Bug Report Priority Prediction Using Developer-Oriented Socio-Technical Features

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1 Performance

Figs. 1-2 demonstrate the performance of different classifiers, i.e., KNN, Random Forest (RF), Decision Tree (DT), Support Vector Machine (SVM), Multilayer Perceptron (MLP), Adaboost (ADA), Naive-Bayes (NB), and Logistic Regression (LR).

2 Parameter Tuning

Fig. 3 shows the tuning of the number of similar reports.

3 Feature Importance

Figs. 4-6 depict the mean (in solid lines), median (in dashed lines), as well as the rank of each feature's importance in descendant order. Due to the limitation of space, only the top 25% features are presented. Metrics given the same rank are marked in the same color.

Every feature has some contribution to the model (mean feature importance ≥ 0.01). In terms of the top 25% important features, the most significant features are the experience and the technical features of bug reports reporting the proportion of high or low priority in similar reports, they always appear in the top-3 ranks. Since the similarity of bug reports is a major aspect in prior studies, our conclusion in line with their observations. However, features derive from similar reports are never among the top important factors in within- and time-wise prediction. Meanwhile, reporter and assignee features are more important in the other 2 scenarios. The sentiment features of reporter and assignee appear in the top 25% in terms of feature importance in all 3 scenarios,

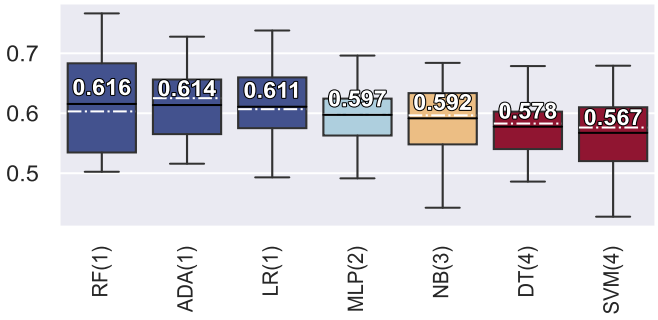

Figure 1. AUC performance and SK-ESD ranks of different classifiers.

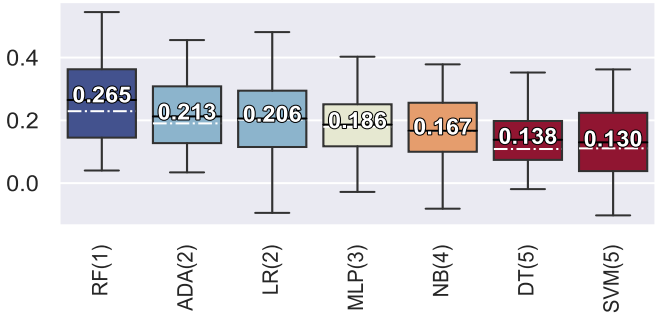

Figure 2. MCC performance and SK-ESD ranks of different classifiers.

but they mostly appear in the ranks lower than 3. In contrast, community-related features contribute little predictive power.

Moreover, an extended version of the original Table 4 is available as Table 1 in this appendix, which shows the remaining features with negligible effect sizes.

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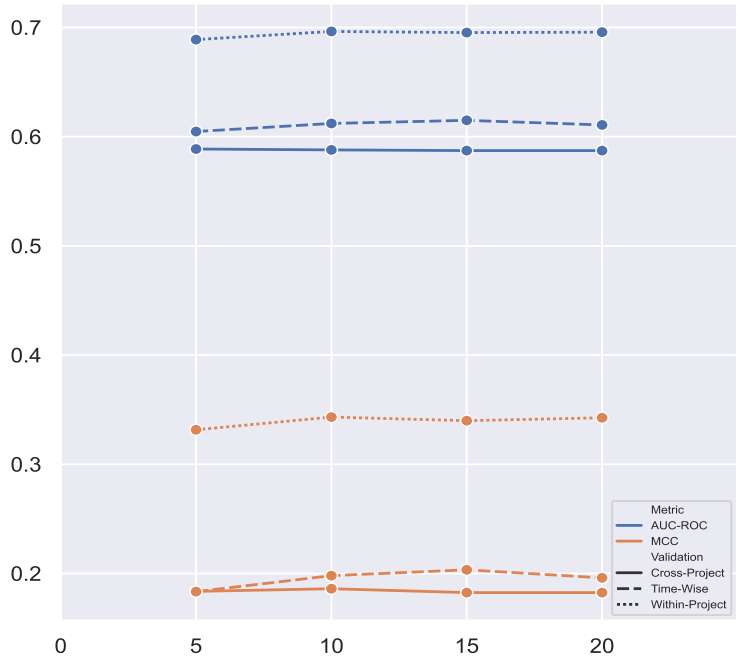

Figure 3. Tuning *S*, *i.e.*, number of similar reports used to generate features.

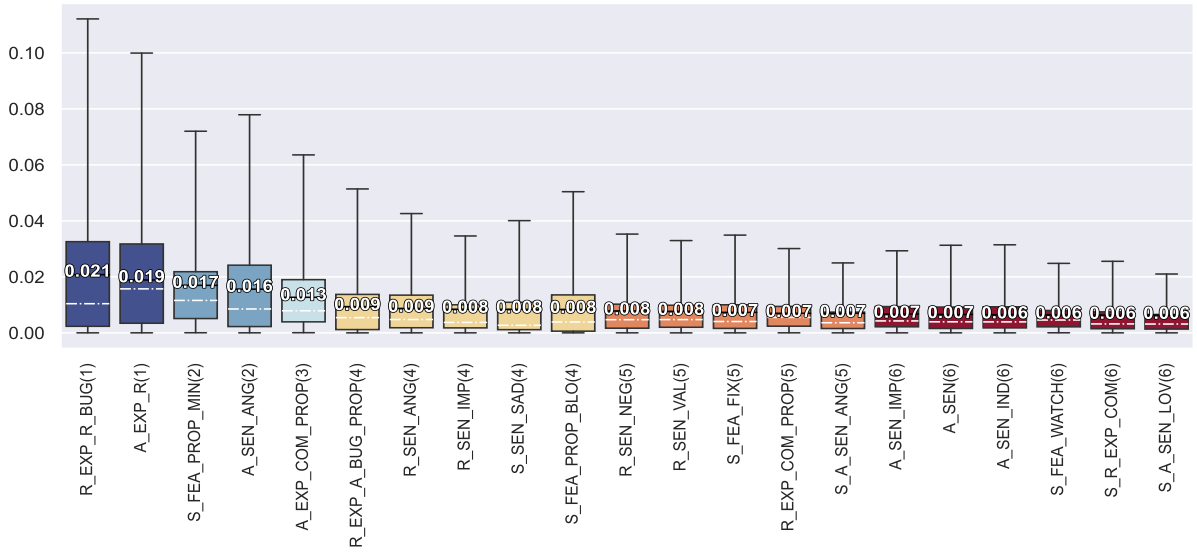

Figure 4. Within-project prediction SHAP feature importance ranked by SK-ESD.

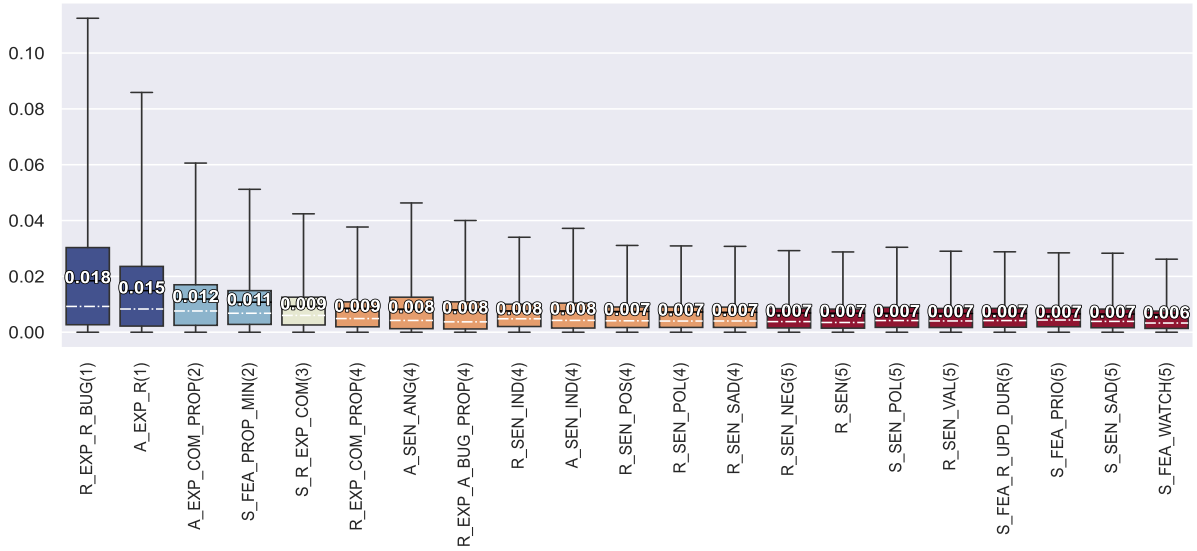

Figure 5. Time-wise prediction SHAP feature importance ranked by SK-ESD.

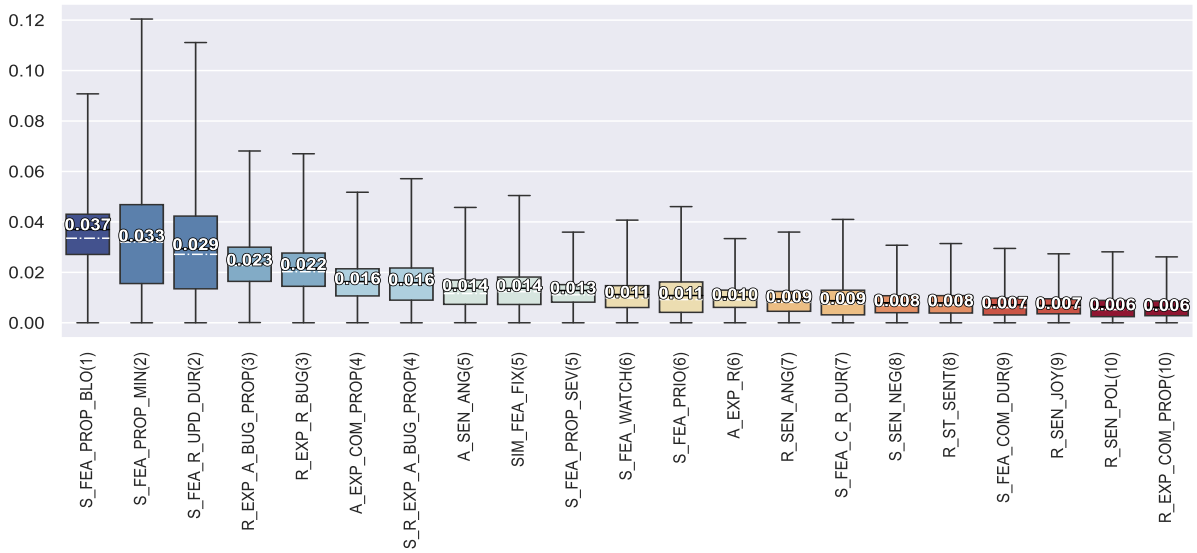

Figure 6. Cross-project prediction SHAP feature importance ranked by SK-ESD.

Table 1. The Power of The Unmentioned Features to Discriminate High (High P.) and Low (Low P.) Priority Bug Reports

Feature	Spearman's ρ		Cliff's δ		Mean		Variance	
	Value	Rank	Value	Effect Size	High P.	Low P.	High P.	Low P.
R_SEN_IND	-0.67	+++	-0.63	L	0.15	0.35	0.02	0.04
S_FEA_COM_DUR	0.54	+++	0.58	L	0.21	0.08	0.02	0.01
R_ST_SENT	-0.47	++	-0.52	L	13.83	24.87	104.45	106.53
S_A_SEN_ANG	0.45	++	0.45	M	0.09	0.05	0.00	0.00
R_SEN_SAD	0.35	++	0.33	M	0.55	0.44	0.03	0.04
R_SEN_NEG	-0.39	++	-0.40	M	-0.11	-0.08	0.01	0.01
R_SEN_ANG	0.42	++	0.40	M	0.26	0.18	0.01	0.01
A_SEN_IMP	0.41	++	0.38	M	0.67	0.37	0.45	0.23
S_R_EXP_COM	0.37	++	0.35	M	57.15	45.73	6735.95	11667.98
S_SEN_POL	-0.31	++	-0.29	S	0.06	0.09	0.01	0.01
R_SEN_POS	-0.32	++	-0.23	S	0.14	0.17	0.04	0.03
A_SEN_IND	-0.30	++	-0.28	S	1.37	1.49	0.07	0.13
S_R_EXP_A_BUG_PROP	-0.30	++	-0.32	S	0.00	0.01	0.00	0.00
S_R_SEN_SUB	0.28	+	0.26	S	0.08	0.06	0.01	0.01
S_A_SEN_LOV	0.28	+	0.24	S	0.19	0.16	0.01	0.01
R_SEN_POL	0.25	+	0.22	S	0.15	0.13	0.02	0.03
R_SEN	-0.14	+	-0.20	S	0.01	0.01	0.00	0.00
A_SEN	-0.27	+	-0.33	S	1.14	1.55	0.47	0.67
S_FEA_C_R_DUR	0.17	+	0.17	S	0.04	0.03	0.00	0.00
S_A_EXP_COM_PROP	0.27	+	0.25	S	3.17	2.71	2.03	1.51
R_EXP_COM_PROP	0.22	+	0.19	S	0.67	0.63	0.01	0.01
A_SEN_ANG	-0.13	+	-0.10	-	0.00	0.00	0.00	0.00
S_SEN_SAD	0.12	+	0.14	-	0.05	0.04	0.00	0.00
S_SEN_JOY	-0.11	+	-0.14	-	0.02	0.02	0.00	0.00
S_R_SEN_ANG	0.14	+	0.14	-	0.22	0.21	0.00	0.01
A_EXP_R	0.10	+	0.07	-	0.08	0.07	0.00	0.01
S_SEN_NEG	-0.06	-	-0.06	-	0.08	0.09	0.00	0.00
S_FEA_WATCH	0.09	-	0.06	-	0.09	0.08	0.01	0.01
R_SEN_VAL	0.06	-	0.08	-	0.03	0.03	0.00	0.00
R_SEN_JOY	0.06	-	0.07	-	0.47	0.46	0.03	0.03
R_SEN_IMP	0.05	-	0.05	-	0.58	0.58	0.04	0.08
R_EXP_R_BUG_PROP	-0.05	-	-0.07	-	0.10	0.10	0.00	0.00