

Quality Ranking of Features in Software Product Line Engineering

Introduction

Problem Statement & Motivation

Approach

Evaluation

Conclusions and Future Work

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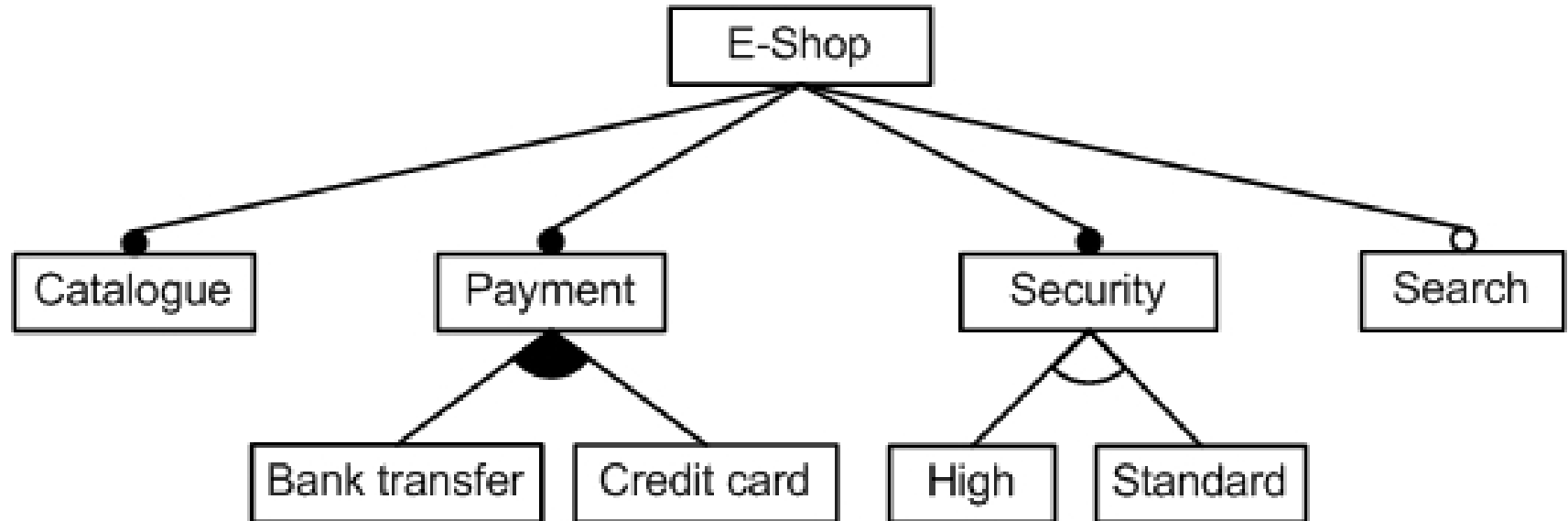
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- Software Product Line Engineering (SPLE)
 - Develop a family of software products that share great commonalities
 - Promotes systematic reuse
 - Reduce time to market
 - Increase productivity
 - Improve quality
- SPLE processes
 - Domain Engineering
 - [Application Engineering](#)



- Product Line Feature
 - “prominent or distinctive user-visible aspect, quality, or characteristic of a software system”⁽¹⁾
- A feature model
 - Representation of all products of the SPL in terms of features

(1) Kang, K.C. and Cohen, S.G. and Hess, J.A. and Novak, W.E. and Peterson, A.S., "Feature-oriented domain analysis (FODA) feasibility study", Technical Report CMU/SEI-90-TR-021, SEI, Carnegie Mellon University, November 1990



Functional requirements

- Relatively well-handled

Non-Functional requirements

- Inefficiently managed



How do features affect desired quality attributes?

- Rank features according to their ability to satisfy the desired quality attributes
- Analytical Hierarchical Approach (AHP)
 - Previous work
 - Given a pair of features and a quality attribute:
 - Which feature supports the quality attribute best?
- Using ELO ranking
 - Current work



Ease of Use	Command-Line	Drag-Drop	Color-Based	TimeAlerts	One-Login	CallGuide	RIV	Rk
Command-Line	1	1/5	1/3	1	1/6	2	7.3	6
Drag-Drop	5	1	3	5	1/3	3	23.8	2
Color-Based	3	1/3	1	5	1/5	1	13	4
TimeAlerts	1	1/5	1/5	1	1/5	3	9.1	5
One-Login	6	3	5	5	1	1/3	30.8	1
CallGuide	1/2	1/3	1	1/3	3	1	15.9	3

Quality Attribute: Ease of Use

Problems

- Not practical for one domain expert to **conduct all comparisons**
- **Hard to consolidate** results from different domain experts
- **Difficult to preserve consistency**
 - Call Guide > One Login; One Login > Drag & Drop
 - Call Guide < Drag & Drop

- ELO
 - Calculate relative skill in pair-wise competitions
 - Calculate expected score
 - Update ratings based on results



- ELO in SPLE
 - Rate and rank features after each round!
 - 1 = feature “wins”
 - 0.5 = draw
 - 0 = feature “loses”

Process

- Step 1: identify & decompose all critical QAs
- Step 2: relate features to attributes
- Step 3: domain experts compare *randomly selected* feature pairs based on a given QA
- Step 4: compute **expected score** of all features
- Step 5: **update** feature ratings
- Step 6: produce a comprehensive chart of features' contributions to QAs

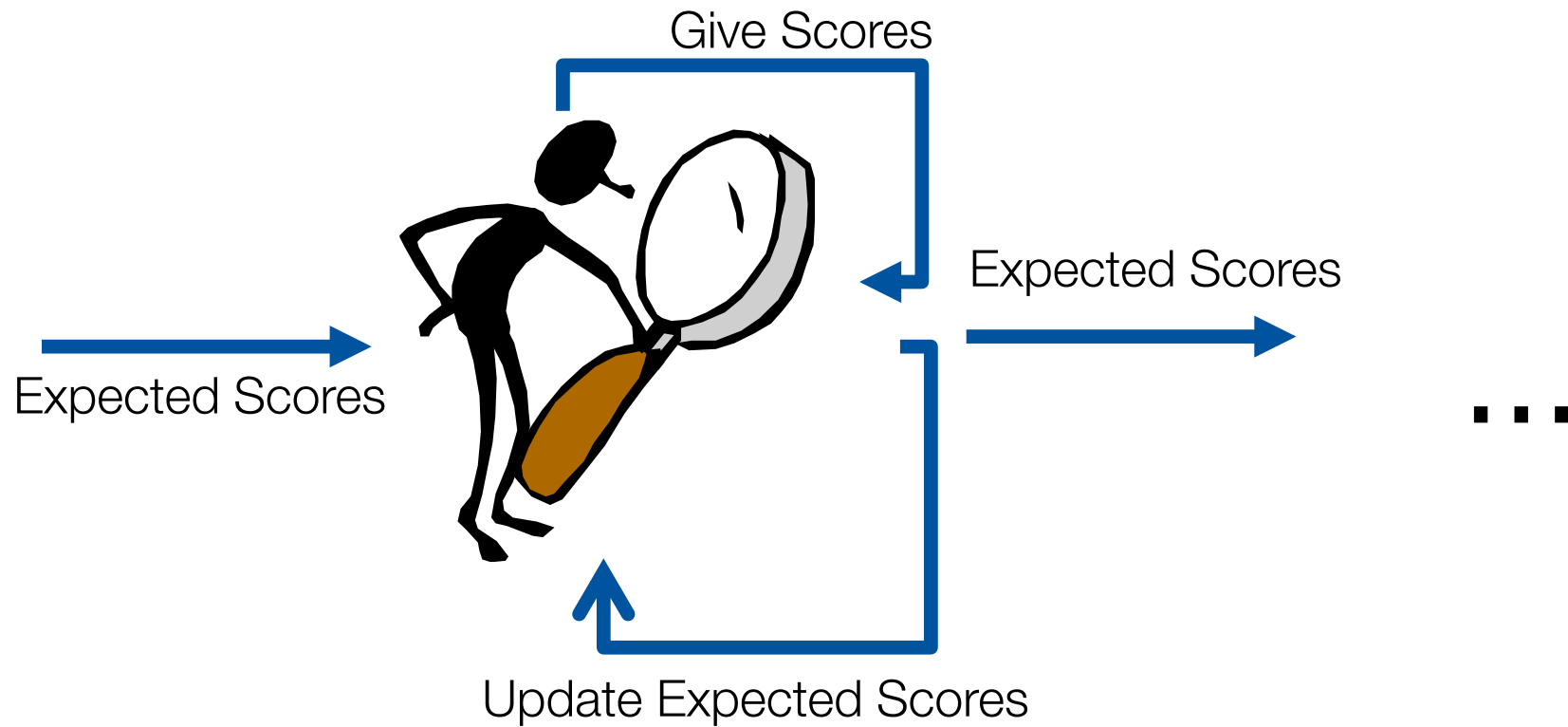


TABLE I. QUALITY ATTRIBUTES AND CONTRIBUTING FEATURES

Ease of Use	Data Access Security	Dispatch Respond Time	Data Transfer Speed	Data Transfer Security
Command-Line	Password	Call Distribution	Mobile	Web-Access
Drag-Drop	Biological	Call Scheduling	Two-Way Radio	WAN
Color-Based	Key	GIS Call Identification	In-Car Computer	LAN
Timer Alerts	Role-Based	Call Location Identification	WAN	Modem 19200bps
One-Login	One-Login	Data Sharing	LAN	Modem 9600bps
Call Guide	Call Guide	Timer Alerts	Encryption	Encryption
		Location Mapping	Modem 19200bps	
		Notification Entry	Modem 9600bps	

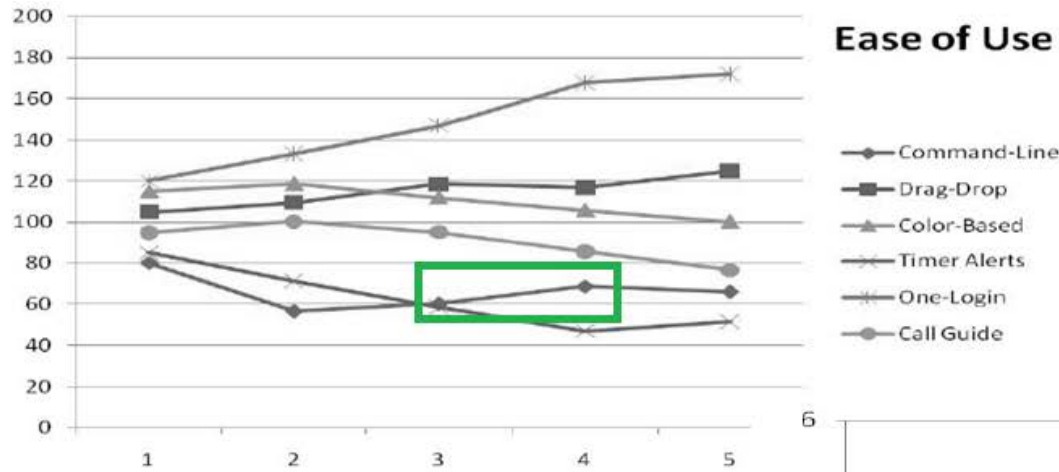


Fig. 1. Rating update for “Ease of Use”

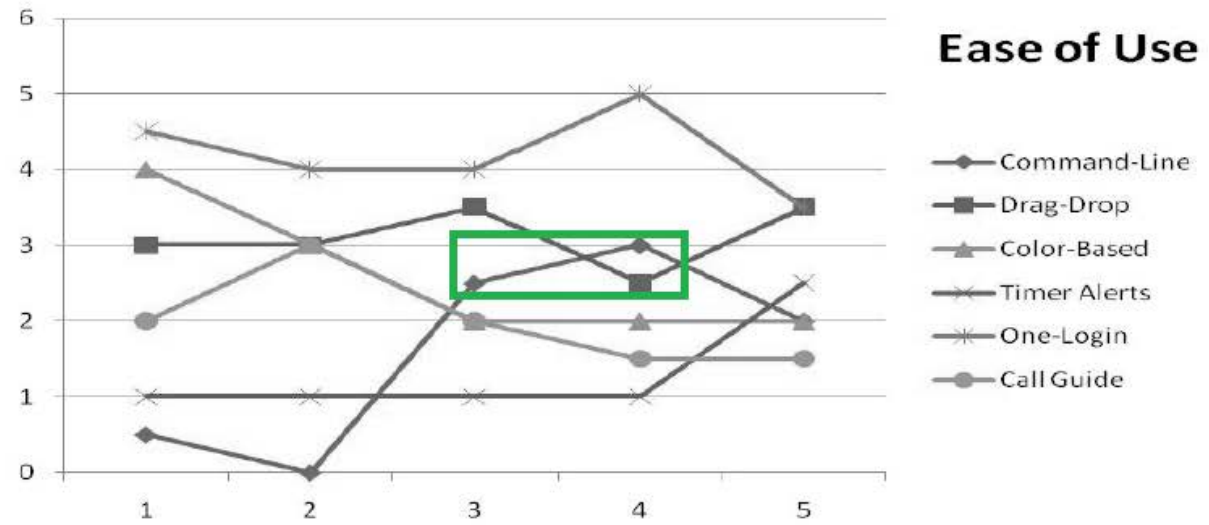
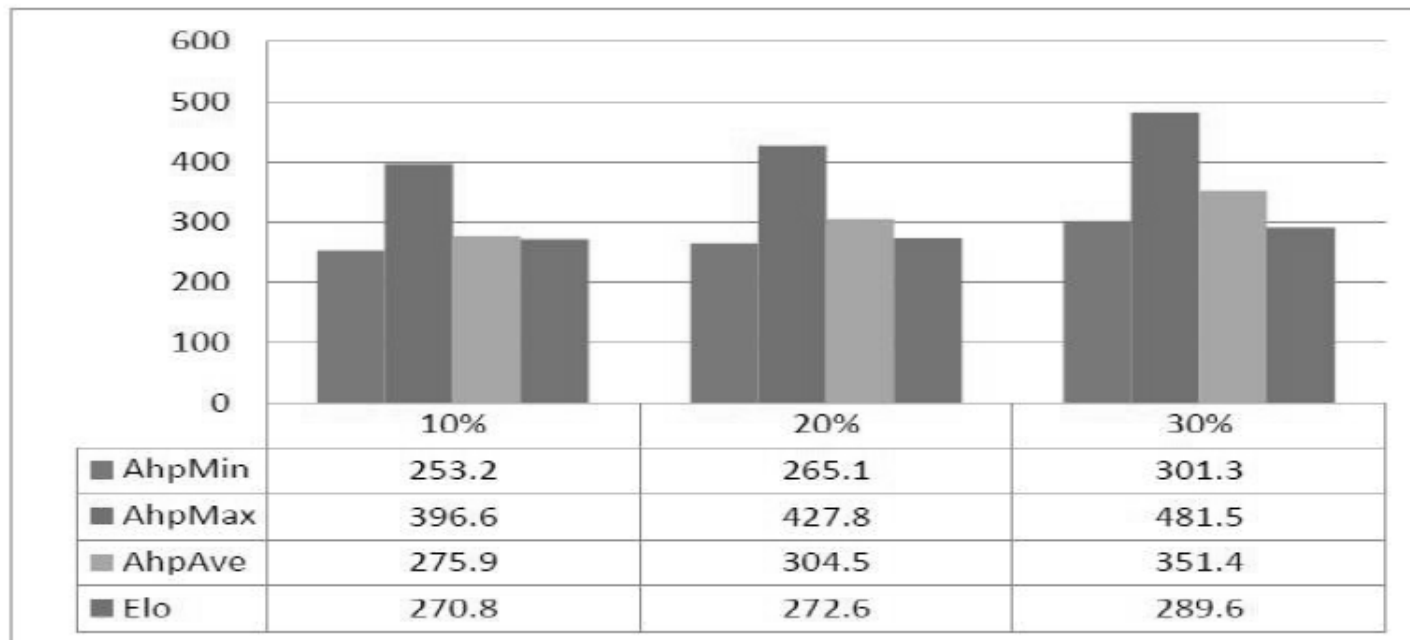


Fig. 2. Actual Scores for Each Feature of “Ease of Use”

$$F_1 > F_2 > F_3 > \dots > F_{50}$$

“Perfect Ranking“

- Generated expert rankings
- Introduced noise
- Compared AHP with ELO



ELO

- Combine experts opinions
- Inconsistency issues are solved by feedback
- Partial results from experts are possible

- More robust than AHP

- Coming up next: [impact of feature groups on QA](#)