

REQUIREMENT ELICITATION BASED COLLABORATIVE FILTERING USING SOCIAL NETWORKS

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Abstract

In software engineering activity, requirement elicitation is the first phase, in which important requirements related to the project are gathered from different stakeholders. Most projects fail due to inadequate stakeholders and requirements. To identify and prioritize stakeholders and their requirements a method called StakeRare is developed by using social networks and collaborative filtering. Initially the stakeholders are prioritized depending on their roles and project influence. Then the stakeholders are asked to recommend other stakeholders to build a social networks and rate the initial list of requirements. Finally a collaborative filtering is used to prioritize requirements based on stakeholders ratings. This process is easy to scale to large software projects with many stakeholders and requirements. It produces complete and accurate requirements than the existing method.

Keywords-- Social network ,collaborative filtering, requirement elicitation techniques.

I. INTRODUCTION

Requirement analysis is an important part in software engineering process, since errors at this beginning stage propagate through the development process and hard to repair. There are many elicitation techniques used to gather information[6]. As it includes many stakeholders it is necessary to identify and prioritize the stakeholders initially[4]. To identify and prioritize stakeholders and requirements a method called StakeRare is used. It mainly aims to address three problems Requirement prioritization, inadequate stakeholder, incomplete requirement[8].

In existing system, requirements are gathered by using many techniques like interviews, face to face meetings, focus groups. Direct interaction is needed to collect requirements from the stakeholders. It does not suit for large scale software projects.

This paper proposes a novel method StakeRare-Stakeholder Recommender Assisted method for Requirement Elicitation[8]. It address requirement prioritization by using collaborative filtering[3] where the requirements are prioritized based on stakeholder ratings. It address inadequate stakeholder by using social networks where stakeholders are asked to recommend other stakeholders. It addresses incomplete requirements by collecting needed requirements from all the stakeholders.

StakeRare is a novel method, it uses social networks to connect all stakeholders and gather requirements by collaborative filtering to prioritize the requirements based on stakeholders ratings[4].

Section2 describes about the Stakeholder identification,section3 describes the Stakeholder prioritization, section4 describes about identifying requirements, section5 describes about collaborative filtering, section6 describes about social networks and section7 describes the conclusion followed by references.

TECHNIQUES

II. STAKEHOLDER IDENTIFICATION

A stakeholder is a person, group, organisation, member or system who affects or can be affected by an organisation's actions. Identifying stakeholder is an important part in requirement elicitation[1].



Fig 1 : StakeRare method

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Helen Sharp, Finkelstein and Galal have identified four groups of baseline stakeholders: users, developers, legislators and decision makers[1]. For each role it identifies supplier stakeholder, client stakeholder and satellite stakeholder. StakeRare identifies a stakeholder by StakeNet[4] method. Using this method important stakeholders are identified instead of omitting the stakeholders. Project scope is mailed to all the stakeholders within the organization. Then these stakeholders recommend other stakeholders[4].

III. STAKEHOLDER PRIORITIZATION

StakeNet prioritizes the stakeholder using social networks, where stakeholders are asked to recommend other stakeholders to build social network[8]. Initially the project scope is identified. Based on the project scope, the list of stakeholders are gathered based on stakeholder roles and project influence. Stakeholders are identified for every roles[4]. After identifying the stakeholder they are asked to give their stake and recommendations. Stake explains about the stakeholders influence on the project and it is in the form as explained below[4].

<stakeholder, stakeholder role, salience >

Stakeholder refers to stakeholder name, stakeholder role denotes stakeholder's role on project and salience denotes a number in ordinal scale (e.g. 1-5). Then a network is created between the stakeholders depending on their influence on other stakeholders, as stakeholders as nodes and their recommendations as links[4]. Stakeholders are prioritized by applying social network measures to the network. Various measures used to prioritize are Betweenness centrality, Closeness centrality, PageRank, Degree centrality, In-degree centrality, Out-degree centrality[4]. Based on these measures two lists are produced: Prioritized stakeholder roles and prioritized stakeholders.

IV. IDENTIFYING REQUIREMENTS

Requirement elicitation techniques like interviews and focus groups are existing practices. Interviews need face-to-face interaction with all stakeholders and thus it is not efficient and it is time consuming. An elicitation technique that does not require direct interaction with the stakeholder is the survey method[8]. Nuseibeh and Easterbrook says that survey method involves a set of written questions in the form of questionnaires to a list of stakeholders.

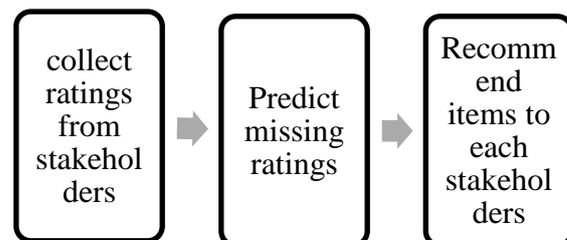
It is a mix of close ended questions with fixed responses and open ended questions where stakeholders have freedom to write their own ideas[8]. It is a qualitative and quantitative to analyse requirements.

StakeSource identifies requirements by interviewing an initial list of stakeholders[2]. It creates a tool and enters the project description. And asks the stakeholders for requirements by sending an email to each stakeholder. The email contains a link that will bring the stakeholder to a requirement elicitation[2]. StakeRare identifies requirements by creating a template. A template response to that template by giving their suggestions and ideas[2]. Thus a complete set of requirements needed to project are collected accurately and completely.

V. COLLABORATIVE FILTERING

In internet, opinions from a large set of users are gathered and filtered for information, a process called collaborative filtering[8]. User preference on an item is expressed through ratings. It is able to determine what a large set of users think of an item, collaborative filtering also develops a personalized view of item based on ratings. The assumption is that those with similar interest in the past will continue to share on future[8].

Collaborative filtering is a technique to filter large sets of data for information and patterns. This technique is used in recommender systems[3], mainly focuses on user's preference. Stakeholders give ratings for each requirements. Rating is a numerical value assigned based on stakeholder's preference. The important requirements that are needed by the project are analysed accurately and completely using this technique.



Initially the stakeholders give ratings for list of requirements. Collaborative filtering uses k-Nearest Neighbour(kNN) algorithm to prioritize requirements[8].

This algorithm compares profile of all the stakeholders and analyses important requirements. This technique compares the interest of all stakeholders, it identifies the like-minded stakeholders. A complete set of requirements are gathered accurately. Relevant requirements to stakeholders can reduce the number of requirements each stakeholder has to identify and prioritize[8], while still ensuring they aware of the requirements they may be interested in.

Predict ratings:

The formula used to measure similarities between user m and user n are explained below by Schafer et al in 2007[8].

Formula for UserSim(m,n) is,

$$UserSim(m, n) = \frac{\sum_{i \in CR_{m,n}} (r_{mi} - \bar{r}_m)(r_{ni} - \bar{r}_n)}{\sqrt{\sum_{i \in CR_{m,n}} (r_{mi} - \bar{r}_m)^2} \sqrt{\sum_{i \in CR_{m,n}} (r_{ni} - \bar{r}_n)^2}}$$

Where CR_{m,n} is an item rated by both m and n, r_{mi} is a rating user m provides on item i, r_{ni} is a rating user n provides on item i, and \bar{r}_n is the average rating provided by the user n. The output ranges from -1 and +1, user in perfect agreement score +1, and person in perfect disagreement score -1. After computing the similarities between pair of user profiles, a neighbourhood is created for user by selecting k most similar users. The value of k varies depending on the different characteristics of dataset. The similarities between each pair of user profiles, UserSim(m,n), is used to compute predicted ratings.

The formula provided by Schafer et al to predict user U's ratings on item I is as follows.

$$\bar{r}_m + \frac{\sum_{n \in \text{neighbour}(m)} UserSim(m,n) \cdot (r_{ni} - \bar{r}_n)}{\sum_{n \in \text{neighbour}(m)} UserSim(m,n)}$$

Where neighbour(m) is a set of users similar to m, r_{ni} is the rating user n provides on item i, and \bar{r}_n is a average rating provided by user n. Depending on the use of rating scale the user may vary, computation is by means of finding difference of how much it deviate from each recommender mean rather than rating itself. Requirements are prioritized based on the predicted ratings by the stakeholders. Finally top N items are sorted and given to stakeholder as recommendations, where N is number of items recommended to the user.

VI. SOCIAL NETWORK ANALYSIS

Social network is a social structure that connects actors with the recommended links. Relation between the actors are identified[8]. Relation can be binary or valued, directed or undirected. Questionnaire is the most common data collection method, especially when the actors are people[8]. Many network studies focuses on small groups where there limited known actors. In some studies boundary is unknown in that case Snowball Sampling Technique is used. Snowball sampling is also used when it is not possible to take measurements on all the actors in the relevant actor set[8]. Snowball sampling begins with set of actors and actors are asked to recommend other actors. And the actors recommended who are not part of list are asked to recommend other actors. Thus the actors are joined like snowball rolling in the hill[8]. Finally well connected network is built.

VII. CONCLUSION

The stakeRare method is developed to beset three problems: information overload, incomplete requirement and inadequate stakeholder. StakeRare method initially identifies stakeholders and prioritise. the stakeholders based on their roles and requirements is requirements gathered from all the stakeholders using social networks. Collaborative filtering is used to prioritise the requirements based on the stakeholder ratings. Thus complete and accurate requirements are collected for projects and stakeholders are identified correctly which leads to success project

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