



Preference-based Detailed Feedback Management for E-Commerce Applications

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Introduction

In consumer-to-consumer (C2C) e-commerce environments, the magnitude of products and the diversity of vendors have caused confusion and difficulty for consumers to choose the right product from a trustworthy vendor. Feedback system is a widely used solution to help consumers evaluate vendors' reputations. Some C2C environments have started to provide detailed feedback besides the overall rating system to help consumers distinguish individual vendors from multiple aspects. However, the increase in detailed feedback may add to consumer confusion and increase the time needed to consider all aspects for a reputation evaluation decision. This paper analyzes a typical feedback and reputation system for the e-commerce environment and proposes a novel, perception-based reputation model for individual vendors.

Perception-based Fuzzy Logic

Here, we take an example to illustrate Perception-based Fuzzy Logic. We use feedback score (F) and the probability that a vendor's reputation is high (P^*) to build a sample linguistic rule set:

"If F is high then P^* is high."

"If F is normal then P^* is medium."

"If F is low then P^* is low."

The probability of "the vendor's reputation is high" can be represented as an F-granular distribution (Figure 1) and written as:

$P^* = \text{high} * \text{high} + \text{normal} * \text{medium} + \text{low} * \text{low}$

Then we use $Z(F)$ to represent the fuzzy set in F domain and $P(P^*)$ to represent fuzzy set in P^* domain. Then, the linguistic rule set can be represented as:

"If F is Z_i then P^* is P_j ", where $Z_i \in Z(F)$, $P_j \in P(P^*)$.

"if... than..." rule is the most widely used but not the only format to present linguistic rule. As long as uncertainties need to be contained in rules, our proposed fuzzy term description can be embedded into any rule format.

Using f-granular to describe P^* , P^* can be written as: $P^* = \sum_{i,j} Z_i \times P_j$

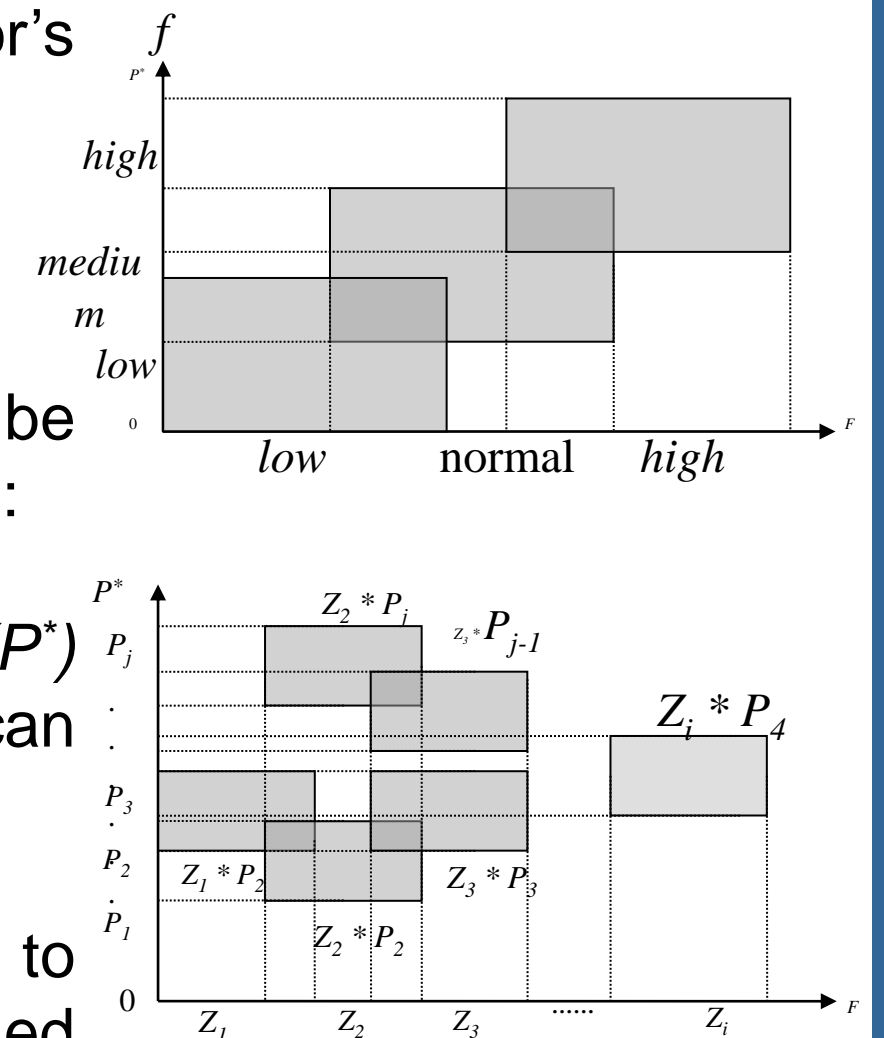


Figure 1. F-granular

Parallel Model

We propose a parallel model as shown in Figure 3, treating detailed feedbacks as a sub set of all relevant factors, in which detailed feedbacks are as important as general factors so that the reputation can be calculated, depending not only upon overall performance factors but also consisting of user's preferences on different aspects within detailed feedbacks. Shoppers can define main policy set for general factors and sub policy set for detailed feedbacks. And these two sets are co-actively processed by reputation generator to calculate a reputation for a vendor.

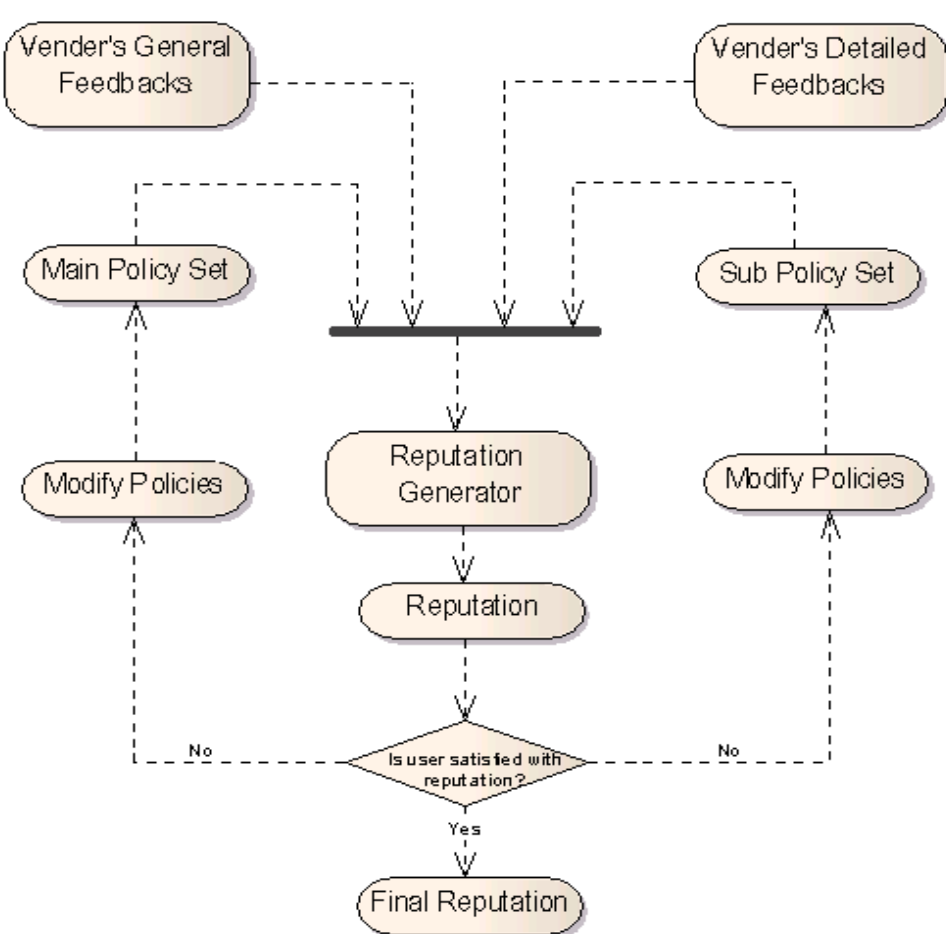


Figure 2. Parallel Model

Feedback Adjustable Model

On the other hand, we propose another model - the feedback adjustable model- in which detailed feedbacks are only used to augment general performance factors,

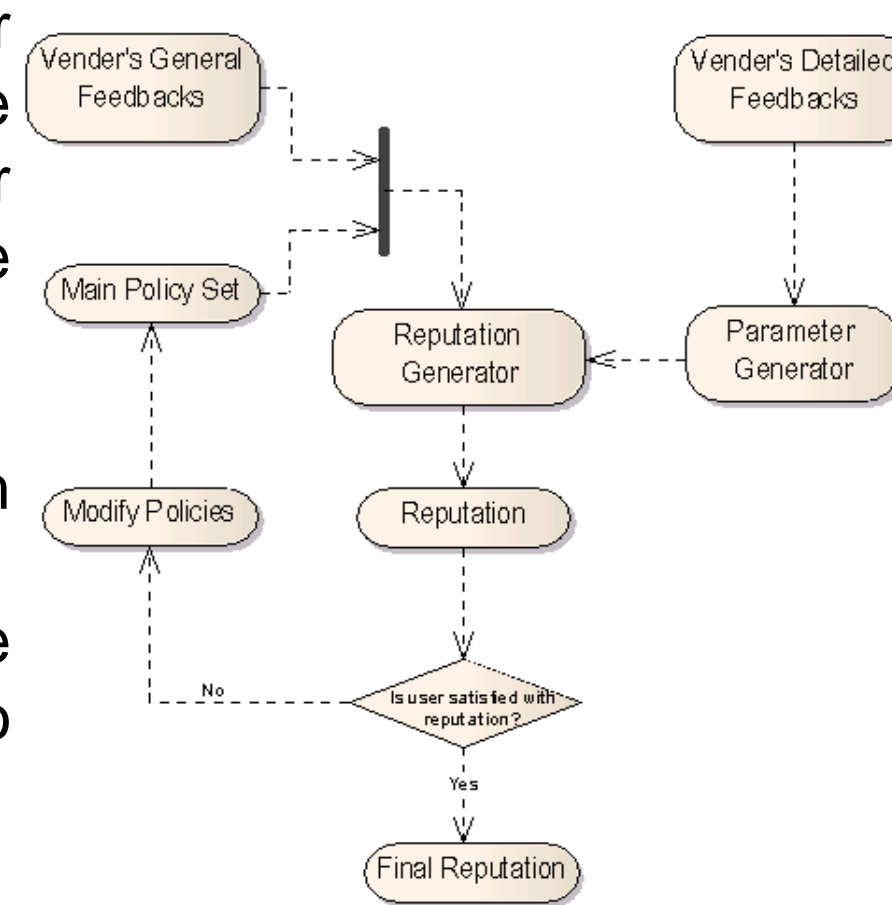


Figure 3. Feedback Adj. Model

which use available detailed feedback ratings to adjust the decision-making process in order to meet shoppers' perceptions toward a vendor. Unlike the parallel model, the feedback adjustable model uses a parameter generator to map detailed feedback ratings into one parameter that has the range from 0 to 1([0,1]). Then this parameter is used in the reputation generation process in order to adjust the calculation of the overall reputation using general feedback information.

Comparison of Different Models

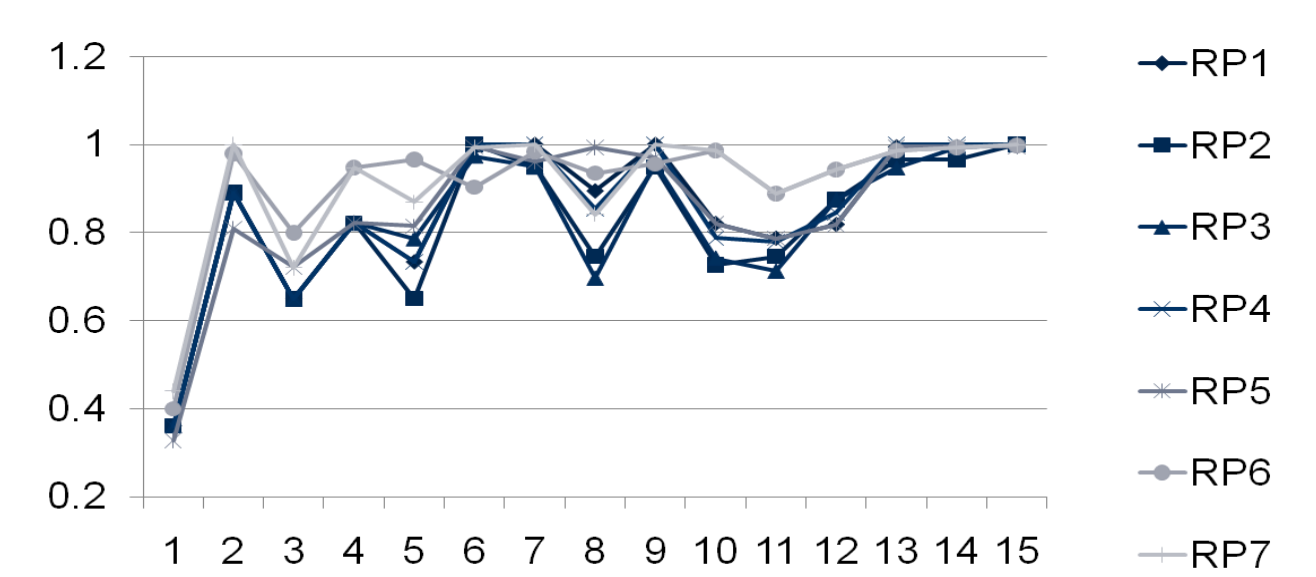


Figure 4. Comparisons of different reputation models

Figure 4 illustrates the comparisons of reputations generated by different models. RP1 to PR7 represents the general model without detailed feedback, parallel model with sub policy set1, parallel model with sub policy set2, feedback adjustable model, general model without RP index and detailed feedbacks, fuzzy beta reputation model and fuzzy beta reputation model with RP index respectively. Our system provides reputations at three different levels: low, normal and high. The confidence of each level will be represented by a percentage following that level. In order to perform the comparison, we normalize our reputations into a reputation score ([0,1]).

Experiments Environment

To examine the performance and adaptability of the system, we select an unlocked Nokia N900 cell phone as the target product for shopping. Then we run the system with the eBay environment. Hundreds of vendors who sell this cell phone (with the "buy it now" option) are compared in the experiments. And according to the percentage of vendors with/without detailed feedbacks (two categories), we proportionally choose first 7 and 4 vendors from the raw result returned by eBay representing both categories for the comparison. Detailed vendors' information is shown in table 1. Then we use different models to calculate the reputation of each vendor respectively. Then we add price information into decision-making and provide users a final recommendation following users' preferences on different policy sets and different models.

Table 1. Vendors' information

Vendor	Price	Positive feedback (%)	Feedback score	12 month feedback	Active Months	Item as des. (rating/# of rating)	Communication (rating/# of rating)	Shipping time (rating/# of rating)	Shipping handle (rating/# of rating)
eBay1	465.00	50	4	6	48	N/A	N/A	N/A	N/A
eBay2	538.00	100	98	83	39	N/A	N/A	N/A	N/A
eBay3	480.99	83.3	32	2	26	N/A	N/A	N/A	N/A
eBay4	499.95	100	144	150	23	N/A	N/A	N/A	N/A
eBay5	649.66	100	57	1	117	4.4/34	4.5/35	4.9/38	4.4/35
eBay6	449.95	99.6	2616	2894	78	4.9/1712	4.9/1703	4.8/1703	4.9/1703
eBay7	529.99	99	684	551	46	4.8/415	4.8/412	4.8/418	4.8/410
eBay8	540.00	98.4	3974	67	106	4.7/52	4.5/51	4.4/51	4.7/52
eBay9	589.99	98.1	743	775	36	4.8/635	4.7/631	4.8/629	4.8/632
eBay10	599.00	100	141	91	17	4.5/43	4.7/43	4.7/43	4.5/43
eBay11	575.00	98.9	105	95	16	4.8/62	4.8/62	4.6/62	4.8/62
eBay12	499.95	100	132	137	15	5.0/61	5.0/61	4.9/60	4.9/61
eBay13	538.00	99.4	1310	188	50	4.9/142	4.8/140	4.9/141	5.0/136
eBay14	538.99	99.7	1708	316	114	4.9/229	4.6/229	4.9/226	4.9/227
eBay15	490.00	100	1439	1119	97	4.9/905	4.9/902	4.9/899	4.9/899

Comparison of Shopping Recommendations

We set the sub policy set 1 used for the parallel model as our default sub policy set. The first main policy set is defined following human common sense, which always tries to select a low-priced product from a reputable vendor. The second main policy set is defined as an extreme case, which always prefers an expensive product from a reputable vendor. Figure 5 indicates the huge differences between two policy sets.

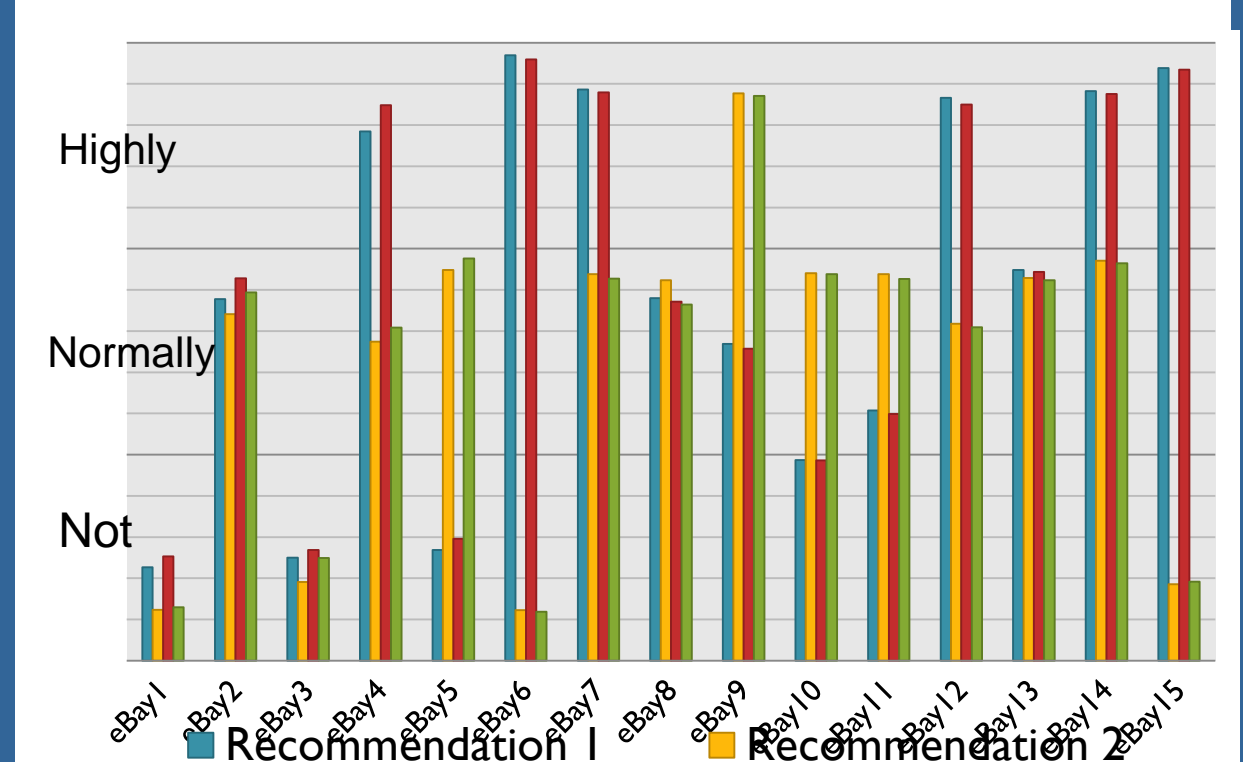


Figure 5. Comparison of recommendations