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AN IMPROVED FUZZY MODEL TO PREDICT SOFTWARE RELIABILITY

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Abstract

Software faults are one of major criteria to estimate the software quality or the software reliability. There are number of matrices defined that uses the software faults to estimate the software quality. But when we have a large software system with thousands of class modules, in such case it is not easy to apply the software matrices on each module of software system. The present work is the solution of the defined problem. In this work software quality is estimated by using the rejection method on software faults. The rejection method is applied on the basis on Fuzzy Logic in a software system. To perform the analysis in an effective way the weightage approach is used on the software faults. In this work we have assigned different weightage on software faults to categorize the faults respective to fault criticality and the frequency. Once the faults are categorized the next work is the implementation of proposed work software fault to represents the accepted and rejected modules from the software system. The obtained result shows the better visualization of software quality in case of software fault analysis.

Keywords: *Software Reliability, Prediction, Reliability Model, Model Selection.*

1. Introduction

Prediction, progress, and process improvement measurement permeates everyday life and is an essential part in every scientific and engineering discipline. Measurement allows the acquisition of information that can be used for developing theories and models, and devising, assessing, and using methods and techniques. Software measurement is a way to track the process. As Grady states, "*Without such measures for managing software, it is difficult for any organization to understand whether it is successful, and it is difficult to resist frequent changes of strategy"*. However, software engineering differs from other engineering disciplines in a number of aspects that have important consequences on software measurement. First, software engineering is a young discipline, so its theories, methods, models and techniques still need to be fully developed and assessed. However, the very nature of software engineering makes measurement a necessity, because more rigorous methods for production planning, monitoring, and control are needed, otherwise the amount of risk of software projects may become excessive, and software production may easily get out of industrial control. This would produce obvious damages to both software producers (e.g., higher costs, schedule slippage) and users (e.g., poor quality products, late product delivery, and high prices). To be effective and make good use of the resources devoted to it, software measurement should address important development issues, i.e., it should be carried out within a precise goal of industrial interest. In this context, software measurement may serve several purposes, depending on the level of knowledge about a process of product.

A. Software Reliability models

Prediction Models:-Prediction models use historical data. In the software development life

cycle it is mainly used prior to development or test phases or it can be used as early as concept phase. The prediction model predicts reliability at some future time.

For the prediction of software reliability we use Rayleigh Model. This model is most suitable for predicting software reliability of any product. This model predicts the expected value of defect density at different stages of life cycle of the project, once parameters like total number of defects or total cumulative defect rate and peak of the curve in terms of unit of time for the curve are decided.

The Probability distribution function of the curve can be given as:

$$F(t) = f(K, tm, t)$$

Where tm is the peak of the curve

t is actual time unit

K is cumulative defect density

Estimation Model: - The estimation model uses data from current from current software development effort. It is usually used later in life cycle that is after some data have been collected. It is not typically used in development phases.

B. Software Reliability Prediction

Some of the specific features of using fuzzy logic approaches in software reliability prediction are:

• It is easy to design and construct models for reliability growth of varying complexity at different points of time for a given data set.

• Fuzzy Logic based models are easily adaptable in complex operational phase for different failure datasets.

•Software reliability assessment has been a vital factor to characterize the quality of software product quantitatively during testing phase. Over the years many analytical model have been proposed for modeling software reliability growth trends with different predictive capabilities at different phases of testing. Yet we need to develop such single model that can be applied for accurate prediction in all circumstances. Here we explore the applicability of fuzzy logic models for better prediction of reliability in a realistic environment and present an assessment method of software reliability growth using connectionist model. we can select a particular model first by generalizing the applicability of application used and second by developing adaptive models.

C. Criteria for software reliability model selection

1. Life Cycle Phase:-Different software reliability models are used in different phases. So it is difficult to find which model should be used in which phase.

Example:-Input domain based model should be only used in the validation phase. We cannot use this model earlier.

2. Output desired by the user:-In this we select only that model which provides the output desired by the user.

Example:-If the mean time to failure required by the user we cannot use Goel Okumutu non homogenous model.

3. Input required by the model: If the input required the model is not available we cannot use that model.

Example:-Software reliability growth model require mean time to failure if this information is not available then we cannot use SRGM.

4. Trend exhibited by the data:-In the curve of collected failure data is matched with the curve of the then we use that model.

Example**:-**If there is increase and decrease in the curve then we use S-shaped model.

5. Validation of assumptions according to data:- In this the models with the high validation of assumption are selected.

Example: - In the exponential models there is an assumption that the testing effort is homogeneous during testing phase. If testing effort is non-homogeneous then exponential models do not give good results.

6. Nature of Project:-It includes that whether the application is terminating or non-terminating. It includes the size of the project.

2. Present Work

IEEE 982.1-1988 defines software reliability as "The ability of a system or component to perform its required functions under stated conditions for a specified period of time." The definition provided by IEEE is intentionally worded vaguely to allow organizations to define a level of reliability that is just right for each specific software project. In fact, the definition for software reliability is the same as the definition of hardware reliability so the reliability of a system can be determined from both

software and hardware components even though software and hardware failures generally occur for different reasons.

Ensuring the reliability of a software project is important to all parties involved including Managers, Marketing, Programmers, and Customers. Unreliable systems can impact software developers and consumers by simply being an annoyance, by costing time and money, or worst case scenario, by costing single or multiple lives. Everybody involved in the software process has reasons for desiring reliable software.

Some of the specific features of using fuzzy logic approaches in software reliability prediction are:

• It is easy to design and construct models for reliability growth of varying complexity at different points of time for a given data set.
• Fuzzy Logic based models are easily adaptable in complex operational phase for different failure datasets.
•Software reliability assessment has been a vital factor to characterize the quality of software product quantitatively during testing phase. Over the years many analytical model have been proposed for modelling software reliability growth trends with different predictive capabilities at different phases of testing. Yet we need to develop such single model that can be applied for accurate prediction in all circumstances. Here we explore the applicability of fuzzy logic models for better prediction of reliability in a realistic environment and present an assessment method of software reliability growth using connectionist model. we can select a particular model first by generalizing the applicability of application used and second by developing adaptive models.

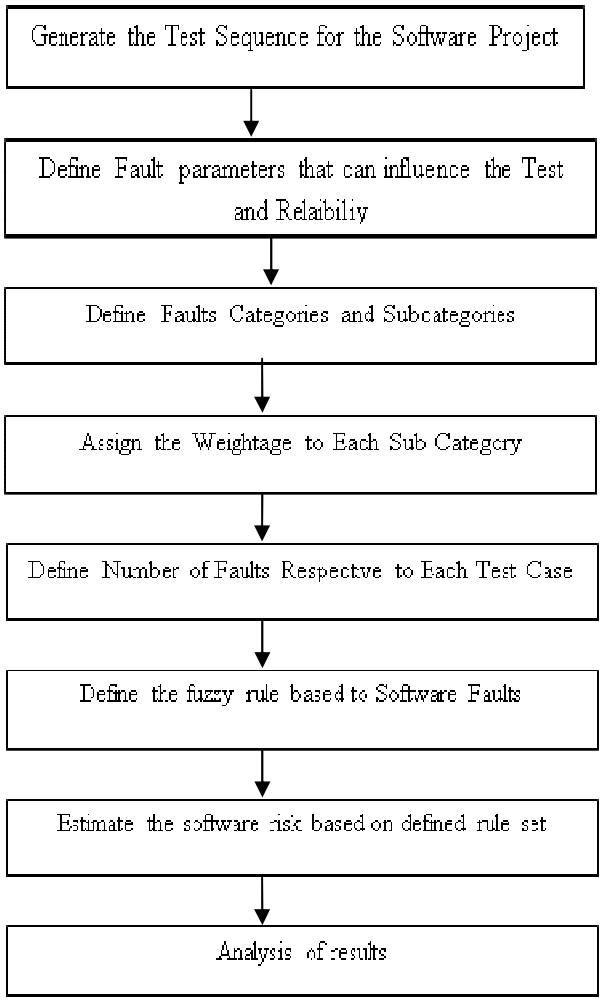
Fuzzy logic is a form of logic used in systems where variables can have degree of truthfulness or falsehood ness. With fuzzy logic, the outcome of an operation can be expressed imprecisely rather than as a certainly. A fuzzy model is a mapping between linguistic terms, attached to variables. Therefore the input to and output from a fuzzy model can be either numerical or linguistic.

3. Proposed Work

The proposed work is about to implement the fuzzy logic to analyse and predict the software reliability. In this work the software system reliability will be estimated based on the occurrence of software faults and the frequency of fault. The faults will be assigned by some weight to define the prioritization to the faults. The work is presented here presented using fuzzy based model.

We propose the use of fuzzy logic to predict software reliability. Software reliability assessment has been a vital factor to characterize the quality of any software product quantitatively during testing phase. The work is based on the software failures or the defects and on which the analytical decision will be drawn using fuzzy logic. It only takes failure history as input and Predicts future failures. The input to the proposed method is software execution time, whereas output of the system is predicted as number of failures. The failures or the errors will be defined with different weights. Therefore, here we explore the applicability of fuzzy logic for better prediction of reliability in a realistic environment and present an assessment method of software reliability growth using connectionist model.

4. Research Design

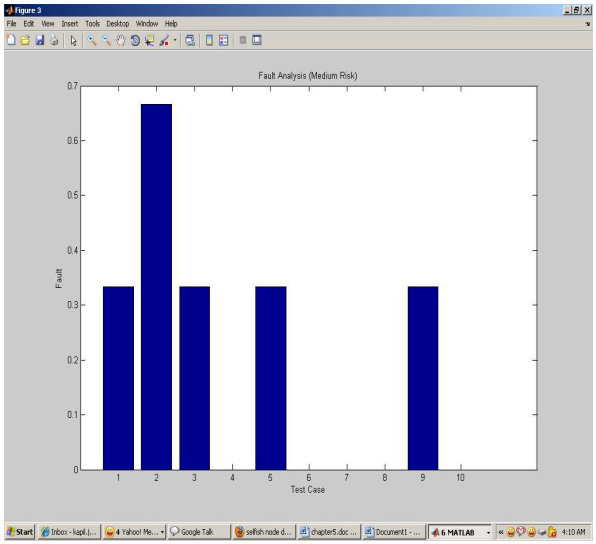


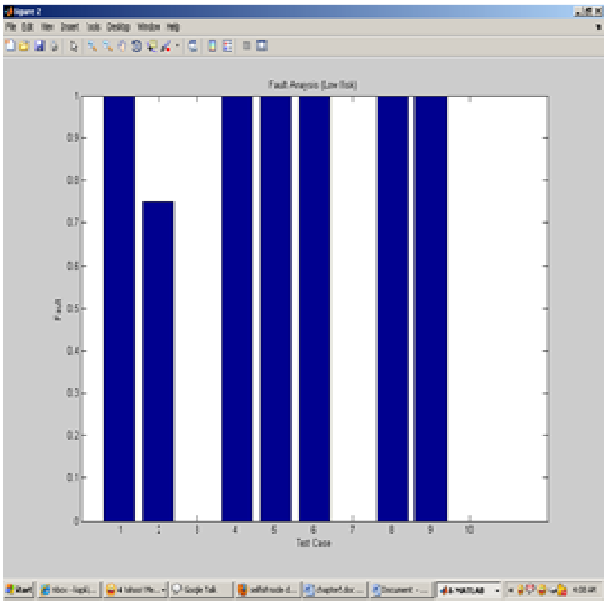
5. Conclusion and Future Scope

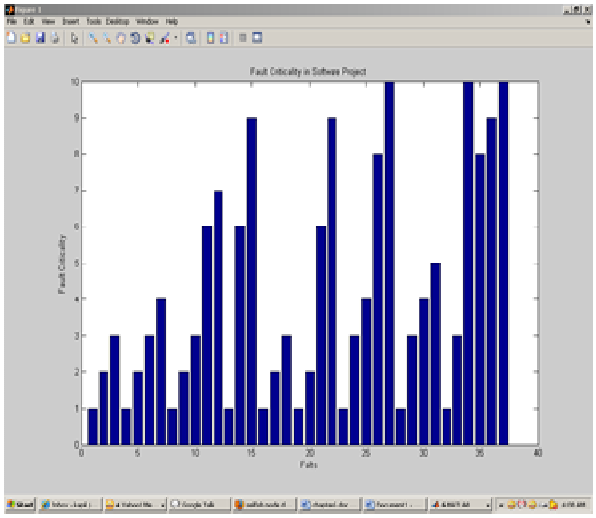
In the end I have reached to the conclusion that to find that which software reliability model should be used we can use software reliability selection algorithm. I have found that for measuring the software reliability there are many models. We cannot use all he models at same time. It means that like or the design phase we can use early prediction models or architecture based models. Now these models have a further sub model which is more than 20.We cannot we all these models for the prediction of software reliability.

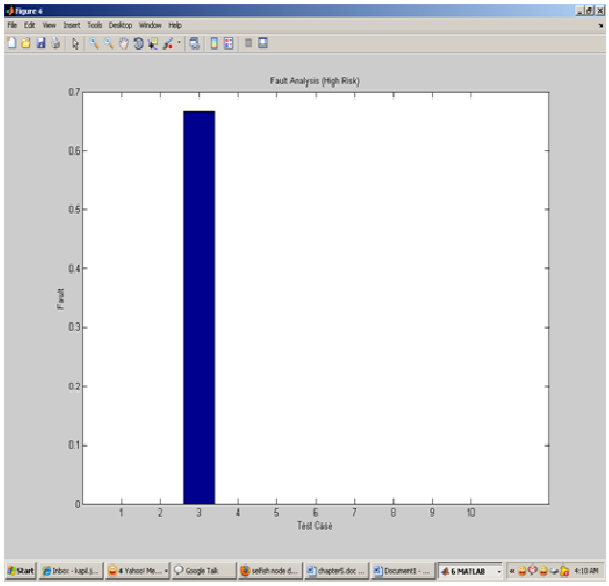
I have designed an algorithm to select the software reliability models. In this algorithm I have given standard weights and relevant weights. On the basis of weights the model which is having highest weight should be selected. At last the algorithm is validated by taking the example which shows that the model which is having highest weight is selected. At the last the algorithm is validated by using the example which shows that which model is best for use

On the basis of this algorithm a database should be developed which can store the information about their different models. In the database most commonly used models should be stored. If after applying the algorithm the results are already stored in the database then it is easy for the user to know that which model is best for use.









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