The Information Push Model Design Based on Individual Preferences in New Media Age

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Abstract: New media has become an indispensable and important tool in human life communication, information collection, and opinion dissemination, and has become an important way of information transmission. In recent years, as a new way of information dissemination, new media has brought a huge impact on our lives. New media is the most important and popular communication medium in the new century, and the communication mode promotes the transformation of the whole society. With the continuous development of information technology, the reform of education informatization continues to advance. People retrieve different information. Because everyone has different hobbies, in order to allow the majority of consumer groups to buy high-quality and inexpensive goods faster, in the paper. By comparing traditional media with new media in information propagation, the differences between them confirms that it is necessary to concern user preference on information push. Combining traditional information push model, new information push model is established in individual preferences in accord with the development trend of information service. The relationship among information classification, preference confirmation and information screening in the process of information push is stated, and information screening mode is designed using group decision-making optimization method and principal component comprehensive evaluation method for reference.

Keywords: New Media; Individual Preference; Information Push; Model

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1 Introduction

With the rapid development and in-depth coverage of the Internet, people are increasingly dependent on access to information resources through the network. The information content from the network, however, is complex and chaotic, which makes users easily fall into the "Information confusion". For internet information servers, falling net aimlessly may consume a lot of resources, but gained little, and makes them face the dilemma that internet users give low service evaluation.

To solve these problems, international and domestic scholars have done in-depth exploration and research on the operating mechanism of information push from various aspects. It is ready to work in the new conditions of the digital society [1]. Dadakhonov outlined the current state of journalist training in Uzbekistan and the experience gained in this regard. It will involve the concept of

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media convergence. Among them, what has been mostly researched is information push technical aiming for personal service, which technically supports the relevant subjects of information push model. This paper sums the former information push model to four directions: information push model on application objects, information push model on information classification model design, information push model on user interest model design and information push model on information filtering technology design. However, the existing research still lacks integration on every sector of information push, emphasizing technology research more than frame design.

Based on the above situation, this paper depends on the actual characteristics of the new media, integrate and design the overall flow of information push effectively, build information push model from the perspective of individual preferences in order to promote information push service toward new directions.

2 Theoretical Description

2.1 Individual Preferences

Individual preferences are emotional trends hidden in a human heart, which is excited by the objective needs guided by subjective psychological, and expressed in individual unique hobby intensively. Psychology usually defined the personal preference as the judge of individual likes things whether or not [2, 3]. Microeconomics considers that individual preferences is a consumer desire for consumption of consumer goods, which is individual subjective expectations [4].

On the basis of combining psychological research on personal preferences, scholars apply personal preferences more on analysis of consumer behavior. In the information push services, research on information push service based on individual preference mainly manifest as user demand for personalized services [5, 6].

Traditional media is relative to the new media, including newspapers and magazines, radio, television and other media [7]. Traditional media is limited by hardware facilities and technical conditions, having time and space limitations in aspect of information dissemination. Based on the information presented, it was concluded that new technologies can be used to raise awareness of the phenomenon of bullying, to develop socioemotional skills and some bullying prevention measures [6]. Faced with traditional media, users receive information passively more so that severs are difficult to make a quick response to the user's unique information needs. Moreover, it will cost more to push information according to personal preference.

New media is the network-oriented, including internet, mobile phone and other media. While disseminating information, new media is free of time and space limitations, and have a fast information transmission, which is convenient for information sharing and interactive. Faced with new media, users can select information more freely. To compete for customer resource, internet information servers will strive to develop information push technology to meet user personal demand and lower the cost of information push according to users' personal preferences.

2.2 Information Push

2.2.1 Information Push Process on the Basis of Personal Preferences

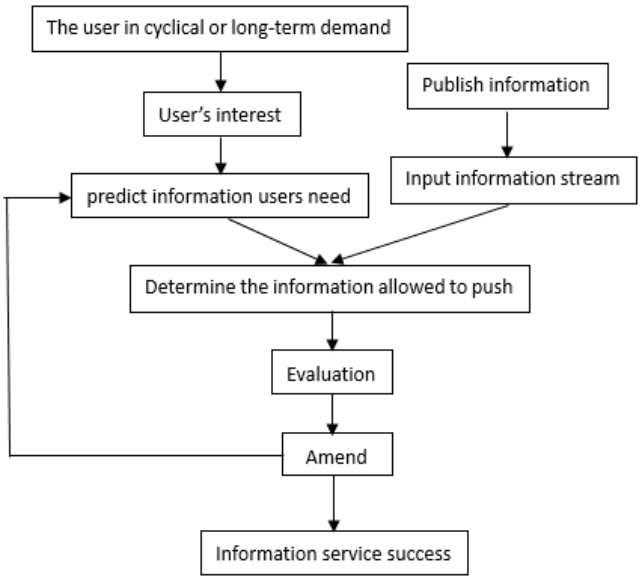

Figure 1 Information push process on the basis of personal preferences

As shown in Figure 1, the process includes: (1) Determination of users' demand which includes their preferences, pursuits and concern frequencies of certain types of information. (2) Effectively describe in terms of the actual orientation of user interest, predict information users need. (3) Accepts an input stream. (4) In accordance with the predicted information users require, filter the input information. (5) Information filtered and determined is allowed to push, then access to the information the result set. (6) users assess the push information according to their gen-

eral demand. (7) When the information does not meet the needs of users, amend the prediction to the information which users need. (8) When the information meets user needs, information service success.

2.2.2 Comparison Between General Information Push Model and Information Push Model Based on Personal Preference

According to service content, traditional information push model can be divided into four parts: push based on hotspot information, push based on custom content, push based on themed information, push based on user requires. While it can be divided into two parts in accordance with service form: (1) web-based information push service model, including notification, abstract, automatic pull, automatic push, web, channel, special formula, etc [8-10]. (2) push service model based on database system, including customers push and server push.

The traditional information push model solves difficulty for user to access to information during certain times. However, at present when information effectiveness has been emphasized, many flaws exposed, such as information overload and "excess", query to accuracy of push information, irregularity response to changes of information, etc.

Information push model based on personal preference, however, aims for meeting with individual demand, embodying the personalized characteristics of service [11]. Firstly, it meet the users' requirements about quality and quantity of information while reducing the risk of information "excess". Secondly, this model establishes a set of personalized service mechanism according to the unique needs, in order to provide information to the individual user's interest preferences timely. Thirdly, it can excavate the user demand, adjust the definition of user preference on the basis of the gradually change of users' knowledge structure, hobby and work property, to meets with potential need for information.

3 Information Push Model Based on Individual Preference in New Media Age

3.1 Establishment of Model

Traditional media is mostly one-way when push information, which is difficult to respond to the information needs of individual users, its process presents as: Information Source → information classification → information push → user. In the process, the server's adjustment cycle to user's interest is overlong, the overall efficiency of information push is not high. While the web-oriented new media is faster and more sensitive as disseminating information. In addition, server can interact with user closely, and adjust timely when users' need changes. The terminal of information push even present as "Information optimization → push information → User rating feedback → Information Optimization → push information", which is an infinite loop process.

Based on the many advantages of new media; we build the following information push model based on individual preferences, see Figure 2:

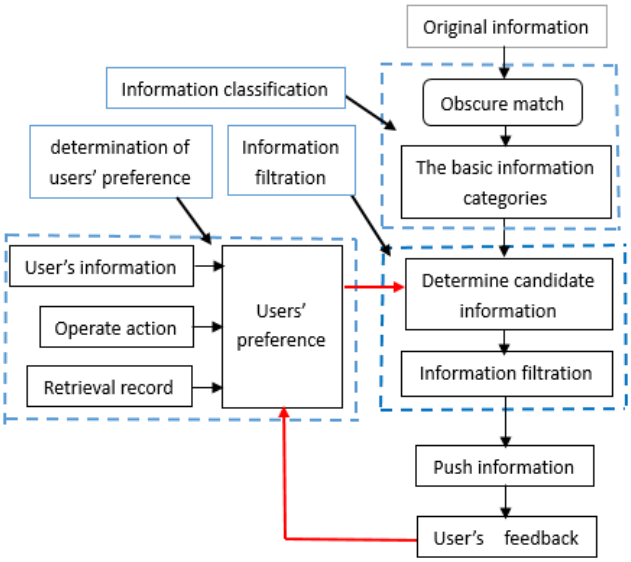

Figure 2 Information push model based on individual preference in New Media Age

This model is mainly divided into three parts. The first is information classification, which is basic classification on original information; the second is determination of users' preference, presenting as the limits on scope of information; the third is information filtration, intending to filter basic information pursuant to the limited range of the information content, and then determine information to meet individual user preference. As shown in Figure 3.

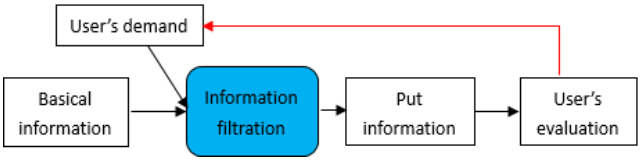

Figure 3 Information cycle pattern based on user's demand

Information filtering is the core of the information push process; therefore, we build a new mathematical model based on previous research according to actual demand. For information classification and determination to user preferences, the paper only does simple overview description.

3.2 Information Classification

Information classification is defined, in certain magnitude of the information, based on certain orientation and purpose, under the guide of certain classification principles and methods, depending on properties, content and users' requires of information, to classify the information in certain architecture. In short, Information classification problem is to use some kind of technical means to group information that has similar characteristics together, forming a plurality of subsets of information collection. In each subset, all information has similar characteristics.

To further study classification, we first need to understand the clustering algorithm. Clustering algorithm are the following categories: Density-based Clustering method, hierarchical-based Clustering methods, Grid-based Clustering method, Division-based Clustering method, Model-based Clustering method and Clustering method based on Computational Intelligence. Different clustering algorithms have play a role in different fields of application, its core is to divide the complicated information to their respective specific properties, and to group information which has the same attributes together.

Now, there exist a variety of information classification ways for different classification object, such as classification based on internet information resources and classification based on traditional documents. Different classification methods use different mathematical algorithms, like Bayesian Network Model based on database information classification and Rough-Set-Theory-oriented Fuzzy classification model. With the deepening of method study and improvement of standards for Information Classification, the utilization of information classification technology in real life also gradually goes mature. Therefore, to classify variable information quickly and efficiently has been possible.

In the network environment, description of the language and script contains a lot of fuzziness. While, it fits people's thinking habits more to use fuzzy classification methods for text classification and processing. Thus we designed the following information classification map referring to fuzzy classification method, for a more intuitive understanding of classification.

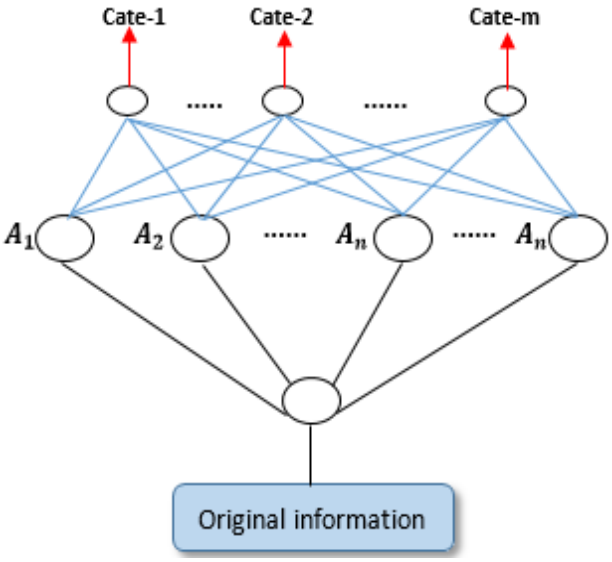

Figure 4 Information classification

As shown in figure 4, original information weighted by fuzzy reasoning is divided into multiple object classes (A_1, A_2,••••••, A_n), each object class and then is divided abstractly depending on the extent of the feature, eventually form the basic information categories (first category, second category, ••••••, m-th category).

3.3 Determine User Preferences

The objectives to determine the user's preference is to explore the information needed by the user from the complex information resources, to promptly push to the user's hand and allow users to automatically obtain simple, effective information meeting their own interests from the complex information. With the information services' increasing pursuit of personalization, changes of users' needs have been paid more attention by information service providers. As for information push technology, to identify and predict users' needs, and provide the user the relevant information, have become its core.

The current method to forecast and determine user's needs comprise the following three categories:

(1) "Pseudo prediction" approach, including content filtering and collaborative filtering. The former excavate resources similar with user's interests, the latter will have to find other user's behavior to make recommendations with the object of interest similar to the current user [12]. The nature of such a method is to use the degree of similarity to forecast the user's current demand.

(2) "Probabilistic forecast" method based on Web data mining. Such methods do statistics behavior based on user

habits, measure and stimulate the change of individual user preference with level of probability finally. Its essence is to determine the law of user behavior based on statistics; however, the method can be easily confined to specific patterns of behavior among high probability.

(3) Approach based on "content associated with the logical" [13, 14]. Such a method, with strong adaptability, integrates law of variation of individual user preferences effectively. But there are also problem such as difficulty to obtain knowledge of the field and notate the information object.

As for the question of predicting user's needs, many scholars using the theories and methods of various disciplines from different angles to research it. Existing research enables information push to determine user's needs in more application. For example, a three-dimensional figurative and quantitative methods of information put forward by Chen has been applied to determine users' interests, and then to information service in agriculture in the country [5]. For the evolution of user needs, Xie to build personalized information service model based on user motivation according to "Maslow's hierarchy of needs", to determine the trend of user's needs [9].

3.4 Information Screening

Push mode based on individual preferences request the information push is filtered according to individual user hobby and preference in information push process, with undesirable information being filtered. Information push to the user eventually could meet their reading needs (not be too long to read) and enhance the dissemination value of information push (be absorbed by user mostly).

In the total information push process, information sieve plays a key role. Information classification process should do optimized selection to sorted basic information and determine a candidate information first, and followed by a comprehensive evaluation of the candidate information and extraction of principal component.

3.4.1 Determine a Candidate Information

Preamble has explained the methods of information classification, this section assumes that the basic information needed to filter has been determined. Then operate a following initial screening according to user preference determined for basic information to determine the candidate information.

This article does not consider the cost of users to access information, which means the cost of user access to information is 0.

Candidate information cluster: $C=\{c_i\}$, i=1, 2,…, N.

User basic information class set: $US=\{d_j\}$, j=1, 2,…, M; $d_j \in US$.

Individual user preferences: X_{US}: $C \rightarrow [0,1]$, $c_i \rightarrow X_{ig}$, X_{ig} indicates the degree of user preference to information class.

There are differences in individual preferences and basic information cluster, which can be measured by the level of consistency of preference differences between any two information class. Consistency guidelines are minimize value of difference as much as possible. This is an optimization problem, the objective function is:

$$J = \sum_{k=1}^{M} \cdot \sum_{i=1}^{N} \cdot \sum_{i<j}^{N} ((X_{ik} - X_{jk}) - (X_{ig} - X_{jg}))^2 w_k$$

In the formula, w_k is weight of each information class. The cost of access to information is known 0, for optimum conditions J to take the minimum, so:

$$\partial J \Big/ \partial X_{vg} = 0 \; v = 1, 2, \cdots\cdots, N \quad (1)$$

Solution of equation (1) is:

$$\begin{pmatrix} X_{1g} \\ X_{2g} \\ \vdots \\ X_{(N-1)g} \end{pmatrix} = \begin{bmatrix} \frac{2}{N} & \frac{1}{N} & \cdots & \frac{1}{N} \\ \frac{1}{N} & \frac{2}{N} & & \frac{1}{N} \\ \vdots & & \ddots & \vdots \\ \frac{1}{N} & \frac{1}{N} & \cdots & \frac{2}{N} \end{bmatrix} \begin{pmatrix} \sum_{k=1}^{M} \cdot \sum_{j\neq 1}^{N} (X_{ik} - X_{jk}) w_k \\ \vdots \\ \sum_{k=1}^{M} \cdot \sum_{j\neq N-1}^{N} (X_{N-ik} - X_{jk}) w_k \end{pmatrix}$$

After solving $\{X_{ig}\}_{i=1}^{N}$ out, the value of X_{ig} can be expressed as the degree of preference for the each basic information class. Filter out the positive X_{ig}, that is candidate information.

3.4.2 Filter Candidate Information

According to the preference value of each class of candidate information, carry out principal component evaluation, set progressive contribution rate value, those standard pieces of information is ultimately push information [15]. Suppose there are j candidate informational needs principal component analysis, i evaluation subject, the value of j-th candidate information class of i-th evaluation

object is x_{ij}. To standardize each x_{ij},

$$\tilde{x}_{ij}=\frac{x_{ij}-\bar{x}_j}{s_j}$$

Among that, $\bar{x}_j=\frac{1}{n}\sum_{i=1}^{n}x_{ij}$, $s_j=\frac{1}{n-1}\sum_{i=1}^{n}(x_{ij}-\bar{x}_j)^2$. In proportion, call $\tilde{x}_i=\frac{x_i-\bar{x}_i}{s_i}$ (i=1, 2, ⋯; m) standardization of candidate info vectors.

The correlation matrix $R=(r_{ij})_{m\times m}$, $r_{ij}=\frac{\sum_{k=1}^{n}\tilde{x}_{ki}\cdot\tilde{x}_{kj}}{n-1}$ (i, j=1, 2, ⋯; m), r_{ij} is correlation coefficient of i-th evaluation subject and j-th candidate information class.

Computing eigenvalues of R: $\varphi_1\geq\varphi_2\geq\cdots\geq\varphi_m\geq 0$, and relevant feature vector u1, u2, ⋯⋯; um, among that, $u_j=(u_{1j},u_{2j},\cdots,u_{nj})^T$, M new indicator variable is consist of a feature vector.

$$\begin{cases} y_1=u_{11}\tilde{x}_1+u_{21}\tilde{x}_2+\cdots+u_{n1}\tilde{x}_n \\ y_2=u_{12}\tilde{x}_1+u_{22}\tilde{x}_2+\cdots+u_{n2}\tilde{x}_n \\ \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \\ y_m=u_{1m}\tilde{x}_1+u_{2m}\tilde{x}_2+\cdots+u_{nm}\tilde{x}_n \end{cases}$$

In the formula, y_1 is the first principal component, y_2 is the second principal component, ⋯⋯; y_m is the m-th principal component.

Computing b_j, information contribution rate in principal component of y_j,

$$b_j=\frac{\varphi_j}{\sum_{k=1}^{m}\varphi_k}\ (j=1,\ 2,\ \cdots;\ m)$$

Sorting $b_1, b_2, \cdots; b_j$, and set α_p to the accumulative contribution rate. When α_p=1 (or α_p=0.85, 0.90, 0.95), select the principal component in the range, which set from the accumulative contribution rate. The selected principal component is the ultimately push information.

4 Conclusions

Internet users' preferences can reflect their information needs. What's more, the level improvement of network information service makes the increasingly seek of personalization. Because user's evaluation can impact the level of information service, information push more to consider individual user preferences to filter information which is needed to push. Information screening is the key to information push. Taking the impact of individual preferences to information screening into account, we carry out the information screening process in two steps. The first is to determine the candidate information referring to group decision optimization method; the second is to use principal component comprehensive evaluation method to filter out the final push information.

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References

[1] A. Tuciak-Deliowska, "Using technology to prevent peer (Cyber) bullying and antisocial behavior," International Journal of Pedagogy Innovation and New Technologies, vol. 5, no. 1, pp. 32–43, 2018.

[2] Changping Hu, Qigan Shao, Gaoling Sun. The analyze of user preference and behavior on individual information service [J]. Theory and Exploration. 03(2008) 4-6.

[3] Scherer K. R. What are emotions? And how can they be measured?. Social Science Information. 44(2005) 695–729.

[4] Dsavid L. Weimer, Aidan R. Vining. Policy Analysis: Concepts and Practice. Pearson: Prentice Hall.: 115. ISBN 013183001-5. Fourth Edition.

[5] Hu P, Fu R. Micro Animation Design Based on New Media App Interaction [J]. 2022. DOI: 10.1007/978-981-16-5854-9_2.

[6] Zhang F, Tang J, Liu X, et al. Understanding WeChat User Preferences and "Wow" Diffusion [J]. IEEE Transactions on Knowledge and Data Engineering, 2022.

[7] Lihong Jiang, Boyi Xu. Aggregation model for group user profile in information filtering [J]. Journal of Shanghai Jiaotong University. 06(2000) 818-820.

[8] Kim K. User Preferences in Drone Design and Operation [J]. Drones, 2022, 6. DOI: 10.3390/drones6050133.

[9] Ying Han. Interprer new media [J]. Cultural and Art•Cultural and Theory. 03(2011) 227-228.

[10] Yingqiu Fan. The service pattern of information push based on grid [J]. Information Research. 0 (2007) 58-60.

[11] Haitao Xie, Xiangwu Meng. A personalized information service model adapting to user requirement evolution [J]. Acta Electronica Sinica. 03(2011) 643-648.

[12] Yuefeng Li, Ning Zhong. Mining ontology for automatically acqui- ring web user information needs [J]. IEEE Transactions on Knowledge and Data Engineering. 18(4) (2008) 554-568.

[13] HUANG H, Wang R J. Acquiring user information needs for person- alized search [A]. International Conference on Information Acqui- sition, ICIA 2007 [C]. Jeju: IEEE Computer Society, (2007) 177-181.

[14] N. S. Avdonina, “Development of professional identity in journalism students using liberal education methods,” Vysshee Obrazovanie v Rossii=Education in Russia, vol. 29, no. 7, pp. 135–143, 2020.

[15] Agustín Borrego, Ayala D ,Inma Hernández,et al.Generating Rules to Filter Candidate Triples for their Correctness Checking by Knowledge Graph Completion Techniques [C] // the 10th International Conference.2019.