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<https://hdl.handle.net/2324/776801>

出版情報 : Proceedings of the 2012 IIAI International Conference on Advanced Applied Informatics, IIAIAI 2012, pp.112-116, 2012-12-14

バージョン :

権利関係 :



Extraction of Tourist Behavior Contexts from Blog by Verbs and Their Objects

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Abstract—Blog articles by tourists contain interesting and personal experiences of where and how they have gone, what they have done and what they thought. Such individual experiences are helpful in many cases compared to the general and official information about the tourist resort by tourist agents. However, it is not easy to choose related articles and to extract still more nearly required information from these unsorted blog articles. This paper proposes a technique of feature extraction by dependency analysis of verbs and objects in those sentences that describe tourist's behavior. This paper applied the method to 7,917,385 blog articles on Kyushu area and reports some analysis on "where and what did they eat" as case studies.

I. INTRODUCTION

The tourist resorts and the touristic institutions have special feature on their own. However, it is not easy to give a potential visitor that information. The tourist agencies already have been making advertisements and campaigns using media in order to get many tourists to come, before the Internet age. Now, they are making an effort to let many people know the special feature of the area or a store using the sightseeing portal site and the original Web page. Some tourists choose a destination using these pieces of Web information, and are enjoying the special feature of the visited area.

On the other hand, blog articles have the information about different individual experience from the information distributed officially. The tourist who actually went to the tourist resort may find by himself the special feature seldom known in addition to the known special feature got in advance, and may enjoy it. Or by a visitor's viewpoint, they may have the information and evaluation which are different from the offer side about the existing special feature. Such the special feature and information that were experienced by the tourist are based on personal experience, and were only shared only among very familiar persons before. However, generally they came to be exhibited by the blog article which described an individual travel record and individual experience now. Such information found out by the tourists is useful also for the tourist that the destination will be decided, the tourist agent who wants to improve the type of service and also for the self-governing body which wants to find out the new special feature of tourism.

However, it is not easy to extract the information appropriately from the blog articles indicated without being arranged, and to use it. In this paper, description of tourists' action

(Tourist Behavior) in blog articles attracted attention. Specifically, the analysis unit of tourism behavior was a three-piece set of the target (noun) of the behavior, the verb of behavior, and the particle that connects them. Their set obtained by the dependency analysis. By extracting such basic data and analyzing them by a statistical method, the typical noun was extracted with typical tourism behavior.

II. EXTRACTION OF TOURIST BEHAVIOR

A. Tourist Behavior

In many cases, tourists will do behavior similar at a tourist resort. We thought it possible to get to know behavior of tourism which is not contained in the existing tourism information by gathering such behavior. Tourism behavior is usually the combination of general action and its object. Therefore, we decided to describe tourism behavior by the set of an object and behavior.

We extract the noun n_i with Verb v_k and Particle p_j first. We defined the set (n_i, p_j, v_k) as behavior.

The behavior which appears in high frequency at the blog article about one area is surely behavior peculiar to the area. We call it tourism behavior.

B. Ranking Method

We consider evaluating the characteristic tourism behavior for every area. This paper evaluates the noun obtained as an object of behavior after fixing the particle and verb of tourism behavior.

Our previous study [12] performed evaluation by the number of the tourism behavior for every area. However, many general nouns have been extracted.

Therefore, the following two points were improved in this paper. The first point is using the deviation of the frequency of appearance of the noun for every area for evaluation. The second point is not having used tourism behavior for evaluation of a noun, but having used the frequency of appearance of the noun in the blog article of an area. Thereby, more information can be used now for selection of object.

This procedure is shown in the following.

- 1) Let L be a set of the area for analysis, and let ℓ be an area belonging to L .
- 2) Let S be a set of all blog articles, and let s_ℓ be a subset which consists of blog articles relevant to ℓ among S .

- 3) We extract the noun which appears in blog article set s_ℓ with p and v by a Japanese dependency analysis. Let N_ℓ be the noun set. Moreover, let N be the set union of N_ℓ for every ℓ .
- 4) We count up number of occurrences $\text{Freq}(n_i, \ell)$ in s_ℓ for $n_i \in N$. We normalize it in the total of the blog articles of the area. Normalized $\text{Freq}'(n_i, \ell)$ is the following formula.

$$\text{Freq}'(n_i, \ell) = \frac{\text{Freq}(n_i, \ell)}{|s_\ell|}.$$

- 5) For each noun $n_i \in N$, the deviation score DS of the number of occurrences for each area is calculated by the following formula.

$$\text{DS}(n_i, \ell) = \frac{10(\text{Freq}'(n_i, \ell) - \mu_\ell)}{\sigma_\ell} + 50$$

where $\sigma_\ell \neq 0$,

$$\mu_\ell = \frac{1}{|L|} \sum_{i=1}^{|L|} \text{Freq}'(n_i, \ell) \text{ and}$$

$$\sigma_\ell = \sqrt{\frac{1}{|L|} \sum_{i=1}^{|L|} (\text{Freq}'(n_i, \ell) - \mu_\ell)^2}.$$

- 6) All nouns are sorted in order of deviation score DS, and nouns with large deviation score are taken up.

III. BASIC DATA

7,917,385 blog articles relevant to the Kyushu area were gathered using a Web crawler. The blog articles containing each prefecture name of Kyushu were extracted from them, and they were made into the information about each prefecture. The number of the blog articles about each prefecture is shown in Table I.

TABLE I
NUMBER OF BLOG ARTICLES

Area (Prefecture)	Number of Blog Articles
Fukuoka	152,421
Saga	22,042
Kumamoto	38,799
Ooita	76,580
Nagasaki	33,711
Miyazaki	38,954
Kagoshima	36,230
Okinawa	114,132

IV. EXTRACTION AND ANALYSIS

In this paper, we decided eight prefectures in the Kyushu area to be the targets for analysis. Furthermore, the following three points were noted as information relevant to the tourism of an area. (1) What is eaten in the area? (2) Where are they eaten in the area? (3) Destination. We tried extraction of this information. The blog articles of Sec. III were used as target data.

A. What does a tourist eat there?

At almost all tourist resorts, the specialty of an area is advertised, and a tourist eats them, or purchases it as a souvenir. However, there are many obscure local specialties ordinarily eaten in the area in addition to them. In recent years, the food which was not advertised as a specialty of an area attracts attention as new resources for tourism in many cases. The attempt which picks out an obscure specialty as new resources for tourism is performed, such as a contest called “Class B gourmet”.

In this section, what is eaten regionally is clarified by extracting the target of the behavior “eat” in blog articles. Specifically, the noun were gathered with the particle “を” for the verb “食べる”.

Deviation score was calculated using the formula of the foregoing paragraph. Only the noun which appeared two times or more is the target of processing in order to avoid the rare occurrence of a word unrelated to the information on an area. 34 nouns had the same, highest deviation score. In order of the value of TF, the extracted noun is shown in Table II.

Most obtained nouns were what is eaten regionally as local specialties. These are felt more suitable than the noun extracted by previous study [12]. Although “沖縄限定品” and “沖縄ランチ” are not the names of a concrete dish, they are generic descriptions of cooking. Therefore, they are simple to remove depending on necessity.

“牛さん豚さん” is not general description. It occurred frequently about the foot-and-mouth-disease damage generated in Miyazaki in 2010.

“一人ケーキ” and “たくさんごちそう” are the compounds which are not correct. Therefore, it is necessary to improve construction of the compound in a morphological analysis.

“郷土料理屋さん” has been extracted by the mistake in a dependency analysis.

B. Where does a tourist eat there?

As tourism information, the information where we eat is also important. Nouns with the particle which deduces a place. The nouns depending on a verb “it eats”. Therefore, we extracted nouns depending on verb “食べる” with the particle “で” which deduces a place.

The number of occurrences performed ranking using the valuation plan of the foregoing paragraph about two or more nouns. The extraction result of 30 higher ranks is shown in table III.

The names of stores and facilities which were appropriately extracted as a place of behavior to “eat” are the following 12 nouns: “ピロティー”, “福岡空港内”, “玖珠サービスエリア”, “梅月堂”, “長崎リンガーハット”, “熊本ワイン工場”, “長浜将軍さん”, “重兵衛”, “菊井カツ”, “香港苑”, “鮎文” and “鹿児島駅”.

Since “ポツポ市” and “鹿児島フェア” are event names, they will be useful information as the place of behavior to “eat”. In addition, place names, i.e., “奥武島”, “東区若宮”, “中心部天神”, “大嶺崎”, “沖縄市”, “長崎市内”, “大分市内”, “北谷” and “沖縄”, are useful in many cases.

TABLE II
TARGET TO EAT

Ranking	Deviation Score	TF	NG	Noun	Area
1	76.458	37		中身汁 (Nakami-Jiru)	Okinawa
2	76.458	28		牛汁 (Gyu-Jiru)	Okinawa
3	76.458	26		海ブドウ (Umi-Budou)	Okinawa
4	76.458	13		山原そば (Yanbaru-Soba)	Okinawa
5	76.458	7		沖縄限定品 (Limited article in Okinawa)	Okinawa
5	76.458	7		沖縄ランチ (Okinawa lunch)	Okinawa
5	76.458	7		ヤギ料理 (Goat dish)	Okinawa
5	76.458	7		本場長崎ちゃんぽん (Nakasaki Chanpon)	Nagasaki
5	76.458	7	*	牛さん豚さん (Ushi-san Buta-san)	Miyazaki
10	76.458	5		木灰そば (Mokkai-Soba)	Okinawa
10	76.458	5		手作り沖縄そば (Hand-made Okinawa Soba)	Okinawa
10	76.458	5		熊本産馬刺し (Raw horse meat from Kumamoto)	Kumamoto
13	76.458	4		名物シシリアンライス (Speciality Sicilian Rice)	Saga
13	76.458	4		与那国ソバ (Yonaguni-Soba)	Okinawa
13	76.458	4		サイミン (Saimin)	Okinawa
13	76.458	4		半額麺 (Noodles at half price)	Fukuoka
17	76.458	3		宮崎産牛 (Beef from Miyazaki)	Miyazaki
18	76.458	2	*	一人ケーキ (Eating a cake alone)	Saga
18	76.458	2		卵掛けご飯 (Cooked rice with a fresh egg)	Ooita
18	76.458	2		氷宇治金時 (Chipped ice)	Ooita
18	76.458	2		あなご重 (Broiled eels on rice)	Ooita
18	76.458	2		350 円お弁当 (Cheap box lunch)	Ooita
18	76.458	2		白味噌ラーメン (Siro-Miso-Ramen)	Okinawa
18	76.458	2	*	郷土料理屋さん (Regional specialties restaurants)	Okinawa
18	76.458	2		沖縄ちゃんぽん丼 (Okinawa Changpon Don)	Okinawa
18	76.458	2		モズクてんぷら (Mozuku Tempura)	Okinawa
18	76.458	2		タコせんべい (Tako Senbei)	Okinawa
18	76.458	2	*	たくさんごちそう (Many dishes)	Okinawa
18	76.458	2		宮崎黒毛和牛 (Miyazaki premium beef)	Miyazaki
18	76.458	2		宮崎マンゴードロップ (Mango Drops)	Miyazaki
18	76.458	2		年越し魚 (Year-crossing fishes)	Kumamoto
18	76.458	2		焼サバ寿司 (Baked mackerel sushi)	Kumamoto
18	76.458	2		南米風レッドカレー (Red curry of the South America style)	Fukuoka
18	76.458	2		ねぎ丼 (Welsh onion bowl)	Fukuoka

where * are marked on unsuitable (NG) extraction.

“花安謝店” and “思案橋店” are parts of store names, respectively, and are unsatisfactory as information. About 花安謝店, it is failure of a dependency analysis. The store name was “だいこんの花安謝店”. “思案橋店” is only the branch name part of a store. Although it is not a mistake, the procedure which restores the whole store name is needed. They are not suitable although the “神戸オフィス” and “機張” (South Korean place-name) are the names of a place of behavior to “eat”.

“干しイカ” and “焼加減” are the descriptions showing the state of foods. They were extracted in order that a particle “で” might lead the noun showing a state. “膳瀬” is the name of a person extracted by the mistake in a dependency analysis.

You can identify that the scores of Table III are hardly different. Furthermore, the kind of noun changes also with values of TF (Term Frequency). Another rate scale which combined Deviation Score and TF may be necessary.

C. Where does a tourist go there?

The destination for every area is also important. The place to which many people go may be tourism spot. We extracted

nouns depending on verb “行く” with the particle “に”.

The number of occurrences performed ranking using the valuation plan of the foregoing paragraph about two or more nouns. The extraction result of 30 higher ranks is shown in Table IV.

The tourism spot, events, and stores which were appropriately extracted as a destination were the following 19 nouns: “奥武島”, “沖縄市民会館”, “産業祭り”, “西大分駅”, “サンエー経塚シティー”, “福岡魂”, “湯平温泉”, “福岡サンパレスホール”, “府内戦紙”, “サンマリンスタジアム宮崎”, “全島エイサー祭り”, “ゴリラチョップ”, “長崎ペンギン水族館”, “宮崎港”, “大分七夕祭り”, “沖縄物産店”, “カスタムカーショー”, “長崎ちゃんめん” and “生活文化展”.

The particle “に” also has the function which indicates a reason in addition to a destination. “沖縄口ケ”, “沖縄家族旅行” and “沖縄取材” were extracted by the function. Separation of them is a future task.

The remaining words are general place-names. They are suitable as a destination. However, it is depended on the purpose whether it is useful as resources of tourism. If there is necessity, we can remove them using the existing place-name

TABLE III
PLACE OF THE ACT TO EAT

Ranking	Score	TF	NG	Noun	Area
1	76.458	121		奥武島 (Ou-jima)	Okinawa
2	76.458	19	*	花安謝店 (Hana-aja-ten)	Okinawa
2	76.458	19		ピロティ (Pilotis)	Okinawa
4	76.458	17		東区若宮 (Higashi-ku Wakamiya)	Fukuoka
5	76.458	16		福岡空港内 (Inside of Fukuoka Airport)	Fukuoka
6	76.458	14	*	膳瀬 (Zense)	Ooita
7	76.458	7		中心部天神 (Central city, Tenjin)	Fukuoka
8	76.458	5		玖珠サービスエリア (Kusu service area)	Ooita
8	76.458	5		ポッポ市 (Poppo Fair)	Okinawa
8	76.458	5		梅月堂 (Baigetsudo)	Nagasaki
8	76.458	5	*	神戸オフィス (Kobe office)	Fukuoka
8	76.458	5	*	機張 (Gijang)	Fukuoka
13	76.458	4		大嶺崎 (Ufun-mizachi)	Okinawa
13	76.458	4		長崎リンガーハット (Nagasaki Ringer Hut)	Nagasaki
15	76.458	3		熊本ワイン工場 (Kumamoto wine brewery)	kumamoto
15	76.458	3		長浜將軍さん (Pub Nagahama shogun)	Fukuoka
15	76.458	3		重兵衛 (Jubee)	Fukuoka
18	76.458	2		菊井カツ (Kikui-katsu)	Okinawa
18	76.458	2	*	干しイカ (Hoshi-ika)	Okinawa
18	76.458	2	*	思案橋店 (Shianbashiten)	Nagasaki
18	76.458	2		香港苑 (Hongkongyen)	kumamoto
18	76.458	2		鮎文 (Sushibun)	Fukuoka
18	76.458	2	*	焼加減 (A baked condition)	Fukuoka
24	76.456	5800		沖縄市 (Okinawa City)	Okinawa
25	76.455	717		長崎市内 (Inside of Nagasaki)	Nagasaki
26	76.452	1157		大分市内 (Inside of Ooita)	Ooita
27	76.451	2712		北谷 (Chatan)	Okinawa
28	76.449	10		鹿児島フェア (Kagoshima Fair)	Kagoshima
29	76.448	234		鹿児島駅 (Kagoshima Station)	Kagoshima
30	76.446	175624		沖縄 (Okinawa)	Okinawa

where * are marked on unsuitable (NG) extraction.

dictionary.

The method of this paper chiefly extracted only concrete destinations compared with our previous study [12]. However, in order to extract more destinations for tourism, the classification method which used the ranking is required.

V. RELATED WORK

We can find tourism information on Web in (a) tourism portal sites, in (b) general web pages, and in (c) blog articles. There are several systems and researches intended for each target.

Esparcia et al. [2] proposed a recommendation and a clustering system, and showed their effectiveness for tourism portals. Ruiz-Martinez et al. [10] developed a natural language interface for tourism search engine. Saito and Ohuchi [11] proposed “keymaps” that visualizes co-occurrences of keywords in tourism documents. Kinjo and Ohuchi [6] analyzed the patterns in HTML documents that characterize the occurrences of NEs(Named Entity), such as the name of the location and the name of the tourism events. Hao et al. [3] and Ozaku et al. [9] studied the clue words that can be used to extract tourism related to NEs. Ishino et al. [5] reported the characteristic keywords that distinguish tourism blogs from other general blogs. Okumura et al. [8] proposed the method

to extract and classify strong points in sightseeing area as support techniques to develop sightseeing area. Wu et al. [13] reported the difference between tourism information which a local government offers, and tourism information written in blog articles. Hirokawa et al. [4] proposed a search engine that focuses on the usage of onomatopoeic words that appear on tourism blogs. Yin et al. [15], [14] proposed the method of searching a characteristic tourism event in each area. The purpose of this paper is extraction of concrete behavior of tourism, and differs from these studies.

Aizawa and Nakawatase [1] tried the automatic extraction of synonyms with sample phrases using dependency analysis of text. Although this paper also uses a dependency analysis for information extraction, collection of synonyms is not the purpose.

VI. CONCLUSION AND FUTURE WORKS

We have been working on content extraction of tourism blogs by dependency analysis of verbs, particles and nouns. This paper used the deviation of frequencies as an evaluation measure of nouns that are used for the object of the verb. The proposed method performed better than the previous method by the authors in extracting many and interesting nouns. On the other hand, the clues of the extraction in this paper are only

TABLE IV
DESTINATION

Ranking	Score	TF	NG	Noun	Area
1	76.458	121		奥武島 (Ou-jima)	Okinawa
2	76.458	88	*	沖縄ロケ (Location shoot in Okinawa)	Okinawa
3	76.458	83		沖縄市民会館 (Okinawa Civic Hall)	Okinawa
4	76.458	80		産業祭り (Industrial Festival)	Okinawa
5	76.458	68		大分市中心部 (Ooita pivot)	Ooita
6	76.458	66		西大分駅 (Nishi-Ooita station)	Ooita
7	76.458	56	*	沖縄家族旅行 (Okinawa family travel)	Okinawa
8	76.458	50		サンエー経塚シティー (Hypermarket, San-A kyouzuka city)	Okinawa
8	76.458	50		福岡県行政書士会 (Fukuoka Gyoseishoshi Lawyers Association)	Fukuoka
10	76.458	39		福岡魂 (Fukuoka Soul)	Fukuoka
10	76.458	39		総合図書館 (General Library)	Fukuoka
12	76.458	38		湯平温泉 (Yunohira Spa.)	Ooita
13	76.458	36		長崎県南島原市 (Minami-Shimabara city)	Nagasaki
14	76.458	33		福岡サンパレスホール (Fukuoka Sunpalace Hole)	Fukuoka
15	76.458	32		先日鹿児島 (Kagoshima on the other day)	Kagoshima
15	76.458	32		福岡市総合図書館 (Fukuoka City Public Library)	Fukuoka
17	76.458	30		府内戦紙 (Funai Patchin)	Ooita
17	76.458	30		サンマリンスタジアム宮崎 (Sun Marine Stadium Miyazaki)	Miyazaki
19	76.458	28		全島エイサー祭り (Okinawa Zento Eisa Matsuri)	Okinawa
20	76.458	27		ゴリラチョップ (Gorilla chop)	Okinawa
20	76.458	27		長崎ペンギン水族館 (Nagasaki Penguin Aquarium)	Nagasaki
20	76.458	27		宮崎港 (Miyazaki Port)	Miyazaki
23	76.458	26		大分七夕祭り (Tanabata Festival)	Ooita
23	76.458	26		大分県サッカー協会 (Ooita Football Association)	Ooita
23	76.458	26		沖縄物産店 (Okinawa product store)	Okinawa
23	76.458	26		カスタムカーショー (Fukuoka Customcar Show)	Fukuoka
27	76.458	25		大分商業高校 (Ooita Commercial High School)	Ooita
27	76.458	25		長崎ちゃんめん (Nagasaki chanmen)	Nagasaki
29	76.458	24		生活文化展 (Life culture exhibition)	Ooita
30	76.458	23	*	沖縄取材 (Okinawa coverage)	Okinawa

where * are marked on unsuitable (NG) extraction.

three pairs of a particle and a verb. In order to extract tourism behavior appropriately, it is necessary to evaluate much more pairs. Moreover, the range of suitable extraction needs to be detected instead of 30 higher ranks. We plan to create a tourism resource extraction system for blogs based on tourists' behavior.

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