

An E-commerce Recommender System Based on Degree of Specialties in Online Shops

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Abstract Use of online shopping sites, such as Amazon and Rakuten, has increased in recent years. Many shops participate in these sites. The categories of shops represent various intended uses for listed items. For example, a flashlight is often used for camping or emergency items, so some shops use a category such as “Outdoors” or “Emergency Supplies” for that item. In this paper, we aim to build a recommender system for specialty shops based on the viewpoints of items browsed by users. We first extract viewpoints of browsed items by using category structures of online shops. Through this, we analyze the category structures and selection of goods to determine specialty shops.

Key words Online shopping, A recommender system, Category structures

1. Introduction

Use of online shopping sites, such as Rakuten ichiba and Amazon has increased in recent years. These sites have category structures for classifying items based on their intended uses. For example, a flashlight used for camping has the category “Outdoors.” Online shopping sites recommend various items based on users’ item browsing histories, using a Collaborative Filtering method. However, in this method, other items are often recommended from the same category as the category of an item browsed by a user, but items have viewpoints.

Many shops participate in online shopping sites. The sites have not only their own category with all items but also many specific category structures in the participating shops. These categories represent some of the intended item uses. In this work, we recommend participating shops and items in shops based on viewpoints for browsed items, considering these shops’ viewpoint specialties. A user has a purpose in browsing items. Using specific category structures in participating shops, we assume intended browsed item uses. For example, we recommend specialty shops having the categories “Outdoors” and “Emergency Supplies” for flashlights.

2. Our Approach

2.1 A Recommender System for Specialty Shops

In this work, we use specific category structures in par-

ticipating shops to infer viewpoints among browsed items. Specifically, we use parent categories having child categories with browsed items in participating shops, because these categories might represent intended uses of items. For example, when the browsed items are flashlights and retort-packed food and there are parent categories “Outdoor Gear” or “Emergency Supplies” having these items in participating shops, we infer that the viewpoints among these browsed items are outdoor leisure and disaster preparedness. Then, we analyze category structures in participating shops, in order to determine specialty shops based on these viewpoints and recommend these specialty shops. Figure 1 shows an example of a recommendation. A user has browsed “Flashlight” and “Retort-packed food.” We present parent categories “Outdoor Gear” and “Emergency Supplies” as viewpoints for these items. Then, we also present child categories such as “Outdoor Gear > Camping” or “Emergency Supplies > Foods” under the parent categories. Choosing a category, a user can browse recommended items suitable for the user’s purposes.

2.2 Related Work

Kato et al. [1] and Duc et al. [2] proposed methods for searching objects based on the relational similarity between words from their emergence distribution on the Web. These methods are similar to our work in that they use relations among objects, but our method differs in extracting relations among objects based on online shops’ category structures.

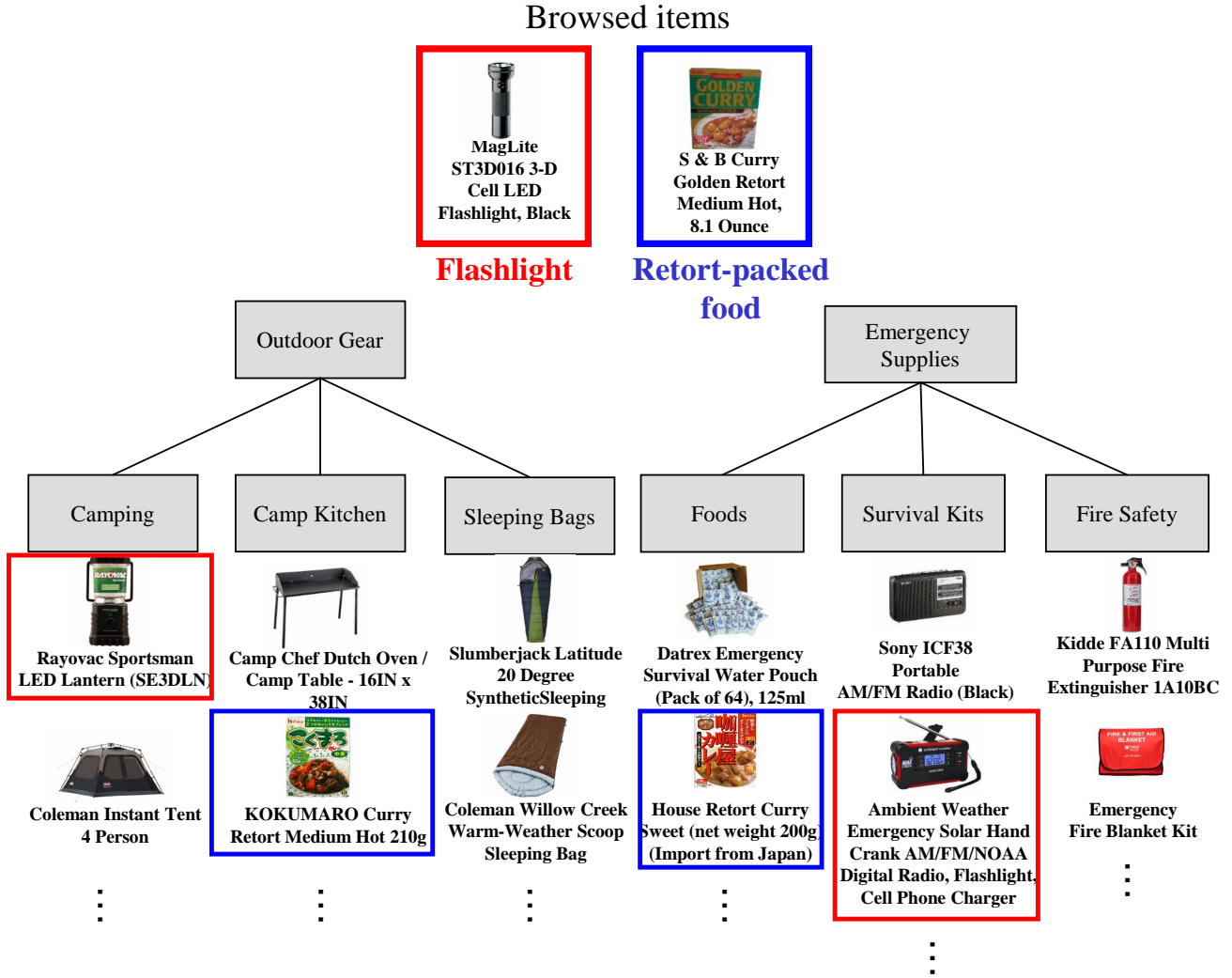


Figure 1 An E-commerce Recommender System based on Degree of Specialties in Online Shops

Seki et al. [3] and Cao et al. [4] proposed a method for recommending suitable items for a user's context. It is similar to our work in recommending suitability for a user's viewpoint, but our method differs in considering specialties to recommending shops based on a user's viewpoint.

Rakuten ichiba [5] ranks participating shops according to opening day, number of items, and number of reviews. However, that site does not consider shop specialties.

3. A Method for Determining Degrees of A Shop's Specialty Based on a Viewpoint

In this section, we explain methods for calculating degrees of a shop's specialty in regard to viewpoints among browsed items. We define a shop's specialty as the result of a calculation using an item classification method, item selection, and the main target genre of items in the shop.

3.1 The Degree of a Shop's Specialty Based on a Classification Method of Items

We consider an item classification method to determine the degree of shop specialty. Shops having detailed categories for classifying items and using the categories properly are specialty shops. The degree based on the classification method $C_Score(X, i)$ is calculated using the following expression:

$$C_Score(X, i) = \alpha \times Detail(X, i) + (1 - \alpha) \times Uniformity(X, i) \quad (1)$$

where the function $Detail$ returns a degree of detail of a category structure in a shop i based on browsed items X , and the function $Uniformity$ returns a degree of detail of using the category structure properly. $Detail$ and $Uniformity$ of shop i based on items X are calculated as follows:

$$Detail(X, i) = W(X, i) \times D(X, i) \quad (2)$$

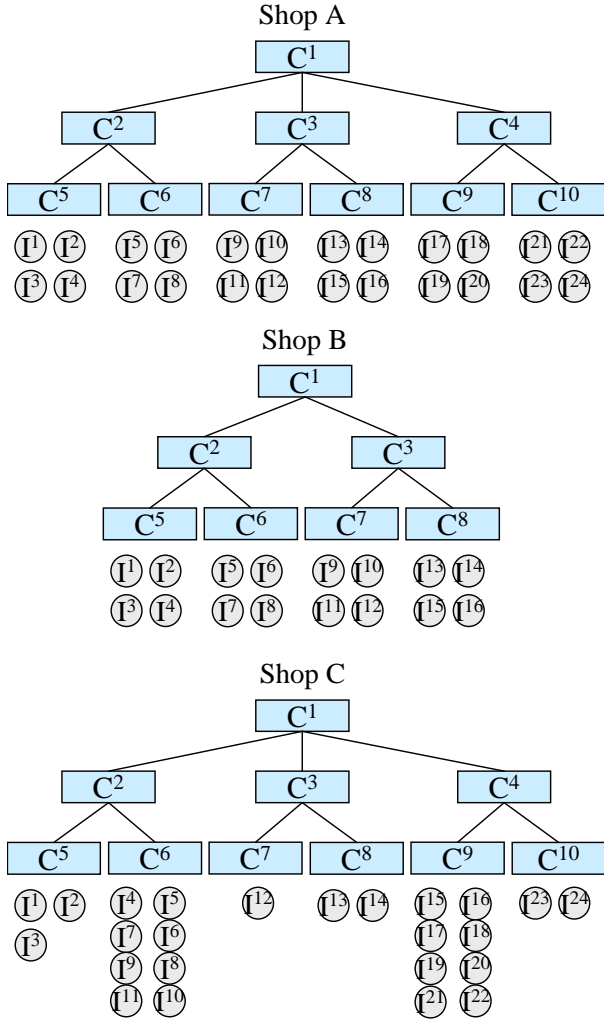


Figure 2 Classification by category structures based on viewpoints

where W and D are, respectively, the number of last categories of shop i 's category structure and the number of layers in the category structure of a parent category with items X .

$$Uniformity(X, i) = \frac{1}{1 + \sigma} \quad (3)$$

$$\sigma = \sqrt{\frac{1}{p} \sum_{l=1}^p \left(C(X, i, l) - \frac{\sum_{l=1}^p C(X, i, l)}{p} \right)^2} \quad (4)$$

where C is the number of items belonging to category l . This category l is one of last categories of shop i 's parent category structure with items X . σ is a standard deviation of the number of items belonging to end categories of shop i 's parent category structure with items X . Intuitively, *Uniformity* means the degree of uniformity in quantities of items belonging to end categories. Figure 2 shows examples of a shop's degree of specialty based on the item classification method. Shop A's category structure of "C¹" with width six and depth three is more detailed than shop B's

category structure of "C¹" with width four and depth three. Shop A has more uniformity in quantities of items belonging to categories than shop C.

3.2 The Degree of a Shop's Specialty Based on Selection of Items

We consider selection of items to determine a degree of shop specialty. Shops with a large range of items are specialty shops. The degree based on selection of items $S_Score(X, i)$ is calculated using the following expression:

$$S_Score(X, i) = \beta \times \left(Cover(X, i) - \frac{\sum_{n=1}^m Cover(X, n)}{m} \right)^2 + \gamma \times \left(Rare(X, i) - \frac{\sum_{n=1}^m Rare(X, n)}{m} \right)^2 \quad (5)$$

$$\beta = \begin{cases} 1 & \left(Cover(X, i) \geq \frac{\sum_{n=1}^m Cover(X, n)}{m} \right) \\ -1 & (other) \end{cases} \quad (6)$$

$$\gamma = \begin{cases} 1 & \left(Rare(X, i) \geq \frac{\sum_{n=1}^m Rare(X, n)}{m} \right) \\ -1 & (other) \end{cases} \quad (7)$$

where the function *Cover* returns a degree of the quantities of all items, and the function *Rare* returns a degree of selection of hard-to-find items of a point of view based on browsed items X in shop i . *Cover* and *Rare* of shop i based on items X is calculated as follows:

$$Cover(X, i) = \frac{|G(X, i)|}{|\bigcup_{n=1}^m G(X, n)|} \quad (8)$$

where G is a set of items of a viewpoints based on items X in shop i . The function *Cover* returns the ratio of the number of G of a viewpoint based on items X in shop i to the number of G of the viewpoint based on items X in all shops. Intuitively, *Cover* means the degree of quantities of items of a viewpoint based on browsed items X .

Figure 3 shows examples of shops' degree of specialty based on *Cover*. Because Shop D's "C¹" category has more items than Shop E's "C¹" category, Shop D is more specialized for a viewpoint as "C¹" based on *Cover* than Shop E.

$$Rare(X, i) = \sum_{o \in G(X, i)} R(X, o) \quad (9)$$

$$R(X, o) = \begin{cases} e^{-\log\left(\frac{|S(X \cup o)|}{|S(X)|}\right)} - 1 & (|S(X \cup o)| \leq \delta \times |S(X)|) \\ 0 & (other) \end{cases} \quad (10)$$

where G is a set of items of a viewpoint based on items X in shop i . S is a set of shops having items X and item o the

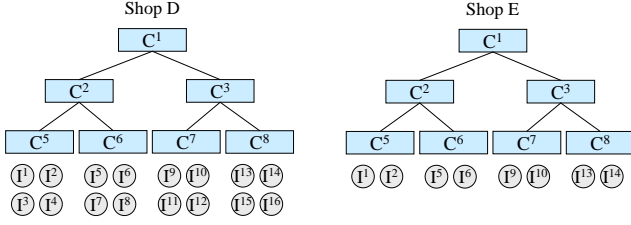


Figure 3 Quantity of items based on a viewpoint

same as one of $G(X, i)$. Using S , we determine an item o 's rarity $R(X, o)$. R returns a item o 's rarity. When number of $S(X \cup o)$ is δ ($0.0 \leq \delta \leq 1.0$) of number of $S(X)$ and over, $R(X, o)$ is 0.

Figure 4 shows examples of items' rarity. Because items I^1 , I^2 , I^3 and I^4 belong to Shop A, Shop B, and Shop C, they are not rare. However, item I^5 is rare, because it belongs only to Shop A. Intuitively, *Rare* means the degree of selection of hard-to-find items that most shops do not have.

3.3 The Degree of a Shop's Specialty Based on the Main Target

We consider that all of a shop's items match a viewpoint of browsed items. Shops having only items of a viewpoint of browsed items are specialty shops. The degree based on the main target of a shop is calculated using the following expression:

$$Precision(X, i) = \frac{\log |G(X, i)|}{\log |N(i)|} \quad (11)$$

where G is a set of items of a viewpoint based on items X in shop i . N is a set of items in shop i . The function *Precision* returns the ratio of the number of G to the number of N .

4. Examples of Calculating Shops' Specialties Based on Viewpoints

We calculated the degree of specialty of shops in rakuten.co.jp based on the three viewpoints "Emergency Supplies," "Outdoor," and "Kitchen & Dining" (see TABLE 1). We collected 50 shops to each viewpoints by using the The Rakuten Item Search API In the experiment, we calculated the degrees of these shops' specialty based on viewpoints (see TABLE 2, TABLE 3, TABLE 4). We present the calculation results in TABLE 5, TABLE 6 and TABLE 7, showing *Detail*, *Uniformity*, *Cover*, *Rare*, *Precision*, *C_Score* and *S_Score*.

TABLE 5 shows that Shop anzenlif and Shop bousaikan have high degrees of specialty based on the classification method (*C_Score*). Because these shops have a relatively detailed category structure of "Emergency Supplies" and deal effectively with it, these shops are specialty shops in terms of the classification method. Therefore, it is believed that the *C_Score* values of these shops are reasonable. In con-

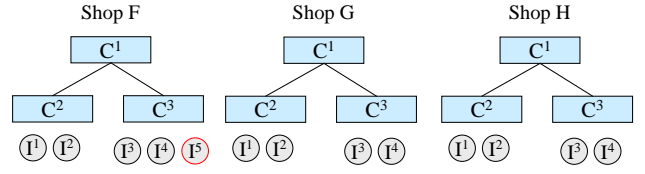


Figure 4 Rarity of items

trast, Shop maxshare, Shop royal3000, etc. have a low degree of *C_Score*. Shop maxshare's category structure and Shop royal3000's category structure of "Emergency Supplies" are each composed of only one category, so these shops are not specialty shops in terms of the classification method. Shop bousaianshin has the most detailed category structure. However, this shop could not deal effectively with the category structure. Therefore, this shop is not a specialty shop in terms of the classification method and its low degree of *C_Score* is reasonable.

Shop bousaianshin has a high degree based on selection of goods (*S_Score*), and its *Cover* is very high. Thus, this shop has enormously many items based on the viewpoint "Emergency Supplies." In addition, selection of hard-to-find items (*Rare*) in this shop is very high. Similarly, because Shop mitsuyoshi, Shop r-kojima and Shop bousaiss have relatively many items based on the viewpoint, these shops also have high degrees of *Cover* and *Rare*. It may be suspected that *Rare* tends to be high if *Cover* is high. However, this is an undesirable outcome. If a shop has many items, the degree of *Rare* must be low when the shop does not have many hard-to-find items. We suspect that the cause of the problem is a method of determining whether a item in a shop is had other shops. The Rakuten Item Search API can not retrieve JAN (Japanese Article Number). Instead of using JAN, we use item names qualified by each shops to determine whether a item in a shop is had other shops. Therefore, accuracy of the method is low. We need to modify the method.

Shops having a high degree of *Precision* are Shop bousaiss, Shop bouhanbousai, Shop bousai-web, etc. All items in these shops are of the viewpoint "Emergency supplies," so they are shops as a whole targeting emergency supplies. Therefore, we believe that the *Precision* values of these shops are reasonable.

Results of calculation by our method shown by TABLE 6 and TABLE 7 denote the same tendency of results shown by TABLE 5. Thus, we confirmed that our method to calculate the degree of specialty of shops based on a classification method of Items (*C_Score*) and a main target of a shop (*Precision*) could determine specialty shops. On the other hand, our method to calculate the degree of specialty of shops based on selection of items (*S_Score*) could not de-

termine specialty shops. However, it may be suspected that S_Score could determine specialty shops if not considering hard-to-find items (*Rare*).

5. Conclusion

In this paper, we proposed a method for determining degree of shops' specialty based on a viewpoint extracted by using category structures of online shops to build a recommender system for specialty shops based on viewpoints of items browsed by users. In addition, to verify the our method, we calculated the degree of specialty of shops in rakuten.co.jp based on the viewpoint "Emergency Supplies," "Outdoor," and "Kitchen & Dining"

As future work, we intend to repeat the experiment after we modify a method for determining whether a item in a shop belongs to other shops in order to verify the method for calculating *Rare*. Then, we need to evaluate the usability of the recommendations of specialty shops determined by our method to confirm that it can match user viewpoints.

Acknowledgment

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Table 1 Experimental data: shop data

Viewpoint	The number of shops
Emergency Supplies	50
Outdoor	50
Kitchen & Dining	50

Table 2 Experimental data: shop data based on "Emergency Supplies"

Shop's Name	The number of items	The number of item based on the viewpoint	The category structure depth	The category structure width
japan-1	5293	78	2	3
amnakuya	1149	1097	5	108
anzenlife	405	403	5	146
be-kan	714	707	5	173
bousaianshin	13324	13286	5	194
bousaikan	1190	259	5	70
bousaiss	441	441	3	48
ganpon	511	433	5	75
saibou	487	238	4	77
wowsystem	914	108	2	7
bouhanbousai	14	14	2	8
bousai-web	237	237	3	53
gekiyasukaguya	6805	38	2	8
maxshare	608	23	1	1
murauchi-denki	236906	123	2	5
onestep	33204	82	2	4
royal3000	1527	18	1	1
smile-hg	4648	133	4	9
ecojiji	975	17	3	4
r-kojima	25291	424	3	5
kaumall	52031	215	2	6
your-shop	2313	113	2	12
auc-tokutoku	1218	38	2	5
good-choice	6633	195	2	5
mitsuoyoshi	4425	958	5	25
matsukiyo	14879	28	1	1
otakaratuhan	3508	12	1	1
santecdirect	28939	205	1	1
the-eikoh	936	26	1	1
tsuruha	17413	96	2	1
ouchimawari	1370	11	1	1
mercurys	1873	15	1	1
ecdexin	14943	12	1	1
exsmile	2419	39	1	1
ssn	2325	4	1	1
okuwa	2199	39	2	4
colecocle	615	73	1	1
ksheep1	9530	32	1	1
k-yokohama	2402	35	2	1
wellness-web	18639	101	2	1
ichibankanshop	16058	24	1	1
wide02	4660	143	2	9
neotec-bafa	31789	168	1	1
yamalab	475	37	1	1
e-kitchen	18046	65	1	1
brico	6498	108	2	10
bungu-kaumall	48158	209	2	6
sekichu	12109	89	1	1
varietyshop	2914	22	1	1
sanbless	8914	49	1	1

Table 3 Experimental data: shop data based on “Outdoor”

Shop's Name	The number of items	The number of item based on the viewpoint	The category structure depth	The category structure width
kaumall	52031	316	3	12
your-shop	2313	70	2	6
gmart	1508	16	1	1
good-choice	6633	704	3	22
ecdenxin	14943	752	1	1
k-yokohama	2402	151	1	1
ichibankanshop	16058	281	2	4
comroad	41174	324	2	11
wide02	4660	181	2	7
atmall-pumpkin	2541	131	1	1
neotec-bafa	31789	347	2	6
yamalab	475	283	4	27
hikers	212	211	5	56
e-kitchen	18046	82	3	5
echigoya-online-shop	6246	332	1	1
brico	6498	63	2	11
bungu-kaumall	48158	304	4	11
sekichu	12109	162	2	12
narukiya	3726	81	1	1
varietyshop	2914	65	1	1
p-tano	18464	73	1	1
userlife	155	46	4	10
item-land	9120	7	2	1
fieldlife	499	497	7	123
angelcitiz	10090	54	1	1
genkimart	140	1	1	1
nadeshico-ga	7928	234	2	4
sanbless	8914	15	1	1
sunruck-direct	4810	191	2	4
ripistation	51151	280	3	11
tokyo-hyakkaten	707	5	1	1
magimaguu	1647	39	1	1
livinza	4298	2	1	1
japan-l	5293	103	2	3
auc-bigmo	835	98	3	10
cocoroco	3290	153	1	1
basecamp	1492	1485	6	171
toolex	1723	353	2	2
netonya	4434	245	4	22
auc-pleasure0905	1970	51	1	1
fashion-kosen	32912	966	2	8
hab	8519	6288	4	123
marumoto	3698	328	2	11
hows	43469	343	2	11
ap-zakka	41220	340	2	11
nst21	4622	76	1	1
venusta	374	3	1	1
pedalmania	2967	16	1	1
emishop	884	29	1	1
auc-power	724	8	2	1

Table 4 Experimental data: shop data based on “Kitchen & Dining”

Shop's Name	The number of items	The number of item based on the viewpoint	The category structure depth	The category structure width
r-kojima	25291	69	1	1
ecoji	975	36	2	4
kaumall	52031	547	3	18
plywood	4711	219	3	7
auc-tokutoku	1218	97	2	7
good-choice	6633	4339	4	139
matsukiyo	14879	396	1	1
otakaratuhan	3508	25	2	2
santecedirect	28939	183	2	4
ouchimawari	1370	24	3	4
mercurys	1873	15	1	1
ecdenxin	14943	875	2	2
exsmile	2419	545	3	8
ksheep1	9530	369	3	39
k-yokohama	2402	323	3	13
wellness-web	18639	827	3	19
ichibankanshop	16058	14	2	1
comroad	41174	1102	3	18
wide02	4660	747	4	43
neotec-bafa	31789	185	3	22
echigoya-online-shop	6246	707	3	29
brico	6498	103	2	14
sekichu	12109	329	2	10
narukiya	3726	449	3	10
neoleaf	60945	9118	4	35
varietyshop	2914	77	2	2
hb-navi	9361	4	1	1
nadeshico-ga	7928	861	5	29
sanbless	8914	603	3	21
richell	2822	299	2	9
livingearth	518	62	4	15
sunruck-direct	4810	285	3	20
katuhara	7994	52	2	5
aires	2525	394	4	13
ozshop	4516	1	1	1
ripistation	51151	531	3	17
raison-store	1056	343	4	38
tokyo-hyakkaten	707	2	1	1
joyfullmart	1041	669	5	29
magimaguu	1647	37	2	1
livinza	4298	443	4	30
aandi	845	426	2	2
zakkashop	2714	330	3	32
cherrybell	966	104	3	12
zaka-mmc	4992	951	5	70
dan-dan	1217	97	1	1
rgbw	3701	194	4	26
tubasa55	935	105	3	20
shopmarna	472	102	3	9
japan-l	5293	298	3	9

Table 5 Experimental results: Degree of specialty based on “Emergency Supplies”

Shop's name	Detail	Uniformity	Cover	Rare	Precision	C_Score	S_Score
japan-l	0.0052	0.4450	0.0041	0.0054	0.5081	0.0006	-0.0008
anmakuya	0.5562	0.0326	0.0123	0.0222	0.9934	0.0045	-0.0001
anzenlife	0.7523	0.0918	0.0089	0.0119	0.9992	0.0173	-0.0004
be-kan	0.8916	0.0349	0.0079	0.0141	0.9985	0.0078	-0.0004
bousaianshin	1.0000	0.0062	0.6642	1.0000	0.9997	0.0015	1.3570
bousaikan	0.3602	0.2064	0.0107	0.0153	0.7847	0.0186	-0.0003
bousaiss	0.1476	0.0587	0.0222	0.0277	1.0000	0.0022	0.0000
ganpon	0.3860	0.0707	0.0170	0.0244	0.9734	0.0068	0.0000
saibou	0.3168	0.1094	0.0099	0.0126	0.8843	0.0087	-0.0004
wowsystem	0.0134	0.0704	0.0060	0.0106	0.6867	0.0002	-0.0006
bouhanbousai	0.0155	0.4617	0.0007	0.0006	1.0000	0.0018	-0.0012
bousai-web	0.1631	0.0343	0.0110	0.0153	1.0000	0.0014	-0.0003
gekiyasukaguya	0.0155	0.1628	0.0021	0.0036	0.4122	0.0006	-0.0010
maxshare	0.0000	1.0000	0.0013	0.0020	0.4891	0.0000	-0.0011
murauchi-denki	0.0093	0.0661	0.0066	0.0095	0.3889	0.0002	-0.0006
onestep	0.0072	0.0514	0.0045	0.0055	0.4233	0.0001	-0.0008
royal3000	0.0000	1.0000	0.0010	0.0013	0.3943	0.0000	-0.0012
smile-hg	0.0361	0.0945	0.0074	0.0129	0.5791	0.0009	-0.0004
ecojiji	0.0114	0.2380	0.0006	0.0008	0.4117	0.0007	-0.0012
r-kojima	0.0144	0.0340	0.0213	0.0348	0.5967	0.0001	0.0000
kaumall	0.0114	0.0573	0.0104	0.0105	0.4946	0.0002	-0.0005
your-shop	0.0237	0.1600	0.0055	0.0086	0.6103	0.0009	-0.0006
auc-tokutoku	0.0093	0.1936	0.0020	0.0033	0.5120	0.0004	-0.0010
good-choice	0.0093	0.0246	0.0108	0.0194	0.5992	0.0001	-0.0002
mitsuyoshi	0.1280	0.0283	0.0520	0.0802	0.8177	0.0009	0.0036
matsukiyo	0.0000	1.0000	0.0015	0.0011	0.3468	0.0000	-0.0011
otakaratuuhan	0.0000	1.0000	0.0007	0.0009	0.3044	0.0000	-0.0012
santedirect	0.0000	1.0000	0.0106	0.0188	0.5182	0.0000	-0.0002
the-eikoh	0.0000	1.0000	0.0010	0.0015	0.4762	0.0000	-0.0011
tsuruha	0.0010	1.0000	0.0054	0.0095	0.4674	0.0003	-0.0006
ouchimawari	0.0000	1.0000	0.0005	0.0005	0.3320	0.0000	-0.0012
mercurys	0.0000	1.0000	0.0008	0.0011	0.3594	0.0000	-0.0012
ecdexin	0.0000	1.0000	0.0003	0.0002	0.2585	0.0000	-0.0012
exsmile	0.0000	1.0000	0.0021	0.0033	0.4702	0.0000	-0.0010
ssn	0.0000	1.0000	0.0002	0.0000	0.1788	0.0000	-0.0013
okuwa	0.0072	0.1008	0.0022	0.0017	0.4760	0.0002	-0.0011
colecocle	0.0000	1.0000	0.0037	0.0063	0.6681	0.0000	-0.0008
ksheep1	0.0000	1.0000	0.0018	0.0024	0.3783	0.0000	-0.0011
k-yokohama	0.0010	1.0000	0.0020	0.0031	0.4567	0.0003	-0.0010
wellness-web	0.0010	1.0000	0.0056	0.0100	0.4693	0.0003	-0.0006
ichibankanshop	0.0000	1.0000	0.0013	0.0021	0.3282	0.0000	-0.0011
wide02	0.0175	0.0569	0.0074	0.0120	0.5875	0.0002	-0.0005
neotec-bafa	0.0000	1.0000	0.0086	0.0125	0.4943	0.0000	-0.0004
yamalab	0.0000	1.0000	0.0020	0.0032	0.5859	0.0000	-0.0010
e-kitchen	0.0000	1.0000	0.0036	0.0050	0.4259	0.0000	-0.0009
brico	0.0196	0.1279	0.0058	0.0101	0.5333	0.0006	-0.0006
bungu-kaumall	0.0114	0.0655	0.0103	0.0101	0.4955	0.0002	-0.0005
sekichu	0.0000	1.0000	0.0049	0.0083	0.4774	0.0000	-0.0007
varietyshop	0.0000	1.0000	0.0010	0.0012	0.3875	0.0000	-0.0012
sanbless	0.0000	1.0000	0.0025	0.0038	0.4279	0.0000	-0.0010

Table 6 Experimental results: Degree of specialty based on “Outdoor”

Shop's name	Detail	Uniformity	Cover	Rare	Precision	C_Score	S_Score
kaumall	0.0341	0.0612	0.0195	0.0529	0.5300	0.0005	0.0000
your-shop	0.0107	0.1240	0.0040	0.0103	0.5485	0.0003	-0.0016
gmart	0.0000	1.0000	0.0010	0.0027	0.3788	0.0000	-0.0023
good-choice	0.0634	0.0406	0.0442	0.1264	0.7451	0.0006	0.0069
ecdexin	0.0000	1.0000	0.0430	0.1210	0.6890	0.0000	0.0060
k-yokohama	0.0000	1.0000	0.0094	0.0266	0.6446	0.0000	-0.0005
ichibankanshop	0.0068	0.1479	0.0174	0.0441	0.5822	0.0003	0.0000
comroad	0.0205	0.0013	0.0203	0.0251	0.5440	0.0000	-0.0005
wide02	0.0127	0.0744	0.0107	0.0302	0.6154	0.0002	-0.0004
atmall-pumpkin	0.0000	1.0000	0.0082	0.0109	0.6218	0.0000	-0.0014
neotec-bafa	0.0107	0.0608	0.0202	0.0514	0.5642	0.0002	0.0000
yamalab	0.1044	0.0869	0.0103	0.0286	0.9160	0.0023	-0.0004
hikers	0.2722	0.1275	0.0020	0.0055	0.9991	0.0087	-0.0020
e-kitchen	0.0137	0.4415	0.0052	0.0146	0.4496	0.0015	-0.0012
echigoya-online-shop	0.0000	1.0000	0.0132	0.0375	0.6642	0.0000	-0.0001
brico	0.0205	0.2323	0.0038	0.0107	0.4719	0.0012	-0.0016
bungu-kaumall	0.0420	0.0591	0.0187	0.0497	0.5302	0.0006	0.0000
sekichu	0.0224	0.0885	0.0101	0.0277	0.5411	0.0005	-0.0005
narukiya	0.0000	1.0000	0.0051	0.0119	0.5344	0.0000	-0.0014
varietyshop	0.0000	1.0000	0.0038	0.0098	0.5233	0.0000	-0.0016
p-tano	0.0000	1.0000	0.0046	0.0129	0.4368	0.0000	-0.0014
userlife	0.0380	0.2182	0.0007	0.0019	0.7591	0.0021	-0.0024
item-land	0.0010	1.0000	0.0002	0.0005	0.2134	0.0002	-0.0025
fieldlife	0.8390	0.0401	0.0056	0.0144	0.9994	0.0084	-0.0012
angelcitiz	0.0000	1.0000	0.0034	0.0084	0.4327	0.0000	-0.0017
genkimart	0.0000	1.0000	0.0001	0.0000	0.0000	0.0000	-0.0026
nadeshico-ga	0.0068	0.0441	0.0147	0.0413	0.6076	0.0001	-0.0001
sanbless	0.0000	1.0000	0.0009	0.0022	0.2977	0.0000	-0.0023
sunruck-direct	0.0068	0.1627	0.0119	0.0306	0.6195	0.0003	-0.0003
ripistation	0.0312	0.0536	0.0173	0.0455	0.5197	0.0004	0.0000
tokyo-hyakkaten	0.0000	1.0000	0.0003	0.0007	0.2453	0.0000	-0.0025
magimaguu	0.0000	1.0000	0.0020	0.0056	0.4946	0.0000	-0.0020
livinza	0.0000	1.0000	0.0001	0.0002	0.0829	0.0000	-0.0026
japan-l	0.0049	0.0307	0.0063	0.0168	0.5405	0.0000	-0.0011
auc-bigmo	0.0283	0.1406	0.0036	0.0080	0.6815	0.0010	-0.0018
cooroco	0.0000	1.0000	0.0096	0.0274	0.6211	0.0000	-0.0005
basecamp	1.0000	0.0382	0.0614	0.1464	0.9994	0.0096	0.0117
toolex	0.0029	0.1538	0.0222	0.0631	0.7873	0.0001	0.0003
netonya	0.0849	0.1170	0.0080	0.0227	0.6551	0.0025	-0.0007
auc-pleasure0905	0.0000	1.0000	0.0032	0.0088	0.5183	0.0000	-0.0017
fashion-kosen	0.0146	0.0132	0.0303	0.0870	0.6608	0.0000	0.0017
hab	0.4790	0.0082	0.3715	1.0000	0.9664	0.0010	1.0322
marumoto	0.0205	0.0828	0.0204	0.0557	0.7051	0.0004	0.0001
hows	0.0205	0.0017	0.0215	0.0263	0.5466	0.0000	-0.0004
ap-zakka	0.0205	0.0030	0.0213	0.0264	0.5485	0.0000	-0.0004
nst21	0.0000	1.0000	0.0046	0.0103	0.5132	0.0000	-0.0016
venusta	0.0000	1.0000	0.0002	0.0002	0.1854	0.0000	-0.0026
pedalmania	0.0000	1.0000	0.0010	0.0027	0.3468	0.0000	-0.0023
emishop	0.0000	1.0000	0.0016	0.0040	0.4963	0.0000	-0.0022
auc-power	0.0010	1.0000	0.0005	0.0013	0.3158	0.0002	-0.0024

Table 7 Experimental results: Degree of specialty based on
“Kitchen & Dining”

Shop's name	<i>Detail</i>	<i>Uniformity</i>	<i>Cover</i>	<i>Rare</i>	<i>Precision</i>	<i>C_Score</i>	<i>S_Score</i>
r-kojima	0.0000	1.0000	0.0027	0.0101	0.4176	0.0000	-0.0044
ecojiji	0.0126	0.1907	0.0014	0.0058	0.5207	0.0006	-0.0050
kaumall	0.0955	0.0101	0.0197	0.0782	0.5805	0.0002	0.0000
plywood	0.0360	0.0271	0.0059	0.0254	0.6372	0.0002	-0.0026
auc-tokutoku	0.0234	0.0308	0.0026	0.0109	0.6439	0.0002	-0.0043
good-choice	1.0000	0.0347	0.1691	0.7362	0.9518	0.0087	0.4608
matsukiyo	0.0000	1.0000	0.0153	0.0611	0.6226	0.0000	-0.0002
otakaratuuhan	0.0054	0.4000	0.0005	0.0020	0.3943	0.0005	-0.0056
santecedirect	0.0126	0.0285	0.0072	0.0296	0.5071	0.0001	-0.0021
ouchimawari	0.0198	0.3266	0.0003	0.0010	0.4400	0.0016	-0.0057
mercurys	0.0000	1.0000	0.0006	0.0024	0.3594	0.0000	-0.0055
ecdenxin	0.0054	1.0000	0.0325	0.1336	0.7048	0.0014	0.0037
exsmile	0.0414	0.0286	0.0071	0.0308	0.8087	0.0003	-0.0020
ksheep1	0.2090	0.0663	0.0133	0.0513	0.6451	0.0035	-0.0006
k-yokohama	0.0685	0.0683	0.0117	0.0464	0.7422	0.0012	-0.0008
wellness-web	0.1009	0.0323	0.0324	0.1418	0.6832	0.0008	0.0047
ichibankanshop	0.0018	1.0000	0.0005	0.0021	0.2725	0.0005	-0.0055
comroad	0.0955	0.0096	0.0428	0.1754	0.6592	0.0002	0.0108
wide02	0.3081	0.0433	0.0134	0.0560	0.7833	0.0033	-0.0004
neotec-bafa	0.1171	0.0533	0.0065	0.0235	0.5036	0.0016	-0.0027
echigoya-online-shop	0.1550	0.0436	0.0173	0.0739	0.7507	0.0017	0.0000
brico	0.0486	0.1073	0.0040	0.0172	0.5279	0.0013	-0.0035
sekichu	0.0342	0.0374	0.0129	0.0544	0.6165	0.0003	-0.0004
narukiya	0.0523	0.0436	0.0149	0.0561	0.7427	0.0006	-0.0003
neoleaf	0.2505	0.0042	0.2954	1.0000	0.8276	0.0003	0.9334
varietyshop	0.0054	0.1429	0.0027	0.0104	0.5445	0.0002	-0.0043
hb-navi	0.0000	1.0000	0.0002	0.0004	0.1516	0.0000	-0.0058
nadeshico-ga	0.2595	0.0572	0.0202	0.0848	0.7527	0.0037	0.0001
sanbless	0.1117	0.0209	0.0202	0.0856	0.7039	0.0006	0.0001
richell	0.0306	0.0320	0.0113	0.0444	0.7175	0.0002	-0.0009
livingearth	0.1063	0.2857	0.0012	0.0047	0.6603	0.0076	-0.0051
sunruck-direct	0.1063	0.0582	0.0100	0.0403	0.6667	0.0015	-0.0012
katuhara	0.0162	0.1261	0.0020	0.0067	0.4397	0.0005	-0.0049
aires	0.0919	0.0935	0.0139	0.0539	0.7629	0.0021	-0.0004
ozshop	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	-0.0059
ripistation	0.0901	0.0096	0.0188	0.0745	0.5787	0.0002	0.0000
raison-store	0.2721	0.0690	0.0073	0.0300	0.8385	0.0047	-0.0021
tokyo-hyakkaten	0.0000	1.0000	0.0001	0.0002	0.1056	0.0000	-0.0058
joyfullmart	0.2595	0.0322	0.0101	0.0439	0.9364	0.0021	-0.0010
magimaguu	0.0018	1.0000	0.0014	0.0057	0.4875	0.0005	-0.0050
livinza	0.2144	0.0495	0.0170	0.0699	0.7284	0.0027	0.0000
aandi	0.0054	0.0057	0.0165	0.0704	0.8984	0.0000	0.0000
zakkashop	0.1712	0.0575	0.0043	0.0187	0.7335	0.0025	-0.0033
cherrybell	0.0631	0.1626	0.0028	0.0118	0.6757	0.0026	-0.0042
zaka-mm	0.6288	0.0692	0.0329	0.1212	0.8053	0.0109	0.0024
dan-dan	0.0000	1.0000	0.0038	0.0165	0.6439	0.0000	-0.0036
rgbw	0.1856	0.1436	0.0057	0.0229	0.6411	0.0067	-0.0028
tubasa55	0.1063	0.1455	0.0032	0.0122	0.6803	0.0039	-0.0041
shopmarna	0.0468	0.0690	0.0032	0.0134	0.7512	0.0008	-0.0039
japan-l	0.0468	0.0111	0.0108	0.0434	0.6645	0.0001	-0.0010