An Intelligent Prototype for Requirements Validation Process Using Machine Learning Algorithms

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Abstract— with the advancement of technology, the world is growing and developing rapidly, and the demand for software has become greater and more, and one of the most important steps in building any program is the requirements of the programs, and checking the requirements when applying them manually, requires great effort, time, cost and accuracy. Automated requirements were not sufficient. In this study, we will propose a technique for automatically checking software requirements by using machine learning to represent textual data from software requirements specifications, an overview of prototyping-based models in machine learning is presented in this paper. The framework, notes, i.e. data, are stored in terms of typical reps. the system can be used in conjunction with an appropriate similarity scale in the context of the unsupervised analysis of high-dimensional complex datasets. Supervised learning is represented in prototyping systems in terms of vector quantization learning. In most cases, The familiar Euclidean distance serves as a measure of difference. We present framework extensions to non-standard measures give an introduction to use adaptive distances in related learning, Briefly, the prototype is less costly from any other technical for validating the requirement because it make in the first and the prototype too can reuse and customer involvement

Keyword: AI in software engineering, smart requirement engineering, Requirements validation, validation techniques, machine learning in requirements engineering

I. INTRODUCTION

The different process of activities is executed in a structured method to elicit, validate, and maintain user called software engineering, to build any software you must in some of steps the first of these steps is software requirement. The goal of requirements engineering is to develop and maintain a software in organization way right with high efficacy. The process of gathering, analyzing, and documenting software requirements from the customer is known as requirement engineering [1].

The process of gathering, analyzing, and documenting software requirements from the customer is known as requirement engineering. The goal of requirements engineering is to develop and maintain a System Requirements Specification document. Program requirements are defined as a description of the features and functions of the target system. So that it conveys the expectations of the users of the program so that these expectations from the customer's point of view can be clear or hidden, known or unknown, expected or unexpected.

When they collected the requirement for any system from the stakeholder's, it's taken some analysis, cleaned and discuss between developer and stakeholder's, the output of this process for all accepted by developers and clients (stakeholder's) called requirement specifications. The requirement specifications can origination into two categories: (functional requirement (FR) and non-functional requirements NFR. The requirement specifications are written then it named documentation for system, this documentation must be correct, unambiguous, comprehensive and complete. If it not corrects or not complete this leads to a loss of time and effort and an increase in the financial cost to the stakeholders [2].

The requirement specifications different because various stakeholders from changed sections with different educational backgrounds are involved in the requirements engineering (RE) and the more development procedure [3,17].

Requirements Validation smooths in resolving the conflicts between different users (stakeholders) of the system due to incompleteness or any unsuitability of requirements within the available constraints [1], The requirement specifications documentation is written in natural language, this process leads to problem of unlimited natural language lies in its standard character and vagueness. Accordingly, requirements formulated in this method cannot be mechanically processed without resolution the vagueness by hand. Thus, all further tasks like the validation of the requirements and the transition to the model-based design have to be done manually, and checking the requirements when applying them manually, requires great effort, time, cost and accuracy. Automated requirements were not sufficient. In this study, we will propose a technique for automatically checking software requirements by using machine learning to represent textual data from software requirements specifications. [3,17, 21, 22]

Wrong requirements, if not caught early, may lead to

serious problems, such as high costs, long lead times, delays in delivery, failure to achieve the goals expected by the customer, and human error is possible, and there is no reason to believe that it does not happen during the development of the system. Problems can arise from a misunderstanding between analyst and client, ambiguity in documentation, etc. Mistakes that occur at this stage and are not corrected are often the most persistent, costly, and time-consuming to address. Therefore, it is important to start with moving steps that will reduce, detect, and correct errors as quickly as possible. Preventing errors is a matter of good software engineering practice. In the requirements validation process, the requirement Engineer run a different type of test to verify the requirements. And to check these items: Completeness checks, Consistency checks, Validity checks, Realism checks, Ambiguity checks and Verifiability, The validation process was manual it took a lot of time and effort, and there was a need to make the validation process automatic.

Automating requirement go to approaches would needs the formalization of user who will work the system whereas current methods handle requirements that are mainly stated in languages (such as natural language) which lack the required degree of validation.

The above researches show that compare between two Techniques (Prototyping and Animation) to Validation requirements using machine learning and answer of question which effect ML Algorithm provides the better performance for the requirements Validation with using Prototyping task?

The rest of this paper is structured as follow: section II introduces a literature review of related work, Section III describes Smart solutions for Validation requirements; The Result and Discussion are showed in section IV; Finally, Section V presents our conclusions and future works.

II. RELATED LITERATURE

This section summarizes the previous research on requirement analysis, requirements identification, requirement specification, software quality, validation, software quality requirement and A Natural Language Software Requirements Specification.

A. REQUIREMENT ANALYSIS

Demirel et al showed in [6] that Requirement analysis is one of the main contests in software growth system. Client requirement description and organization needs various effects to software system and still is an upgrading zone on both theoretical and manufacturing fields. Models like CMMI also discovers requirement development and organization and specifies the specific objectives and practices for them. Herein paper, main challenges and subjects of requirement organization are recorded with respect to a standardization action, namely CMMI.

Ali et al provided in [7,12] The defeat and success of any software mainly depends on a technical document called as Software Requirement Specification (SRS) document, as it include all supplies and structures of the system. In the previous, many programmers had been done to advance the quality of the SRS, with respect to varied property of the software, but the software success rate is not acceptable and the room for improvement is still there. We have updated a varied approach to resolution those issues. Our methodology contains of four processes. Result of the past processes will be added to IEEE standard format. A 3rd party inspection will be showed to check the requirements of the user and SRS. After reviewing SRS using inspection models and transmission Total Quality Score (TQS) third party will submit a complete report to club of Requirement Engineers (RE). This repetition will not only find the problem but will answer the issue on its way.

B. REQUIREMENTS IDENTIFICATION

Pandey et al provided in [5,13, 23] Requirement's identification practices specialize in the assignment of a singular symbol for every demand . These distinctive identifiers are wont to refer needs throughout development and management. needs identification method consists of 3 sub activities. the essential list activity includes vital list and non-vital list whereas identification activity includes labelling, structure primarily based identification and symbolic identification. The last technique is to support and automate the organization of things, which incorporates dynamic renumbering, information record identification and base lining wants.

C. REQUIREMENT SPECIFICATION

Requirements specification document performances as a foundation for the complete code development procedure. The suggestions of Associate in Nursing Inadequate Specification are these days recognized and exploit a lot of concern within the code trade. it's been claimed that "the prosperous style of Associate in Nursing data system depends on the accuracy of its necessities specification" which the poor specification of necessities may be a major reason of system failure. Checking info for its perceived Correctness and completeness is so a vital mechanism within the construction of adequate necessities method is thought as validation. Validation ensures the accuracy of the findings of the necessities Analysis and thus confidence within the specification Validation conjointly facilitates the flow of data between the stakeholders and therefore the system analyst. Fickas states the assembly of the Specification is not most a translation method as Associate in Nursing interactive drawback finding process". The validation procedure varies in larid of the illustration format adopted to gift the necessities to the users.

D. SOFTWARE QUALITY

Kiran et al. in [9,14] proposed a framework to define one of a kind requirement validation strategies for requirement validation primarily based totally on the character of system. The proposed framework is beneficial for system managers as it facilitates them in choosing the requirement validation equipment or strategies for one of a kind tasks that subsequently reduces the time and value of the undertaking. The strategies taken into consideration through the authors consist of prototyping, inspection, testing, viewpoint, model-primarily based totally, and simulation. The approach especially specializes in facilitating requirement engineers for the choice of suitable requirement validation strategies.

The proposed approach was implemented to an undertaking wherein designing is a key problem of the client. Therefore, primarily based totally at the proposed framework's suggestions, the unique requirement validation approach is selected, and a prototype is generated. Prototyping, in this case, indicates the layout homes and capability of the gadget however does now no longer embody the correctness of the gadget capability. Through this framework, the high-satisfactory of the undertaking has improved; duet choosing the proper requirement validation strategies. The proposed framework suggestions are restrained to specific tasks and strategies.

E. Validation

Raja et al showed in [11,15] requirements validation guarantees that the software program requirements specification incorporates entire and consistent set of necessities which can be in line with the consumer needs. This paper affords evaluate of requirements validation techniques like requirements inspections, necessities prototyping, necessities checking out and viewpoint-orientated necessities validation. This paper highlights professionals and cons of those requirements validation strategies. In necessities checking out special interest is given to TCD inspections, powerful requirement elicitation is a maximum vital workout to fulfil the requirements for a specific system. Its intention to gather properly requirements from stakeholder with inside the proper way. It is vital for each organization to expand first-rate software program product that can fulfill user's need. Checking facts for its perceived correctness and completeness is a prime a part of the specification improvement technique and is referred to as Validation Requirement specification documents.

The successful implementation of the proposed requirement technique may have an excellent effect on the manufacturing of first-rate software program product. In this paper, we've got defined the significance of requirement validation over the requirement elicitation. Also, we have mentioned approximately the requirement validation and its scope in requirement improvement

Kim et validated al in [10,16] the requirement via a proper technique for the European railway system. The authors formalized a hard and fast of ninety requirements and subdivided the requirements into one of a kind instructions and sub sequent transformed the requirements from informal to formal manner with person be given ascend scalability. Although the authors solve the specific problem, the method does now no longer have applicability for all embedded systems as it calls for information to use formal techniques and is, therefore, taken into consideration as expensive.

F. SOFTWARE QUALITY REQUIREMENTS

Dollmann et al supplied in (2016) they paintings is indeed associated with the quality of software, however now no longer of textual requirements. Less related to quality, however nevertheless the usage of machine learning, is a studies aimed toward the identity and annotation of requirements in consumer generated content

G. Natural Language Software Requirements Specification

Fabbrini et al presented in [18] a tool known Quality Analyzer of Requirements Specification for the study of natural language requirements. The meaning of Quality Analyzer of Requirements Specification has been grounded on a special Quality Model for requirements. The Quality Model goals at provided that a quantitative, corrective and repeatable assessment of requirement documents. To validate the Quality Model several real requirements documents have been analyzed by our tool showing stimulating outputs

H. Semi-Supervised learning:

Semi-supervised learning is a learning model concerned with the education of how machine and Natural systems such as persons study in the presence of both branded (labeled) and unbranded (unlabeled) records. In the past, learning has been studied either in the unsupervised model as clustering and outlier detection. Anywhere all the records is unbranded (unlabeled), or in the supervised model as classification and regression) anywhere all the records is branded (labeled). The aim of semi-supervised learning is to know how joining branded (labeled) and unbranded (unlabeled) records could change the learning performance, and proposal algorithms that take advantage of such a combination.[19,20]

III. SMART SOLUTIONS FOR CLASSIFYING REQUIREMENTS

To check requirements is true (validation), many requirements validation techniques i.e. Prototyping

Animation, Reviews and etc. are used in co-located software development, in this study we answer the question that what effect ML Algorithm provides the better performance for the requirements Validation (Prototyping) task?

A. SOFTWARE QUALITY MEASUREMENT MODEL

A description approximately the high-satisfactory of a software program system or product is a displaying approximately the capability of the software program to execute and keep a decide stage of service. Software high-satisfactory can so be formulated because the grade to which the system is capability to execute and carry out and update (maintain) a unique stage of service.

The technique to software program high-satisfactory tracks a dimension technique, attributes its miles primarily based totally on measuring the grade to which software program residences installed unique requirements. Copy Characteristic software program residences from other, which may be prominent quantitatively or qualitatively.

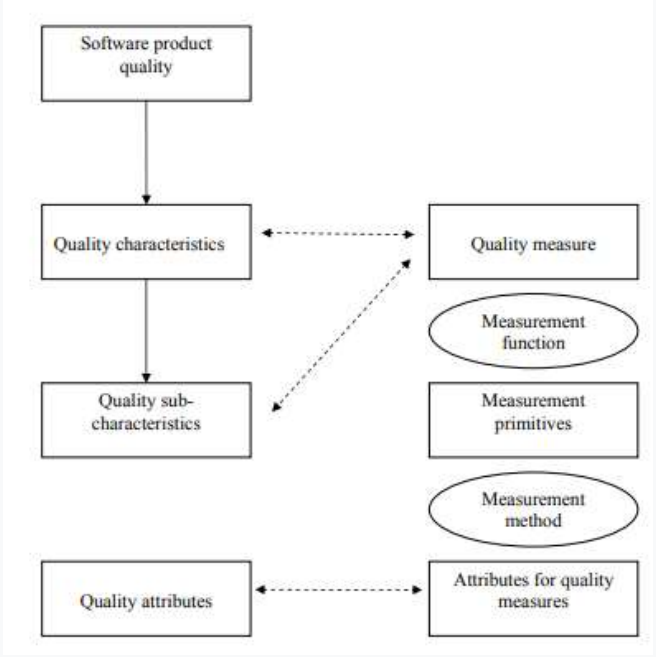

Figure 1 shows the relations between Quality measure (QC and SQC).

Quality attributes (QA) or residences are calculated, as the extent to which the software program product is may be able to presenting and updating (maintaining) it is unique stage of what the stakeholder they wanted. QA belong to at least one or many sub-characteristics. QA can be measured via way of means of executing and making use of a dimension technique. A dimension technique is a logical order of operations used to QA with recognize to a unique scale. The outputs of executing and making use of dimension technique is known as a base degree. A dimension characteristic is a set of rules used to sign up for the bottom measures. The outputs of making use of a dimension characteristic is known as a high-satisfactory measures. In this technique, high-satisfactory measures turn out to be quantifications of the high-satisfactory characteristics (QC) and sub-characteristics (SQC). Many of high-satisfactory degree can be used to label a QC or SQC. Not all software program residences are measurable. This is particularly the case for useful requirement residences. Figure 1 indicates the family members among Quality degree (QC and SQC).

B. Prototyping:

A epitome could be a functioning model of the system. It aids in discussing a selected drawback, justify a selected question, or creating a selected call, and thus, adscititious with written code specification.

Requirement's prototyping is also a necessary technique for validatory users' requirements as a result of it showed the shell of degree actual system to be designed. Prototypes facilitate in validatory requirements by providing a valuable insight into the system. Prototype's unit associate degree honest tool for validatory requirements notably once you are not pretty assured that you {simply that you just} simply have associate degree honest set of requirements. A pair of forms of prototypes area unit mentioned inside the literature, i.e. throw-away prototypes, and biological process prototypes. "Throwaway prototypes" aids in characteristic the requirements that weren't properly understood. Throwaway models unit discarded or thrown away once the user feedback once the initial set requirements unit in-built the epitome. It helps in breakdown requirements conflicts between the event team and conjointly the shoppers by taking feedback on the model.

If every unit given a defined set of requirements, then the model is discarded and conjointly the requirements unit assimilated in SRS "Evolutionary prototyping" on the other hand, is performed on a set of settled requirements and is subject to quality constraints as obligatory inside the package development. biological process prototypes unit designed from initial requirements and bit by bit refinement is made with relying upon feedback from the user.

The competencies of a system are decided via way of means of its attributes. Some software attributes are inherent to the system; a few are given to the system. "Inherent", as contrary to assigned, method modern in somewhat, in particular as a everlasting feature or feature.

Stakeholder software package quality necessities shall be prioritized. the standard model may be used as a listing to make sure the coverage of all quality aspects. Incomplete, ambiguous, and subjective stake holder software package quality necessities shall be known.

The known issues shall be documented. Conflicts, inconsistencies, and incongruence between the neutral software package quality necessities shall be known. The known problems shall be documented. further neutral necessities finding the known issues with neutral software package quality necessities shall be documented in keeping with necessities for neutral software package quality necessities. further neutral necessities shall be traceable to original neutral software package quality necessities. neutral necessities that are replaced shall be marked in and of itself. neutral software package quality necessities ought to be valid. If the validation method identifies new neutral necessities or modifies the present necessities, this shall be explicit and therefore the reason shall be documented Figure 3 shows the relation between stakeholder's and Software system quality

Figure 2 shows the Software system quality

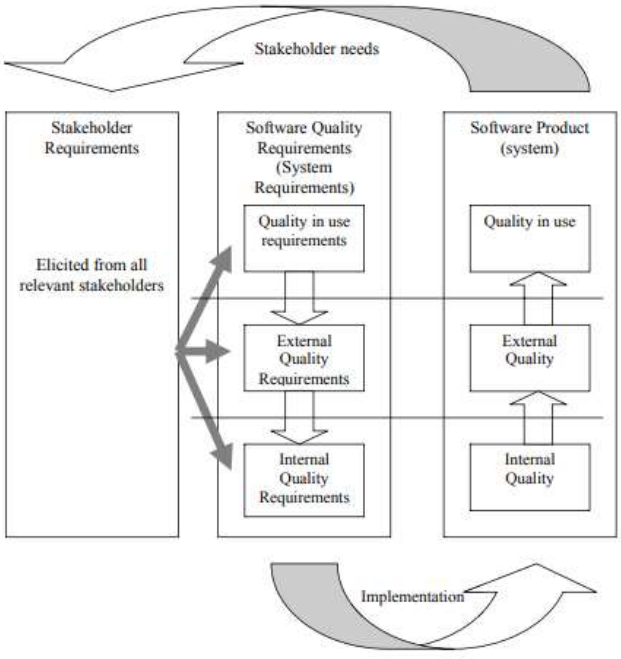

Figure 3 shows the relation between stakeholder's and Software system quality

C. PROTOTYPES IN UNSUPERVISED LEARNING

One thinkable goal of unsupervised learning is the description and shown of vectorial information by labeled it. The aim could be to decrease storage wants, to reveal buildings such as collections in the data, or to pre-process big datasets for additional analysis. Unsupervised analysis can make available valuable insights into the landscape of the dataset at hand, and it plays an significant role in the context of visualization..

IV. THE RESULT AND DISCUSSION

The prototype is less costly from any other technical for validation the requirement because it make in the first and the prototype too can reuse and customer involvement.

The organization size of prototype is small or large that determine by the volume of requirement in the software. We show the output of the studying and talk over its effect. Effective ML Algorithm provides the better performance for the requirements Validation with using Prototyping with comparing between it and anther called inspection its take from previous study. We show the output of the studying and talk over its effect. effect ML Algorithm provides the better performance for the requirements Validation with using Prototyping with comparing between it and anther called inspection its take from previous study.

	Requirements Inspection	Requirements Prototyping
Team Size	Large	Small
Cost	More Costly	Less Costly
Organization Size	Large	Small & Large
Reuse	N/A	Yes
Customer Involvement	No	Yes

V. CONCLUSION AND FUTURE WORK

The study, we proposed the prototype vector gadget to percentage the graph-primarily based totally semi-supervised learning. By the usage of the prototype vectors to approximate the graph-primarily based totally regularize additionally due to the fact the whole prediction model, we are able to significantly lessen the hassle length and observe our set of rules to large-scale real-global problems. in the future, nicely explore one-of-a-kind approaches to boom it. for instance, nicely recollect one-of-a-kind label reconstruction schemes

supported neighborhood facts geometry. we are able to additionally derive the prototype model for the Laplacian-regularized algorithms. Finally, our cutting-edge prototype choice treats the classified and unlabeled facts as similarly important. this could be prolonged to a weighted model that assigns importance-primarily based totally weighting primarily based totally on a few earlier knowledge, In realizing this aim we have established a three level procedure that enables non-technical stakeholders to generate a fundamental prototype of the requirements, make corrections to that prototype, and evaluate the prototype via stakeholder interaction

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