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Search-Based Bug Report Prioritization for Kate Editor Bugs Repository

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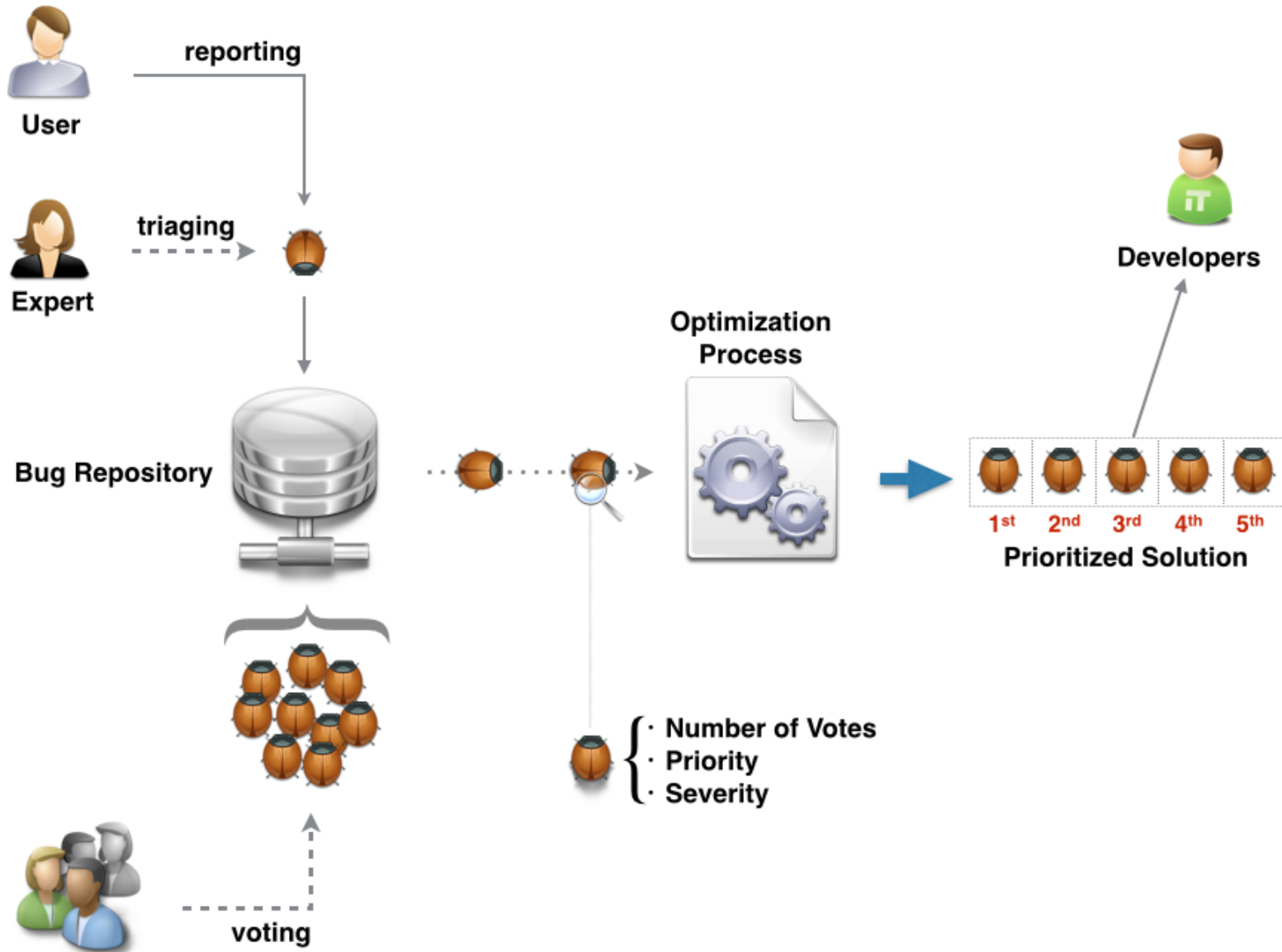
Why do prioritize bugs?

- Software quality is closely linked to development and maintenance processes;
- Bug fixing is indispensable;
- Large software projects those employ distributed teams;
- How to determine in which order these bugs will be addressed, taking into account the views of various user profiles involved?

Challenge Track

- Challenge accepted!
- Project: Kate Editor
 - A formulation bug prioritization of Kate Bugs Repository was proposed and evaluated;
 - A Genetic Algorithm was employed as optimization technique.

Proposed Approach



Problem Formulation

Consider:

- $B = \{b_1, b_2, b_3, \dots, b_N\}$, the set of all available bugs, where N is the number of bugs present in the repository;
- $P = \{p_1, p_2, p_3, \dots, p_M\}$, a specific order of bugs, where M is a parameter which represents the number of bugs to be prioritized

Problem Formulation

Maximize $(\alpha \times \text{relevance}(P) + \beta \times \text{importance}(P) - \gamma \times \text{severity}(P))$
subject to $\text{pos}(P, b_i) < \text{pos}(P, b_j)$, if $b_i < b_j$ and $b_j \in P$

where:

- $\text{pos}(P, b_i)$ returns the position of bug b_i in P if $b_i \in P$, and ∞ otherwise.

Function *relevance(P)*

The ***relevance(P)*** function considers the users votes to measure how relevant is to solve the bugs present in **P**.

$$relevance(P) = \sum_{i=1}^N votes_i \times isIn(P, b_i)$$

where:

- $votes_i$ stores the normalized number of votes given by the repository users to bug b_i ;
- $isIn(P, b_i)$ function returns **1** if $b_i \in \mathbf{P}$, and **0** otherwise.

Function *importance(P)*

The *importance(P)* function aims at encouraging the early resolution of bugs considered to have higher priority by the repository users.

$$importance(P) = \sum_{i=1}^N priority_i \times (M - pos(P, b_i) + 1) \times isIn(P, b_i)$$

where:

- $priority_i$ indicates the priority value given by repository users to bug b_i ;
- $pos(P, b_i)$ returns the position of bug b_i in \mathbf{P} if $b_i \in \mathbf{P}$, and ∞ otherwise;
- $isIn(P, b_i)$ function returns **1** if $b_i \in \mathbf{P}$, and **0** otherwise.

Function *severity(P)*

The ***severity(P)*** function represents the impact of the early resolution of the bugs with highest severity.

$$severity(P) = \sum_{i=1}^N severity_i \times pos(P, b_i) \times isIn(P, b_i)$$

where:

- $severity_i$ is the severity value assigned by the users to bug b_i ;
- $pos(P, b_i)$ returns the position of bug b_i in \mathbf{P} if $b_i \in \mathbf{P}$, and ∞ otherwise;
- $isIn(P, b_i)$ function returns **1** if $b_i \in \mathbf{P}$, and **0** otherwise.

Settings and Execution

- Three datasets extracted from Kate Editor Bugs Repository;
- Three different weight configurations for the objective function;
- 30 executions for each combination of weights and datasets.

Results and Analysis

RQ1: "Is the proposed approach sensible to different weight configurations?"

Table 1. Average and standard deviation of *relevance*, *importance* and *severity* values for each dataset and different weight configurations, with $M = 30$.

Weight Configurations		$\alpha = 2, \beta = 1, \gamma = 1$	$\alpha = 1, \beta = 2, \gamma = 1$	$\alpha = 1, \beta = 1, \gamma = 2$
dataset-1	Relevance	0.859±0.064	0.846±0.075	0.836±0.063
	Importance	0.649±0.021	0.691±0.011	0.680±0.014
	Severity	0.124±0.014	0.121±0.013	0.110±0.007
dataset-2	Relevance	0.870±0.045	0.833±0.059	0.827±0.0777
	Importance	0.647±0.017	0.688±0.017	0.675±0.0147
	Severity	0.128±0.012	0.124±0.013	0.113±0.010
dataset-3	Relevance	0.851±0.050	0.840±0.054	0.841±0.042
	Importance	0.646±0.016	0.707±0.013	0.673±0.015
	Severity	0.146±0.016	0.141±0.018	0.118±0.015

Results and Analysis

RQ2: "What is the result of applying the proposed approach in the Kate Editor Bugs Repository considering a balanced weight configuration?"

Table 2. Information of the first five prioritized bugs of the best found solution using $\{\alpha = 1, \beta = 1, \gamma = 1\}$ in dataset-3 with $M = 30$.

Order	ID's	Description	Votes (relevance)	Priority (importance)	Severity (severity)
1	267618	[PATCH] Kate sidebar does not appear with old sessions	41	1.0	0.55
2	343329	Remote files open up empty	131	0.6	0.7
3	226905	Add support for mime-type sections to .kateconfig files	20	1.0	0.1
4	241502	Kate find bar and split view	40	1.0	0.1
5	313455	JJ Autobracket plugin does not replicate all the functionality of the built in function	219	0.6	0.4

Conclusions

- The proposed approach is able to prioritize bugs;
- It is sensitive to different weight configurations, allowing the user to adjust the option which better suits the faced scenario.

Future works

- Evaluation proposed approach by experts;
- Adaptation to other bugs repositories;
- Application of other meta-heuristics;
- multi-objective version.

Thanks!
Questions?



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