博士論文概要

論文題目

Model and Analysis for Effective Content Distribution
効率的なコンテンツ流通のためのモデル化と分析に関する研究

申請者

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We have been living in a new digital contents society where contents can be distributed, consumed and redistributed in various kinds of methods by anyone. In this environment, there are two kinds of information flow to information or contents distribution: one is primary information distribution, and the other is secondary information distribution. Primary information distribution is the distribution done by providers or broadcasters to consumers through certain kinds of media such as television, newspaper, etc. Secondary information distribution is the distribution done by users to users such as word-of-mouth. In such environments, there are many unsolved technical and social problems we need to address. For instance, consumers have been exposed to almost infinite amount of contents provided by various sources everyday, and finding their preferred contents are becoming more difficult. However, current searching technology is only limited to filtering information according to user preferences. As user preferences are changing dynamically, it is not convenient to input preferences information every time when the preferences change. Another issue is the lack of model and tools to measure and analyze the effectiveness of an entire distribution. Existing researches have not considered methods for measuring and analyzing the effectiveness of contents distribution in both primary and secondary information distribution. We cannot ignore the power of secondary information distribution anymore as the advanced information technologies have enabled secondary information distribution to take place in various methods and media. Therefore, it is necessary to analyze the power of secondary information distribution, but the study in this research area is still not sufficient. In addition, the issue of the secondary information distribution of illegal contents is crucial and also needs to be addressed.

The issues above illustrate that we are still far from the ideal world of contents distribution in which contents or information should be smoothly and effectively distributed. In order to solve the problems and to improve effectiveness of contents distribution, the author considers that metadata and contents distribution model including analysis methods are the key elements which must be investigated thoroughly. Hence, these key elements are studied in this thesis, and the research achievements are summarized as follows:

Chapter 1 ("INTRODUCTION") describes research background, objective of this thesis and thesis organization.

In Chapter 2 ("THE STATE-OF-THE-ART CONTENT DISTRIBUTION"), some standards of multimedia content metadata (MPEG-7, MPEG-21, TV-Anytime Forum) are briefly introduced. In addition, major learning methods to build automatic adaptive metadata system or to acquire user preferences metadata are described with its pros and cons. Some problematic points in related works are described. The collaborative filtering and knowledge-based approaches in these related works are not effective in corresponding to dynamical change of metadata in all users. Hence the author considers that
combining content-based method with well-structured metadata needs to be studied more. Subsequently, existing research studies of content distribution analysis are described. According to the existing studies, there are models that can analyze the primary or secondary information distribution but there is no model that can analyze both. The model and the analysis methods for entire information distribution must be investigated. In addition, the current model for analyzing the secondary information distribution is not appropriate because it does not fully consider the human behavior of information distribution. Therefore, the model which fully takes account of human behavior is necessary. Finally, the issues discussed in this chapter are organized as a model, and the studies in this thesis are positioned to the model.

In Chapter 3 ("AUTOMATIC ADAPTIVE METADATA FOR PERSONALIZATION OF AUDIO-VISUAL CONTENT"), a method to make the preference information be updated and generated automatically in the user terminal side is proposed. In the existing research works such as collaborative filtering approach, there is a problem in privacy issue because its performance depends on the number of users whose behavior is known. In addition, a drawback of knowledge-based method is the static adaptation ability while use preferences change is dynamic. In the proposed method of this chapter, the content-based approach is applied, and user's viewing history is used as feedback metadata. Subsequently, the system is implemented with optimized parameters. In our implementation, TV-Anytime Forum's metadata and MPEG-7 user preferences description are used for the proposed system on audio-visual content searching and filtering. For renewal user preferences information, a basic user preference tool ("preferenceValue Type") of MPEG-7 User preferences description is adopted to adapt user aspects. Furthermore, the requirements and necessary functional components for implementing the proposed system, as well as data generation process are designed to use for the experiment. The components are audio-visual content metadata filtering, data structure transformation, and preferences value weighting system. Finally, the simulation results show that using the proposed system, every time a selection is made, user preferences information can be renewed automatically and adequately with the optimized parameters.

In Chapter 4 ("CONTENT DISTRIBUTION MODEL AND ANALYSIS FOR PRIMARY AND SECONDARY INFORMATION DISTRIBUTIONS"), a content (advertisement) distribution model and analysis method for both primary and secondary information distributions are proposed. While there is no a model and analysis method which can analyze both of the information distributions in the existing research studies. The proposed model is defined to 6 states and 11 operations, and the Markov Chain Model and its theory are used to analyze the information transition among the 6 states. The analysis methods of the proposed model are explained, and some examples are illustrated in applying the model. In order to verify whether the proposed model can be used in real-life advertisement distribution, the author conducted a practical experiment of advertisement distribution at Global Information and
Telecommunication Studies (GITS), Waseda-Honjo Campus. The experimental result shows that the proposed model can present a part of the real world advertisement distribution, and can be used to measure and analyze the effectiveness of advertisement distribution.

Chapter 5 ("MODEL AND ANALYSIS OF SECONDARY INFORMATION DISTRIBUTION") describes a study of analyzing secondary information distribution. Almost all of research studies in this area use the SIR model for their analysis. However, the author considers and shows that using the SIR model is not suitable because it does not fully cover the human behavior of information distribution. Hence, another information distribution model based on human behavior is proposed as well as the dynamic parameters to make the model more practical for the social network in real life. Subsequently, the simulations are conducted based on the small-world network and its characteristics. Having conducted various simulations, the results show that the model can present, analyze and predict the effectiveness of the secondary information distribution. The simulation results also show to accelerate the distribution by using the parameters in the proposed model, and how the model can be useful for optimizing and controlling information distribution on social networks.

Chapter 6 ("ANALYSIS OF ILLEGAL CONTENT DISTRIBUTION") explains a study of illegal content distribution. The proposed model from Chapter 5 is used to conduct the simulations based on one dimensional (ring lattice) and two dimensional (square lattice) small-world networks. The study shows how to use the model to analyze illegal content distribution. Having conducted the simulation, results show that two-dimensional small-world network is more appropriate than one-dimensional small-world network to represent and analyze real world content distribution on social network. Furthermore, the analytical results from this study can be used to optimize a number of equipped DRM software in the network in order to protect illegal distribution.

Chapter 7 ("CONCLUSION") describes the summaries of the studies and also several issues that need to be further studied. For example, in Chapter 3, the optimized combination of parameters depends on user's viewing behavior. However, mapping the optimized parameter values to practical user viewing behavior needs to be investigated further. The remaining issue in Chapter 4 is that, because the experiment is done on simple cases of content (advertisements) distribution, complicated case of content (advertisements) distribution should be investigated in our future works such as pull methods of secondary distribution and the combination of various advertisement distribution media. In Chapter 5 and Chapter 6, the relationships between the real-world phenomena and the model's parameters, as well as ways to map those parameters to such phenomena, must be studied further. Furthermore, some influencing factors and their impacts on real-world content distribution will be investigated and analyzed by using the proposed model to analyze and control illegal content distribution.
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