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Interactive Software Release Planning with Preferences Base

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Presentation
agenda

- Introduction
- Proposed approach
  - Release planning model
  - Model of user preferences
  - Interactive formulation
- Preliminary empirical study
- Conclusions

Introduction

Introduction

- Release planning is a difficult problem;
- Various aspects, such as the customers needs and specific constraints;
- The current SBSE approaches to software release planning fail to effectively consider the user preferences;
- Interactive Optimization can be applied when human expertise is relevant to processo of search.

Main idea

is to incorporate the decision maker in the optimization process, allowing a fusion of his preferences and the objective aspects related to the release planning problem.

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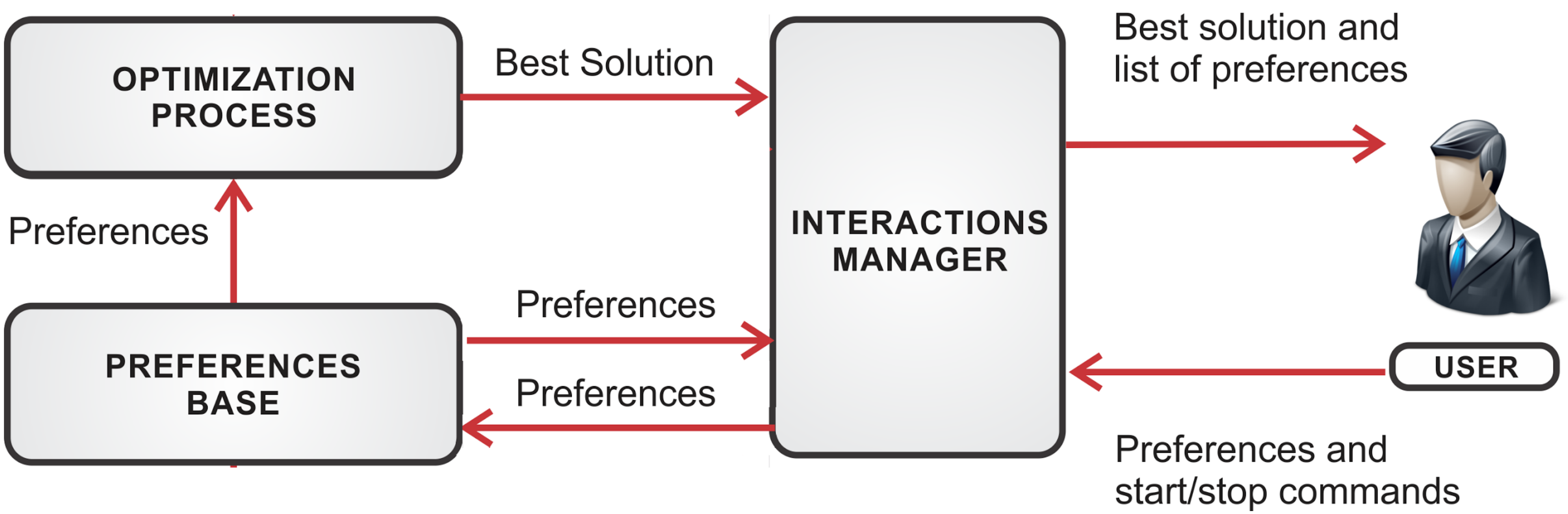
Proposed approach



Release Planning Model

Requirements $R = \{r_1, r_2, r_3 \ldots r_N\}$

- Each requirement $\boldsymbol{r_i}$ has a risk $\boldsymbol{risk_i}$
- Each requirement $\boldsymbol{r_i}$ has an implementation cost $\boldsymbol{cost_i}$

Releases $K = \{k_1, k_2, k_3 \ldots k_P\}$

- Each release $\boldsymbol{k_q}$ has a budget $\boldsymbol{s_q}$

Clients $C = \{c_1, c_2, c_3 \ldots c_M\}$

- Each client $\boldsymbol{c_j}$ has a degree of importance $\boldsymbol{w_j}$
- Each client $\boldsymbol{c_j}$ assigns an importance value to all requirement $\boldsymbol{r_i}$

Model of user preferences

Preference assertions are defined by prepositional predicates

example

Representation: *positioning_in*(r_i, k_q).

Parameters: Requirement r_i and a release $k_q \neq 0$.

Basic interpretation: One requirement should be placed in a certain release.

Formal interpretation: *positioning_in*(r_i, k_q) is satisfied, iff, $x_i = k_q$.

Model of user preferences

1. coupling_joint
2. coupling_disjoint
3. positioning_precedes
4. positioning_follows
5. positioning_after
6. positioning_before
7. positioning_in

Preferences Base $Set\ T = \{t_1, t_2, t_3 \ldots t_Z\}$

- *Where* $\boldsymbol{t_i}$ = < *Preference Assertion,* $L \in \{1,2,3 \ldots,10\}$ >
- ***L*** *is the importance level of the preference* $\boldsymbol{t_i}$

Interactive Formulation

When there aren't user preferences

$$Fitness(S) = \begin{cases} score(S), & if\ Z = 0 \\ \frac{score(S)}{penalty(S)} & otherwise \end{cases}$$

When there are user preferences

Interactive Formulation

Aspects of releases planning

$$score(S) = \sum_{i=1}^{N} y_i \times (value_i \times (P - x_i + 1) - risk_i \times x_i)$$

Aspects introduced by interactions

$$penalty(S) = 1 + \mu \times \left(\frac{\sum_{i=1}^{Z} L_i \times violation(S, T_i)}{\sum_{i=1}^{Z} L_i} \right)$$

Interactive Formulation

$$Fitness(S) = \begin{cases} score(S), & if\ Z = 0 \\ \frac{score(S)}{penalty(S)} & otherwise \end{cases}$$

$$\begin{aligned} \text{maximize} \quad & Fitness(S), \\ \text{subject to} \quad & \sum_{i=1}^{n} cost_i \times f_{i,q} \leqslant s_q, \forall q \in \{1, 2, ..., P\} \end{aligned}$$

Preliminary
empirical study

Research Question

How effective is the approach in finding solutions which satisfy a high number of important preferences?

Settings and execution

- Two datasets based on real data;
- A set of random preferences for each dataset;
- An Interactive Genetic Algorithm (*a priori* interaction);
- 30 executions of each μ variation.

http://goes.uece.br/altinodantas/pb4isrp/en/

Results and analysis

Results (average and standard deviation) of *Satisfied Preferences* (SP), *Satisfaction Level* (SL) and *Score* with **μ** variation for each instance.

μ	dataset-1			dataset-2		
	SP	*SL*	*Score*	*SP*	*SL*	*Score*
0	0.40±0.03	0.40±0.02	25074.8±58.33	0.37±0.05	0.36±0.05	38561.3±154.8
0.1	0.54±0.01 ▲	0.57±0.02 ▲	24889.8±80.55 ▼	0.58±0.03 ▲	0.58±0.04 ▲	38359.9±168.4 ▼
0.2	0.62±0.02 ▲	0.66±0.02 ▲	24591.2±104.23 ▼	0.64±0.04 ▲	0.66±0.04 ▲	37871.7±425.9 ▼
0.3	0.65±0.02 ▲	0.71±0.02 ▲	24312.2±152.30 ▼	0.71±0.05 ▲	0.73±0.05 ▲	37218.1±583.9 ▼
0.4	0.74±0.02 ▲	0.77±0.03 ▲	23862.6±292.98 ▼	0.73±0.04 ▲	0.76±0.05 ▲	36954.5±624.9 ▼
0.5	0.75±0.03 ▲	0.80±0.02 ▲	23568.0±270.29 ▼	0.77±0.05 △	0.81±0.05 △	36332.8±646.7 ▽
0.6	0.77±0.02 ▲	0.83±0.02 ▲	23173.3±288.83 ▼	0.80±0.03 ▲	0.85±0.05 ▲	35774.0±873.3 ▼
0.7	0.80±0.03 △	0.86±0.02 △	22867.4±315.07 ▽	0.83±0.04 △	0.88±0.05 △	35211.4±999.6 ▽
0.8	0.81±0.02 △	0.87±0.01 ▲	22804.4±287.04 ▼	0.86±0.05 ▲	0.91±0.04 ▲	34630.7±902.4 ▼
0.9	0.82±0.02 ▲	0.87±0.01 △	22731.9±315.73 ▽	0.86±0.04 △	0.93±0.03 △	34459.7±802.9 ▽
1	0.83±0.02 △	0.88±0.01 △	22494.3±477.97 ▽	0.88±0.04 △	0.94±0.04 △	34052.5±674.0 ▽

43% **SP** 48% **SL** **Score** 10.3%

51% **SP** 58% **SL** **Score** 11.7%

Conclusions

and future works

Conclusions

- The approach is able to satisfy almost of all user preferences;
- Prioritizing the most important ones, with little loss of score.

Future works

- Mechanism to identify logical conflicts between user preferences;
- Interactive meta-heuristics;
- Consider interdependencies between requirements.

Thanks!

Optimization in Software Engineering Group

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