International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-5, March 2020

A Pragmatic Cost Effective Model to Enhance the COCOMO Model in Software Estimation

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Abstract*: This research work is aimed at to provide effective cost estimation methodology emphasize on cost effort and time . This paper summarizes the cost effort estimation of most conventionally used models like organic and semi-detached models using an improved version of genetic algorithm that enhances an empirical methodology to reduce the cost factor and time factor in software projects. Constructive cost model(Cocomo model) is broadly used for the fruitful valuation of cost estimation which is based on KLOC method(thousands of lines of code).This method yields beneficial result in case of lines of code method but lacks in terms of concept and logics. The same is estimated directly and is computed using the function point analysis. In the software development lifecycle, the software cost effort estimation is the most demanding process. The accuracy of the estimate in choosing the estimation model is an essential factor. Such conventional software effort estimation techniques fail to compute the accuracy of effort estimation and it is not up to the mark. So here, we tend to propose the cost reduction in the software projects by using the improved version of the known genetic algorithm.

Keywords: **COCOMO, Effort estimation, Cost, Software project**

I. INTRODUCTION

The software cost effort estimation plays a vital role in software projects. The software application has increased with the evolution of computers. [5][8]COCOMO model is the most common model used in effort estimation, which has different types, of which basic, intermediate and detailed COCOMO model exists. Labor months and thousands of lines of codes are two parameters used in the calculation of effort. An effective estimation makes the software projects [12]cost come down to an extent and reduces the time thereby producing a quality project.[5][9] The COCOMO[10] model is a regression-based model representing the number of lines of code. For the past decade, there is no consistent and efficient model suggested for the systematic and accurate prediction of software project efforts. Now there are so many models for effort estimation, off which the managers choose the most popularly known COCOMO model [2] for the estimation of cost and time for an effective result on the software projects. The objective of the paper is to reduce the cost and time and thereby showing a rapid growth in the quality of the software projects.

Revised Manuscript Received on March 30, 2020.
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II. LITERATURE REVIEW

The paper is under the domain Software Engineering and the area that is being focused is reduction in the cost and increase the quality of the projects that are to be developed. [5]The concept regarding the COCOMO [2] model is an improved mode as well as the hybrid version is to decrease the cost and make the development process more effective by improving the quality largely. We have chosen the improved version of genetic algorithm generally used to create high quality solutions and which belongs to the larger part of evolutionary algorithm.[1]The algorithm is mainly used for optimization and search problems and it's each generation contains a population of individuals which is represented in the form of a bit or float or character or integer. It contains some important properties like efficiency, programmability etc. Here, we use the improved version of genetic algorithm. [1][13]Genetic algorithm is a part of larger evolutionary projects which is used to generate the best hypothesis and also replaces the older one with the best fit hypothesis. Our paper mainly concentrates on the properties like Accuracy or Speed and the algorithm has already inbuilt properties such as Efficiency, Simple Programmability, and Extraordinary Robustness.

[9]The measurable factors which explain the advantages of the products related to software which is an end result of the COCOMO. They are:

A. EFFORT - Effort is defined as the total number of laborers required to finish a task. Effort is computed in person months.

B. SCHEDULE - Schedule is defined as the total time taken to complete the job. The job is proportional to the effort placed. It is computed in units of time such as week, month.

III. METHODOLOGY

Effort Estimation Techniques

A. Cost Constructive Model

The Cost Constructive Model (COCOMO) [5] [2] is the widely used one for software effort estimation.[8]It is mainly used to estimate the cost, effort, time in the software projects. COCOMO [10] predicts the efforts based on the size of the project.

B. Basic Model

Basic COCOMO [1] [9] model is mainly used to estimate the effort in software projects and has three kinds of models which consist of Organic, Semi-detached and Embedded. [8]

- Organic - Small and simple project
- Semi-detached - Medium sized projects with medium time limitation.
- Embedded - Large project team with severe constraints.

According to the Basic Cocomo model, the basic formula is mentioned below:-

(1)

$$\text{Effort} = ab * (KLOC)bb$$

$$\text{Development} = cb *(KLOC)db \quad (2)$$

C. Intermediate Model

Intermediate model [1] [8] is described as a function of size, program and a collection of 15 cost simulations including subjective assessment of the product, hardware, personnel, and project features. These kinds of projects require a number of 300000 lines.

D. Detailed Model

The software is divided into different modules and the modules are estimated and the sum is then computed for a detailed model [1]. [8]This model uses different cost driver's property for various effort multipliers. In the proposed approach, the cost effort estimation is done in the following way. The Cost reduction is done using the formula:-

$$\text{EFFORT} = C*SIZE\text{^}K+TIME/COST \quad (3)$$

Effort can be estimated in man hours or man months. One of the two important questions in estimating the effort is:

- What will be done?
- How much effort will it take?

The effort[6] is calculated with the assumption of improving the quality of the software projects using the improved genetic algorithm and thereby reducing the cost of the project. In the proposed one, we gathered datasets for cost effort estimation and then analyzed it using genetic algorithm in weka tool. The result shows that the accurately classified instances are 87% and the inaccurately classified instances is 12%, so it is made sure that the cost is reduced. According to the Basic Cocomo model, the basic formula is mentioned below:-

The coefficients a_b, b_b, c_b, $d_b$are shown in table1.

Table 1: Basic Model Coefficients

SOFTWARE PROJECTS	BASIC MODEL COEFFICIENTS			
	a_a	b_b	c_c	d_d
ORGANIC	2.4	1.05	2.5	0.3
SEMI-DETACHED	3.0	1.12	2.5	0.35
EMBEDDED	3.6	1.20	2.5	0.32

IV. IMPROVED GENETIC ALGORITHM

Genetic algorithm (GA) is one among the meta-heuristic algorithms, which is a larger part of evolutionary algorithms [1]. It is used to generate high quality solutions for search problems and optimization like crossover, mutation and selection. In order to produce the next generation offspring, the relevant individuals are then selected for the reproduction. The evolution of this algorithm is with a group of randomly generated individuals, and this iterative process is known as generation. This algorithm simulates the natural process by adapting to the environment and able to survive and reproduce and then it goes to the next generation. we use genetic algorithm as it is robust, provide optimization over large space state and unlike artificial intelligence, they do not break the slight changes in the input or the presence of noise.Here,we have a collective group of feasible solution for a given problem, and the solutions will undertake recombination, mutation and so on. Thereby it produces new children and the process is repeated for the next generations. Each and every individual will be given a value for fitness and the most relevant individuals will yield more and more fitter individuals through mating. [1] [13] Genetic algorithms are much faster than any other traditional methods. It supplies a good solution to the problem and also provides a list of good solutions. The most important properties of GA are Efficiency, Programmability, and Extraordinary robustness based on the input data. Moreover, we have included property like accuracy and speed in the improved version. The accuracy or speed of the project is decreased to some extent in the proposed algorithm.

V. RESULT

The Fig.1. Shows the correctly and incorrectly classified instances which are 87.6453% and 12.3457%..We have done with a couple of observations using a massive dataset and we have received considerable output as follows. Fig.2 and Fig.3 shows the cost maximization and cost minimization images. Table 2 shows the classified instances.

Table2: Classified Instances

Correctly Classified Instances	Incorrectly Classified Instances
71	87.65%
10	12.35%

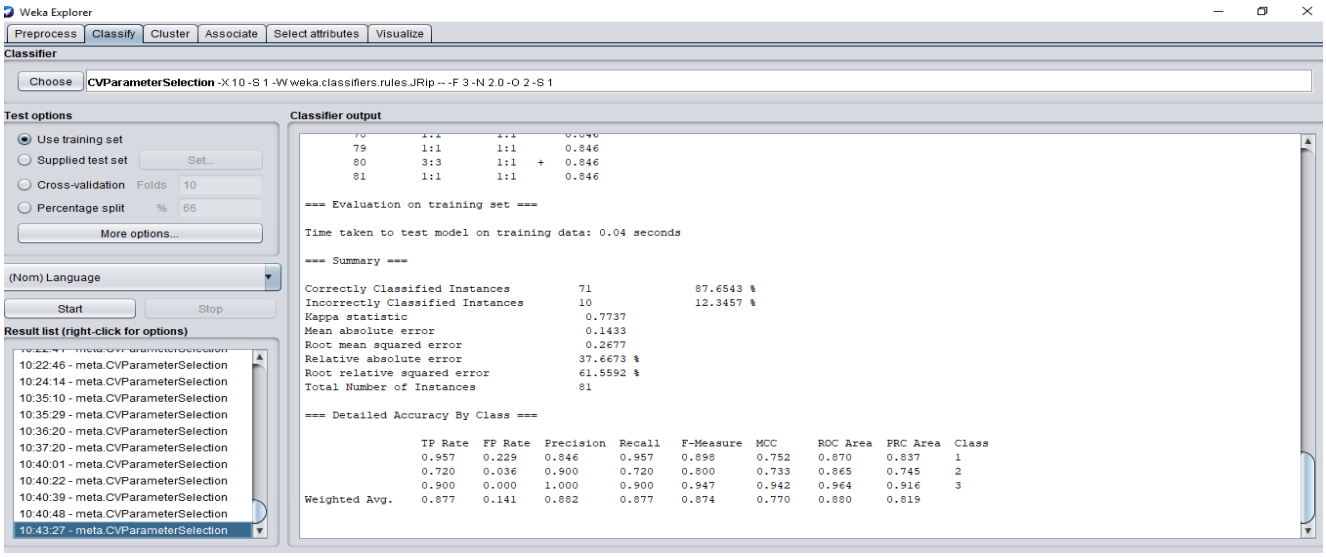

Fig. 1.Correctly and Incorrectly Classified Instances

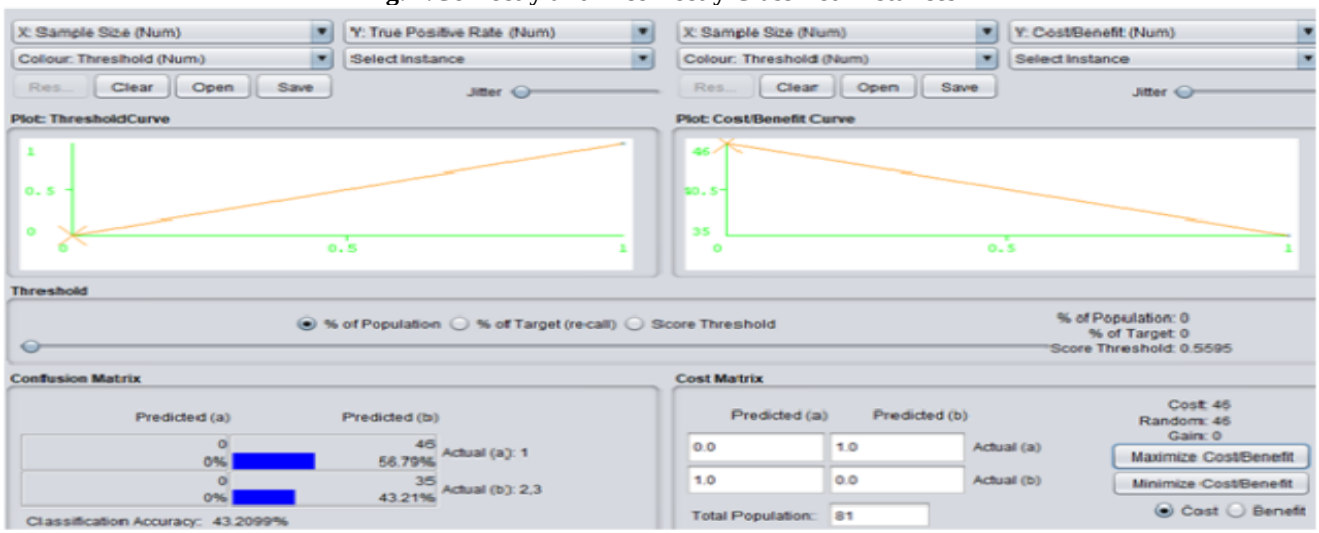

Fig. 2.Maximise cost

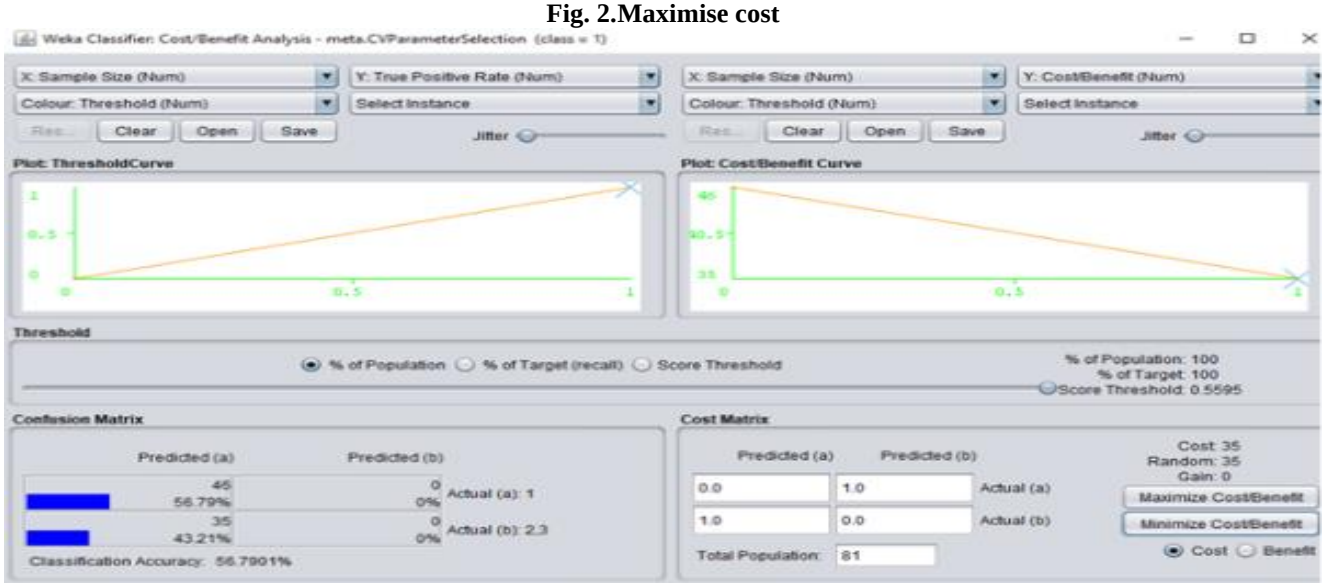

Fig. 3.Minimise cost

VI. CONCLUSION

The major activities in a software project are software effort estimation. It can seriously affect the progress of the project. In the past decade, there are a lot of estimation models described before, where COCOMO [2] is the most known and is commonly used model for software effort estimation [7]. The improvement in reducing the cost of the project is using the improved version of genetic algorithm by one of its properties like accuracy or speed.

This will make the software project's quality a little better than the existing ones.

Pragmatic experiments with weka tool endow with considerable amount of accuracy which we have already noted in the result part. The scope of the future work is to elaborate the accuracy in terms of time factor.[13]Genetic algorithm can provide some enhancement in accuracy and it can also act as an additional tool for the estimation..According to the findings of research, it can be stated as the cost is decreased to an extreme level.

REFERENCES

1. Ramin Saljoughinejad and Vahid Khatibi,28th October 2017,"A new hybrid optimized model based on COCOMO to increase the accuracy of software cost effort estimation"
2. Jovan Zivadinovic,Zorica Medic,Dragan Maksimovic,Aleksandar Damnjanovic and Slanana Vujcic,24-25 June 2011,"Methods of effort estimation in software engineering"
3. Lava Prasad Kafle,November 2014"An Empirical Study on Software Test Effort Estimation"
4. https://www.researchgate.net/publication/268165663_AN_EMPIRICAL_STUDY_ON_SOFTWARE_TEST_EFFORT_ESTIMATION
5. Manal El Bajta,Ali Idri,Jose Luis Fernandez-Aleman, Joaquin Nicolas Ros and Ambrosio Toval,2015,"Software cost estimation for development :A systematic map and review study" https://www.scitepress.org/papers/2015/53715/53715.pdf
6. Rshma Chawla,Deepak Ahlawat and Mukesh Kumar,2014,"Software Development Estimation Techniques : A Review" https://www.researchgate.net/publication/272073337_Software_Development_Effort_Estimation_Techniques_A_Review
7. Kamala Ramasubramani Jayakumar and Alain Abran,October 5th 2013,"A survey of test estimation techniques" https://pdfs.semanticscholar.org/f46b/958b897ff89f25d7f228fc051a89a0dcbc35.pdf
8. Vahid Khatibi Bardsiri and Mahboubeh Dorosti,February 11th 2016,"An improved COCOMO based model to estimate the effort of software projects" https://pdfs.semanticscholar.org/ac0b/89bc8807e99057f2123b70f40100c5ad25f5.pdf
9. Software Engineering COCOMO Model https://www.geeksforgeeks.org/software-engineering-cocomo-model/
10. Gajender pal, Manish Kumar and Kuldeep barala,April 2015,"A review paper on Cocomo model" https://www.google.com/search?q=cocomo+model+in+software+engineering+research+paper&rlz=1C1CHBD_enIN869IN869&oq=cocomo+model &aqs=chrome.1.69i57j69i59j35i39j69i59j0l4.3367j1j7&sourceid=chrome&ie=UTF-8
11. Magne Jorgensen and Martin Shepperd, "A Systematic Review of Software development cost effort estimation studies", Software Engineering, https://www.researchgate.net/publication/3189714_A_Systematic_Review_Of_Software_Development_Cost_Estimation_Studies
12. K K Aggarwal and Yogesh Singh, "Software Engineering", New Age International Publishers(Third Edition), 2010, ISBN (13):978 – 81 – 224 – 2360 – 0
13. Maram Alajlan and Nejmeddine Tagoug, March 2016,"Optimization of COCOMO II model for effort and development time estimation using genetic algorithms." https://www.researchgate.net/publication/301699633_Optimization_of_COCOMO-II_Model_for_Effort_and_Development_Time_Estimation_using_Genetic_Algorith
14. M. Soumya Krishnan, "RFP based requirement prioritization—A one-step solution", Mater. Today Proc., vol. 5, no. 1, pp. 642-649, 2018.

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