소셜 웹에서의 시맨틱스: 개인화 이메일 마케팅 개발 사례

Semantics in Social Web: A Case of Personalized Email Marketing

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요약

유용한 이메일은 소비자 구매행동에 긍정적 영향을 미치며, 온라인 상점에서 소비자를 구매로 유인하는 수단이 된다. 또한 이메일을 통해 소비자와 정기적인 접촉을 갖게 되면 고객의 충성도가 개선된다. 그러나 이메일에도 한계점이 있다. 통계에 의하면, 이메일의 절반 이상이 스팸이다. 이메일 사용자가 증가함에 따라 과거 몇 년 동안에 스팸이 급속도로 증가하고 있다. 본 연구에서는 그러한 이메일 마케팅의 한계점을 극복하기 위해 온톨로지 접근법을 제안하였다. 본 연구에서 제안한 방법은 스팸 메일을 제거하는데 온톨로지를 활용하는 것이 아니라 개인의 특성과 흥미를 고려하여 개인화 콘텐트를 서비스하는데 온톨로지를 적용하였다. 본 연구에서는 도메인 온톨로지를 개발하였고 기존의 FOAF도 활용하였다. 본 연구의 제안 시스템을 시나리오를 통해 검증하였다.

■ 중심어 : | 소셜 웹 | 개인화 콘텐트 | 이메일 마케팅 | 시맨틱 웹 | 온토로지 |

Abstract

Useful emails influence on consumers' purchase behavior and activate them to visit retail stores. Regular contact with consumers by e-mail has positive effects on brand loyalty. However, email marketing has a limitation. Spam now accounts for over half of all e-mail traffic. The increase of email users has resulted in the dramatic increase of spam emails during the past few years. In this paper, we proposed an ontology-based system offering personalized email services to overcome such limitation. Our method is not the ontology-driven spam filtering, but a personalized content service considering personal interests and relations among people by using FOAF and domain ontologies. Our system was successfully tested in email marketing domain.

■ keyword : | Social Web | Personalized Content | Email Marketing | Semantic Web | Ontology |

Ⅰ. Introduction

Online communities separated as isolated islands need to be connected. The interlinked communities allow users to integrate and share knowledge or information. Applying Semantic Web technology to the social web enables a network of integrated knowledge and brings the social web to its full

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potential [1].

In general, user enrolls one or two more social network sites. Currently, user who is in a certain site must login to another site to communicate with a friend who is not a member of the former. Social Semantic Web enables us to automatically contact and communicate with all persons who are members of different social network sites. Ontologies including SIOC (Semantically Interlinked Online Communities), FOAF (Friend-of-a-Friend), and SKOS (Simple Knowledge Organization System) are typical examples leading to the Social Semantic Web. SIOC provides a Semantic Web ontology for representing rich data from the social web in RDF (Resource Description Framework) [2]. FOAF is a simple technology that makes it easier to share and use information about people and their activities (eg. photos, calendars, weblogs), to transfer information between Web sites, and to automatically extend, merge and re-use it online [3]. FOAF ontology provides a unified way describing relations among people. SKOS provides a standard way to represent knowledge organization systems using RDF [4].

Email is a promising marketing channel to promote products and maintain brand loyalty. Email is also a very targeted method to efficiently reach customers. According to Matrin et al.'s study [5], useful emails influence on consumers' purchase behavior and activate them to visit retail stores. Regular contact with consumers by e-mail has positive effects on brand loyalty [6]. However, email marketing has a limitation. Spam now accounts for over half of all e-mail traffic [7]. More than 60% of all emails sent worldwide in May 2005 have been identified as spam [8]. The increase of email users has resulted in the dramatic increase of spam emails during the past few years [9]. Ontology-driven method is an alternative to overcome such limitation. There are some works for finding an efficient spam email filtering with the application of ontology [8-10].

In this paper, we present a new ontology-based method to overcome the problem of current email marketing and to exploit the potential of social web. Our method is not the ontology-driven spam filtering, but a personalized content service considering personal interests and relations among people. Thus, in this paper, we present a system based on FOAF and domain ontology offering a personalized service in email marketing and demonstrate a prototype with a scenario.

II. System and ontology design

Today's email marketing has some limitations such as spam mails and a narrow marketing channel. [Figure 1] shows the process and procedure of an ontology-based email marketing enabling to overcome the barriers of current email marketing. Customers send their profile data to company's web server. Company can plan marketing strategies and provide personalized services for customers by applying profile & domain ontologies and inference process using customer's profile data.

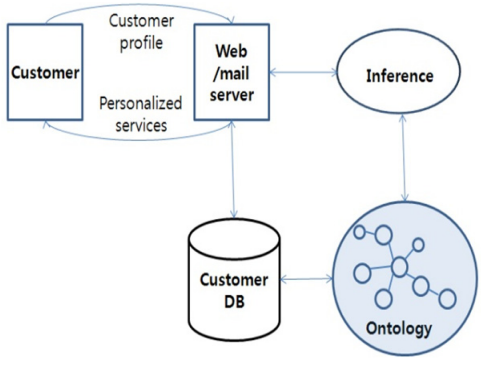

Figure 1. Process of the email marketing based on ontology

The system for personalized email marketing consists of ontology management subsystem, transformer, Web/mail server, and database as shown in [Figure 2]. Ontology engineers create, manage, and merge profile ontology, domain and other ontologies. The transformer converts data in RDF into the formatted data for database or XML (eXtensible Markup Language) and vice versa.

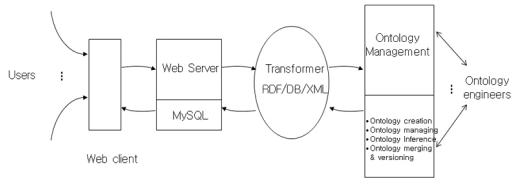

Figure 2. System architecture

Ontology plays a critical role in offering personalized services through email marketing. [Figure 3] shows a part of FOAF and product ontology. A variety of properties in FOAF ontology allows ontology analyzers to specify relations among people. As shown in the left part of [Figure 3], properties such as foaf:knows, foaf:name, and foaf:interest are used to link two people together and describe a customer profile. The right part of [Figure 3] represents an example of ontology of product domain.

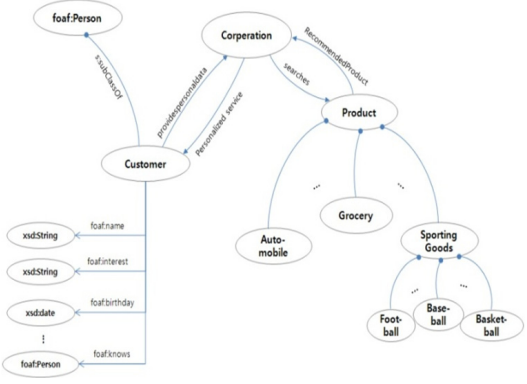

Figure 3. An example of FOAF ontology and product ontology

Ⅲ. Implementation and demonstration of a scenario

The development environment of the system is as follows:

- JDK (Java Development Kit) 6.0
- Eclipse SDK 3.4.1 win32
- JDBC
- MySQL 5.1
- Apache Tomcat 6.0
- TopBraidComposerMe 3.0

The following statement is a scenario for demonstrating implementation of the system.

"*Recommend birthday presents for Kim Gil Dong who is a student of elementary school interested in sports and present a mailing list of people who have some kind of personal acquaintance with him.*"

The system requires some inference rules to provide personalized email services like the scenario. Following rules in SWRL (Semantic Web Rule Markup Language, [11]) indicates the process reasoning the father of person (x) and an alumnus (z) who a friend (y) of person (x) knows.

```
(?x hasFather ?y)  <= (?x hasMother ?m) ∧
                      (?m hasConsort ?y)
(?x foaf:knows ?y)∧(?x foaf:knows ?f)  <=
(?x hasMother ?y)∧(?x hasFather ?f)
(?x hasAlumnus ?z) <= (?x foaf:knows ?y) ∧
(?x hasAlumnus ?y) ∧ (?y foaf:knows ?z)  ∧
(?y hasAlumnus ?z)
                      ...
```

The following is an example using RDF/XML syntax for representing a rule in SWRL to infer hasAlumnus property.

```
<swrl:Imp rdf:about="Def-alumnusknows">
  <swrl:body>
    <swrl:AtomList>
      <swrl:IndividualPropertyAtom>
      <swrl:argument2 rdf:resource="z"/>
      <swrl:argument1 rdf:resource="y"/>
      <swrl:propertyPredicate
        rdf:resource="hasAlumnus"/>
        ---
      <swrl:IndividualPropertyAtom>
      <swrl:argument2 rdf:resource="y"/>
      <swrl:argument1 rdf:resource="x"/>
  </swrl:body>
  <swrl:head>
    ---
   <swrl:IndividualPropertyAtom>
   <swrl:argument2 rdf:resource="Alumnus"/>
   <swrl:argument1 rdf:resource="z"/>
  </swrl:head>
     ---
</swrl:Imp>
```

A program of implementing the transformer is written in Java. A pseudo-code for the program is as follows:

```
Step 1: Importing Java libraries, Jena & SPIN
        libraries;
Step 2: Creating a Jena model and loading the
        ontology file (mms.owl in this
        example);
Step 3: Creating and running an inference model;
Step 4: Querying with SPARQL and storing the
        results on object variables;
          N:= numbers of instances;
Step 5: Connecting Database (MySQL) and
        storing the query results;
            for i:= 1, N
             {transform resources or literals
              in RDF into fields;
             add a record and insert data
            in the fields }
```

The transformer transforms triples resulted from SPARQL query into records and fields and stores them into database like MySQL. [Figure 4] shows the result of query in MySQL for customer's acquaintances and a recommended product for him.

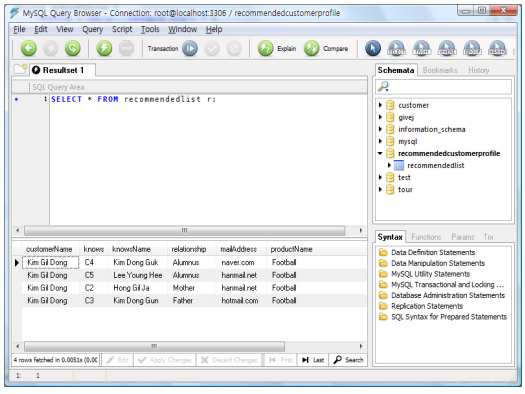

Figure 4. A snapshot of displaying the result of storage from a SPARQL query

The following example is a SPARQL query with Constructor rules inferring a RecommendedProduct property where a company(x) recommends a product (p) for a customer whose interest is sports.

```
CONSTRUCT {
      ?x :RecommendedProduct ?p .
      ?x :sendToMail ?m .}
WHERE {
      ?x :hasCustomer ?c.
      ?c foaf:birthday ?b.
      ?c foaf:interest ?i.
      FILTERregex(?i, "football").
      ?c foaf:knows ?f.
      ?f foaf:mbox ?m.
      ?x :hasProduct ?p.
      ?p a :SportingGoods.}
```

A SPARQL query for the scenario is as follows:

```
SELECT ?customerName ?n ?name
?relationship ?mailAddress ?productName
WHERE {
  :DonggukLtd :hasCustomer ?c.
  ?c foaf:name ?customerName.
  ?c foaf:knows ?n.
  ?n foaf:name ?name.
  ?n rdf:type ?relationship.
  ?n foaf:mbox ?mailAddress.
  :DonggukLtd :recommendedProduct ?p.
  ?p :itemName ?productName}
```

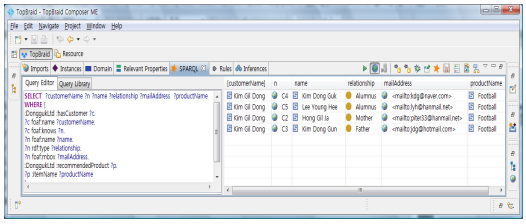

Figure 5. A snapshot of SPARQL query and its result in Topbraid for the scenario

[Figure 5] shows a result of a SPARQL query in Topbraid which is an ontology editing tool.

We tested our prototype for the scenario for Web service. [Figure 6] shows a query result of Web service for the scenario.

Figure 6. A query result of Web service for the scenario

Ⅳ. Conclusion

In this paper, we proposed an ontology-based system offering personalized email services. There have been a number of studies for spam filtering. However, to the best of our knowledge, there was no study applying ontology approach in the area of email marketing. Our research is different from previous studies because we proposed the personalized email marketing approach applying domain and profile ontologies instead of a filtering method. Our system was successfully tested in email marketing domain. The email marketing can be a killer application which plays a critical role of diffusing social semantic web. In further study, the system will be extended to include a component integrating automatically subsystems and to interlink online community sites together. An integration of our system based on ontology and current email marketing software may give an opportunity to increase business value by overcoming the barriers of current email marketing.

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