
An Automated Approach to Requirement Elicitation Using Stakeholder Recommendation and Prediction Analysis

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ABSTRACT

In the field of software engineering, requirements elicitation is the activity in which stakeholder needs are understood. A close interaction between stakeholders of the system is needed for requirement's gathering. Existing methods to identify and prioritize requirements do not scale well to large projects. Requirements prioritization methods require substantial efforts from the requirements engineers when there are many requirements. In large-scale software projects, requirements elicitation tends to be beset by three problems: information overload, inadequate stakeholder input, and biased prioritization of requirements. The model addresses the problems using the following steps - Identify the large project, Analyze the requirements, Identify and prioritize stakeholders, Collect profiles, Predict requirements and Prioritize requirements. It's a novel method that uses social networks and collaborative filtering to identify and prioritize requirements. Malicious stakeholders with false recommendations or ratings are considered. For making predictions, our approach will use one of the most well-known algorithm called k-Means clustering algorithm. Finally, the manual process of stakeholder recommendation is automated. The stakeholders recommend other stakeholders, build the social network, and prioritize the requirements. The method identifies and prioritizes a complete set of stakeholders and their requirements automatically and accurately. These methods outperform the existing methods used in the projects, and require significantly less time from the stakeholders and requirements engineers.

General Terms: Social network, Requirement elicitation, Stakeholders, recommendation.

Keywords: K- means clustering algorithm, Collaborative filtering.

INRODUCTION

The most important activity in software project development is the requirements engineering. For a computer based system, activities involved in discovering, documenting, and maintaining a set of requirements are covered by requirements engineering. Due to wrong requirements, numbers of consequences may arise like the system may be delivered late, system may be more costly than the original estimation, end-user and, customer will not be satisfied, system may be unreliable and there may be regular system defects. According to the survey conducted by ESPI in 1995 that about 40-60% of all defects found in a software project can be traced back to errors made during the requirements stage. There is a need to follow the best practices, tools, technologies, processes and methodologies for requirements engineering. Here we present these concepts to improve the requirements engineering phase.

RE is the process of discovering and managing the purpose of the system for which it was projected. Poor user requirements increase risk of missing opportunity of meeting user's

goals. The first step in the RE process is the elicitation of requirements. The important goals of requirements elicitation is to find out what problems need to be solved. It is defined as "the process of identifying needs and bridging the disparities among the involved communities for the purpose of defining and distilling requirements to meet the constraints of these communities". It is served as a front end to systems development. Requirements elicitation involves social, communicative issues as well as technical issues. With requirements elicitation, requirements analysts, developers, sponsors, funders, and end users are involved.

Existing requirements elicitation approaches have proven insufficient to record complete, consistent, and correct requirements. Studies conducted have shown that 40% of defects in software projects are due to incorrect recorded requirements. Eliciting clear, complete, and correct requirements is still a challenge and a difficult undertaking in requirements engineering. Crucial information related to the requirements is often ignored, and partially or not recorded at all during requirements elicitation. Engineers documenting the requirements may misinterpret, partially document, or omit important statements. Most of the existing requirements elicitation approaches are clearly lacking capabilities to support gathering complete and detailed requirements in a natural flow.

Our project proposes an open and inclusive method for requirements elicitation using social networks and collaborative filtering. An inherent feature in existing requirements elicitation methods is that they depend on a small number of experts such as the requirements engineers or the project team. These experts become a bottleneck in large-scale software projects where they have to process many requirements from many stakeholders. To remove the bottleneck, this work will shift the emphasis from requirements elicitation involving only the experts to a collaborative approach in which all stakeholders have a say.

RESEARCH METHODOLOGY

The study in the previous chapter highlighted the need for methods to identify and prioritise stakeholders and their requirements in large-scale software projects. It is necessary to show that a method that uses social networks and collaborative filtering can be used to elicit requirements in large-scale software projects.

The methodology in this work is divided into four parts:

- Select a software project and study the project to identify lists of stakeholders and requirements.
- Build social network which will help to identify and prioritize stakeholders.
- Develop a method that uses collaborative filtering to identify and prioritize requirements.
- Develop a software tool that supports the above method; apply it to real projects by having practitioners use it in their projects.

Stakeholders are asked to recommend other stakeholders. A social network is built with stakeholders as nodes and their recommendations as links. Various social network measures are applied to prioritize stakeholders. Social network analysis is the application of methods to understand the relationships among actors, and on the patterns and implications of the relationships. Each of these stakeholders is asked to recommend others. Then, new stakeholders who are not part of the original list are similarly asked to recommend others. As the process continues, the group of stakeholders builds up like a snowball rolled down a hill,

which results in a well-connected network.

STAKEHOLDER ANALYSIS

Requirements elicitation involves a wide range of people. These people include customers or clients who pay for the system, users who interact with the system to get their work done, developers who design, construct, and maintain the system, and policy makers who impose rules on the development and operation of the software system. They have diverse backgrounds, expertise, interests, and personal goals. Stakeholder analysis means identification and prioritization of the individuals and groups that can influence or be influenced by the software project. These stakeholders are the source of requirements during requirements elicitation. The task of identifying stakeholders is far from straightforward.

Information about stakeholders is not readily available and it is difficult to arrive at a complete list of stakeholders. Omitting stakeholders is reported as the most common mistake in development efforts. The majority of developers face problems finding the right stakeholders with adequate time, interest, and knowledge for the project. All too often developers omit stakeholders and the omission significantly impacts project success. Our project is going to identify and prioritize stakeholders using the following steps (Figure 1).



Figure 1: Social networking steps

COLLABORATIVE FILTERING

With the Internet, the opinions of thousands can now be considered. Opinions from a large community of users can be gathered and filtered for information and patterns, a process known as collaborative filtering. Collaborative filtering recommender systems produce recommendations for a given user on one or more items. In collaborative filtering, users are the individuals who provide ratings to a system and receive recommendations from the system. A rating is a numerical representation of a user's preference for an item. The requirements are clustered using K-Means algorithm and only relevant requirements are recommended to stakeholders to avoid information overload. To summarize, collaborative filtering is a technique used to filter large sets of data for information and patterns. By collecting information from many users' predictions about the interests of a user are made. The underlying assumption is that users who have had similar taste in the past will share similar taste in the future.

The ratings from the stakeholders' profiles and the priority of the stakeholders and their roles are used to prioritize requirements. To calculate the importance of a requirement in a project, the influence of the stakeholder's role in the project is determined, and then the influence of the stakeholders in their roles is determined. Stakeholder recommender model will contain following steps:-

1. Identify the large project:-

There are a number of reasons and methods to size a project, leading to different views on what constitutes large-scale. In requirements elicitation, the number of stakeholders is used to size a project. For this project, a large-scale software project is defined as a software project with a large and diverse community of stakeholders with different needs.

2. Identify and prioritize stakeholders:-

Stakeholders are asked to recommend other stakeholders to identify and prioritise stakeholders and builds social network which consists of stakeholders as nodes and their recommendations as links various social network measures can be used to prioritise stakeholders. Social network analysis is the application of methods to understand the relationships among actors, and on the patterns and implications of the relationships.

3. Predict requirements

Based on the stakeholders' profile, this step uses collaborative filtering to predict other requirements that each stakeholder needs or actively does not want. The collaborative recommender system computes similarities among stakeholder profiles in order to create a "neighbourhood" for each stakeholder.

The underlying clustering algorithm used is K-Means which exhibits fast running times and returns relatively high quality results. In K Means, an initial set of K centroids (the mean vectors for the corresponding clusters), are randomly selected. The similarity between each need and each centroid is computed, and all needs are then placed into the clusters associated with their most similar centroids. The centroids are then repositioned so as to increase their average proximity to all needs within the cluster. This is followed by a series of incremental optimizations which attempt to maximize the overall cohesion of clusters in the dataset.

4. Prioritize requirements

Once requirements are identified, there is need to prioritise them. Some requirements are critical for the success of the software system. Hence, requirements should be prioritised so that the ones that are most likely to achieve customer satisfaction can be selected for implementation. Prioritization is done by calculating the Stakeholder's Role influence, stakeholder influence and the project influence. Finally using the project influence the importance of the requirements is calculated. Thus the requirements are prioritized automatically as per the stakeholders need.

CONCLUSION

In large scale software projects, the requirement elicitation faces problems like information overload, inadequate stakeholder input, and biased prioritization of requirements. Stakeholder is an individual or a group who can influence or be influenced by the success or failure of a project. Stakeholders have to be identified as they are the source of requirements. Existing methods in stakeholder analysis are likely to either omit stakeholder roles or return "non-stakeholders". This approach uses social networks and collaborative filtering for requirement elicitation for large scale projects to identify and prioritize requirements. It elicits requirements from the stake holders identified by social network. A highly complete set of requirements is identified compared to the existing method used, requiring less time from the requirements engineers and the stakeholders. The model also prioritizes the requirements

accurately. It handles information overload by drawing stakeholders' attention to only the relevant requirements that they are unaware of. Its elicitation method, which provides stakeholders with a predefined list of requirements as well as allowing them to add new requirements, is rated by stakeholders as low difficulty and requiring little effort.

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