial population which is input to learner phase
3. The learner phase also take input the desired error value and their the loop is executed means until minimum error is achieved by considering the KLOC value
4. In the last phase values of one iteration is compared with the previous iteration and when minimum error is achieved as that phase algorithm will exit the loop and display final result in terms of MMRE value.

4. Experimental Results

The proposed research is implemented in MATLAB and the results are evaluated as shown below.

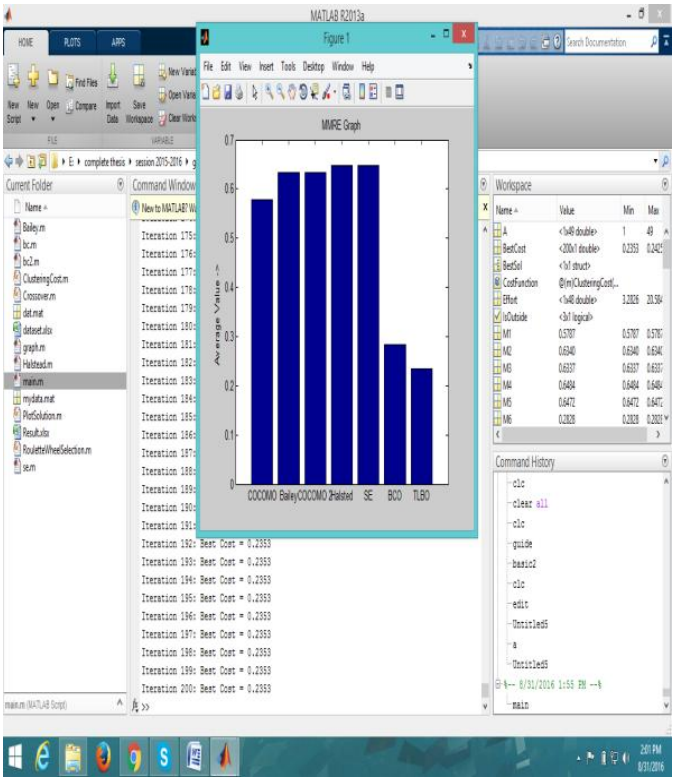

Fig 2: TLBO algorithm performance

As shown in figure 2, the performance of effort are compared and it is analyzed that proposed TLBO algorithm performs well in terms of MSE

5. Conclusion

The effort estimation is the technique which will estimate the efforts for the software development. In this work, we are working on COCOMO model which is based on KLOC values. It means that KLOC value is directly proportional to efforts means if the KLOC is analyzed accurately efforts are also analyzed in the efficient manner. In the COCOMO model two are constants which are 'a' and 'b'. The values of these constants depend upon the size of the project. In this work it is been concluded that to improve performance of COCOMO model we need to analyze KLOC in the efficient manner. In this work, we are using IVR dataset in which 47 projects are considered and KLOC of each project is given in the dataset. To reduce MRE value TLBO algorithm is applied which is based on learner and teaching phase. The proposed and existing algorithms are implemented in MATLAB and it is been analyzed that MRE value is reduced with the use of TLBO algorithm.

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