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Machine Learning Based Approach for Evaluating Agile Based Methods to Enhance Software Quality

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***Abstract:** Developing a quality software product is an essential need of the software industry. Software quality comprises of various factors. Therefore, it cannot be measured on the basis of a single variable. Several agile software development methods have evolved all around the world with the passage of time that contribute towards the development of new and improved software methods. The agile processes have started invading the software development industry to provide good quality software in minimal time. As the changes have occurred in the modern day evaluation metrics, the changes have been observed in the agile oriented quality evaluation methods as well. This paper presents a machine learning based approach for evaluating agile based methods for enhancing software quality. This advanced mechanism of processing the data attributes is inspired by SWARA and FDD. The validation and evaluation has been done using statistical and the quantitative parameters.*

***Keywords:** Feature Selection, Software Quality, Algorithm, Agile Methodologies, Software Development*

I. INTRODUCTION

Agile methods in software development have attracted significant attention, given the ever-changing business environment and cost and competitive pressures [9]. Agile software development processes help the developers to complete the project in a very short frame of time leading to their popularity. Agile methodologies have been one of the most significant models for the processing of software projects to be successful and unsuccessful based on the evaluated quality measures [2][3]. The modern-day quality cannot be measured using standard quality metrics that have been proposed earlier [4]. The paper presents an advanced mechanism of processing the data attributes that are inspired by SWARA and FDD. The evaluation of data factors has been done on the base of high-quality factor orientation using Cosine similarity, Jaccard Similarity, and Euclidean distance for the establishment of more co-related attributes for high precision on a quality measure [5][6]. The proposed work includes the application architecture of Grasshopper algorithm with modified group behaviour that is missing in any other compared state of art architecture.

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II. LITERATURE SURVEY

The study of the literature has been conducted to inter alia search for the key areas pertaining to various agile approaches, their inter-relationship, route for choosing the appropriate agile practices while developing the software, machine learning based approaches for evaluation of agile based methods, already existing selection paradigms, the loopholes in the existing methodologies and the existing solutions to overcome the flaws [10]. In 2008, Chow and Cao provided that a project's nature, the type of project, and its schedule are other important factors that have an impact on the success of agile methods [6]. In Weight based approach by Cropley in 2003 two aspects were considered when selecting a methodology viz; the phases in the methodology and the quality criteria. In this approach, each methodology candidate is given a score based on the importance of the phase, the quality criteria considered and the scope of the methodology. Based on the resulting score, the combination of methodologies is selected and not more than three are to be used [11]. In 2011, Mohd Yusof proposed CuQuP approach (C-complexity, U-uncertainty, Qu-quality, P-phase) in which a number of attributes are identified that influence system development complexity and uncertainty. This study introduces a hybrid approach to select a system development methodology [12]. M. A. Tas and S. Akcan, 2021 discussed that the issue of choosing a provider who meets the requirements of the markets and provide them the ability to become more competitive was considered a challenge to be solved. To tackle the issue of supplier selection, an integrated application of the fuzzy SWARA and fuzzy BMW methodologies was carried out [13]. The research paper by D. Stanujkic, et al.2015 A framework for selecting an appropriate packaging design that takes into account customer preferences and is based on the SWARA method has been proposed as a way to provide an effective method for selecting appropriate packaging [14].

III. FRAMEWORKS FOR AGILE METHODOLOGIES

A. SWARA

This methodology is based upon the weight generation mechanism. The implementation architecture of SWARA algorithm is divided into three steps [1]. The first step is to segment the data into three subsequent categories i.e. good quality, moderate quality and poor quality. The next steps are for the weight generation and propagation mechanism. MSE is used as the basic measure of evaluation in order to evaluate the similarity architecture.

The next step is to divide the entire data into three significant groups. The most significant algorithm for the separation is either considered with k-means or an iterative k-means. Post the application of k-means, the supplied set is divided into three categories. Figure 2 represents the result of k-means for the Promise data.

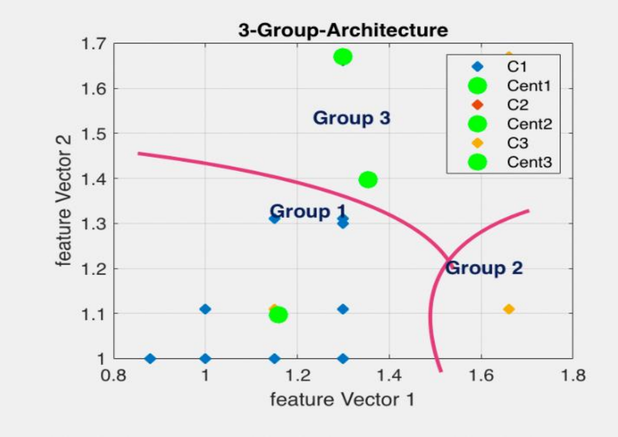

Fig 1. Result for the application of k-means

To generate the weights of the data elements, the simulation has utilized cosine similarity.

B. FCRI

The first step is common for all the processing algorithms as the implementation steps till now are same for every analysed algorithm architecture. FCRI puts the SWARA architecture into implementation loop that exhibits the propagation of the weights in multiple aspects and manner. The FCRI architecture involves multiple propagation values after group formation [8]. The MSE is only propagated for couple of time and that too on a random selected feature value. FCRI improves the propagation architecture by taking the random sample. The propagation of the weight is supported by the validation through statistical parameters.

C. DDA

The DDA (Data Driven Architecture) is oriented towards the random Levy feature or attribute selection that is oriented in terms of data. DDA is all about selecting the best possible elements that represents the best of its originated class to maintain high quality in the end. DDA also supports the separation mechanism among the classes [10][11]. It enhances the FCRI architecture by introducing multiple data selection behavior for multiple numbers of times.

IV. PROPOSED FEATURE SELECTION APPROACH

The proposed algorithm for the attribute selection method is inspired by the architecture of SWARA and DDA methods. In case of SWARA, it updates its weights and uses a similarity index for weight generation, whereas in case of DDA random features are selected out of the given features and then using cosine similarity, the weights are generated. The proposed feature selection approach invades in between and modifies the feature selection approach presented in DDA. The overall work diagram is as follows.

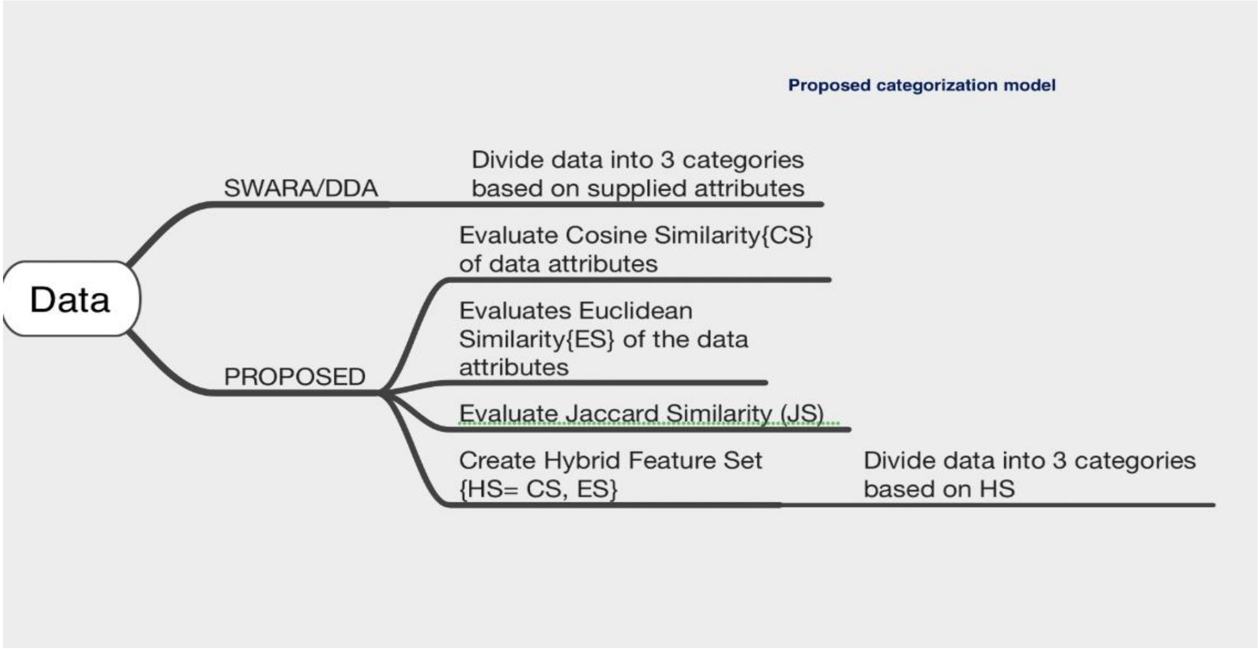

Fig 2. Proposed categorization model

The proposed model categorizes the data on the basis of similarity values to be more precise on the separation of the class values. Cosine similarity, Euclidean Distance and Jaccard Similarity have been used as similarity evaluation of the data [7].

The evaluated similarity indexes have been passed to k-means with 't' number of iterations. The similarity values have been calculated for both the datasets. The k-means is also applied to two-set and then three-set feature to check the robustness of the proposed architecture. To demonstrate, k-means has created three centroids containing two parameters at one time as shown in figure below. The statistical approach evaluates Mean Squared Error (MSE) and Standard Error (SE) of each group and applied if-then rule architecture to validate the group.

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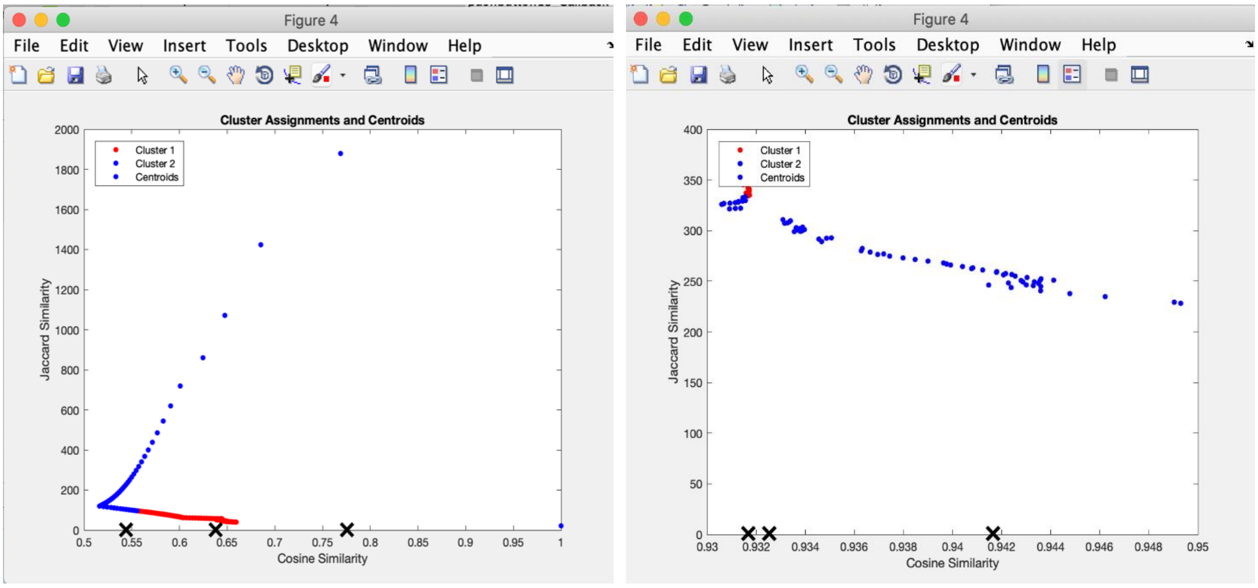

Fig 3: k-means based on cosine similarity and jaccard similarity

V. VALIDATION PARAMETERS

The following statistical parameters have been used for validation of the proposed model.

A. Root Mean Square Error (RMSE)

It is the standard deviation of the predicted errors observed during effort estimation. It computes the distribution distance with respect to the regression line.

$$RMSE = \sqrt{(E_{predicted} - E_{known})^2} \quad (1)$$

B. Standard Error (SE)

It is a statistical term that is used to measure accuracy with the help of sample distribution for representing a population by using standard deviation.

$$SE = \frac{\sigma}{\sqrt{n}} \quad (2)$$

Where SE is standard error, n is number of samples and σ is standard deviation.

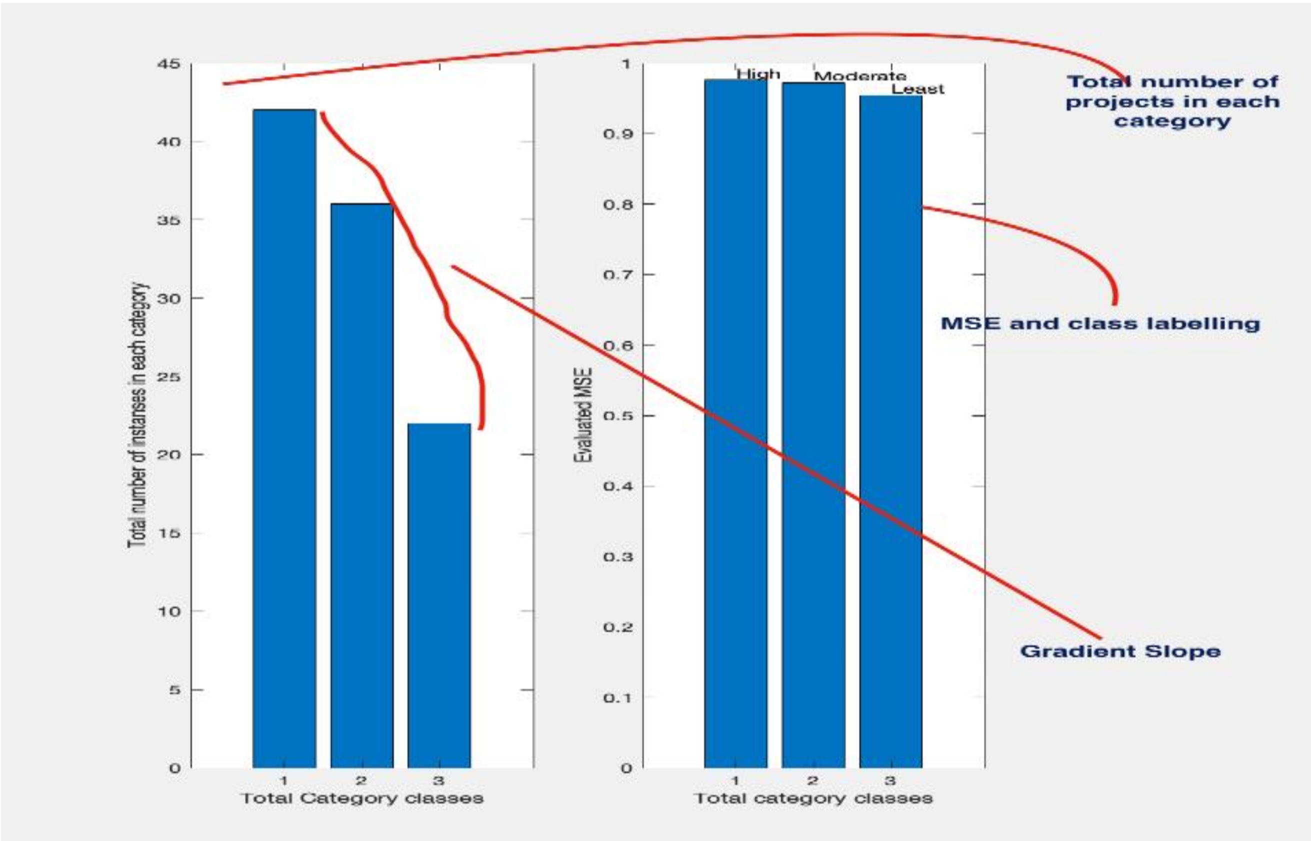

Fig 4: Evaluation and validation

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After validation, it is a challenge to select the best suitable data records for the precise class value. The aim is to enhance the quality of the system. In order to do so, the proposed algorithm architecture uses Grasshopper algorithm for the selection of most suitable records in the list. As it works on similarity measures and aims to enhance the co-relation between the data elements, hence the proposed algorithm is named as cr-GHOA (Co-relation based Grasshopper Optimization Algorithm). The selected data is further passed to Neural Network that is conjugate based and is same for all classification architecture.

VI. RESULTS AND DISCUSSION

The evaluation is conducted on the basis of various quantitative parameters namely precision, recall, f-measure and accuracy. The observed performance parameters using proposed work using different dataset distributions i.e. 70:30, 80:20 and 90:10. The graph below shows that the performance parameters obtained using 90:10 dataset distribution gives better results as more data is available for the training of the system.

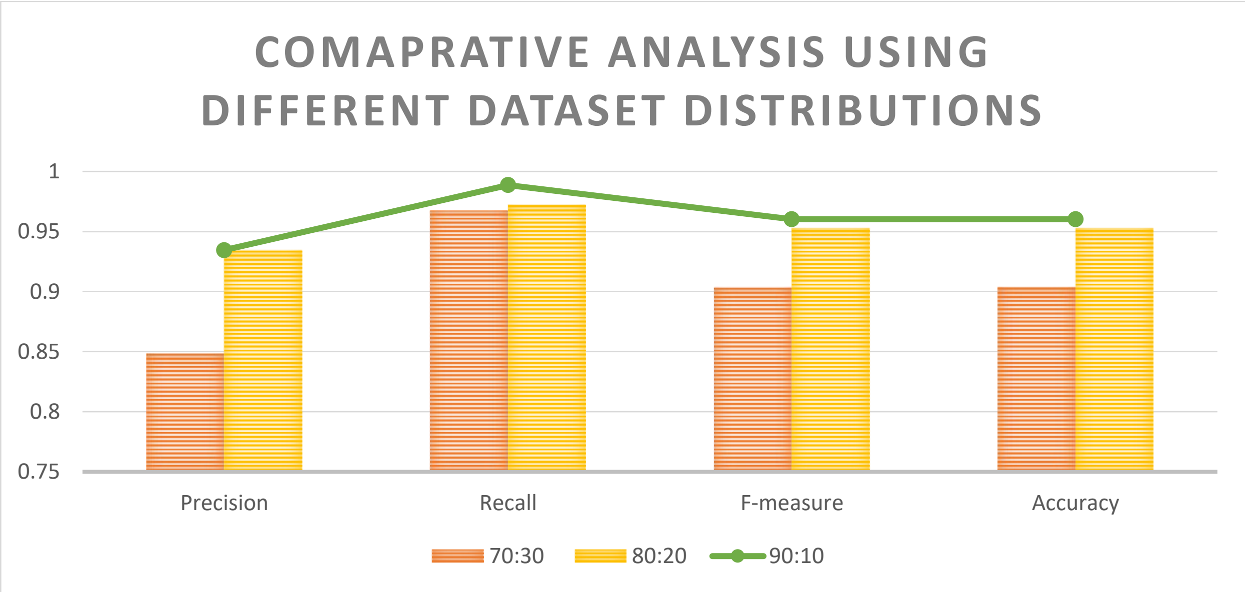

Fig 5. Performance Analysis based on Dataset Distribution

The proposed work outperformed the other agile based technologies even when 70% of the data is used for the training of the system.

VII. CONCLUSION

The proposed algorithm creates the rule architecture utilizing the standard propagation architecture of Levenberg based Neural Network. The training architecture categorise the data into three sub-divisions namely the training data, the validation data and the test data itself. The neural architecture propagates back once the validation is attained. The co-relation establishment has already been taken care of by proposed Grass Hopper Algorithm and thus the true identification of the ground truth leads to prevention in the quality. The propagation weight is updated by Levenberg architecture. This not only saves the architecture from future failures but also prevents the system from producing un-necessary latency in the system.

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