

Evaluation of Individualized Information Service Capability Based on DHNN

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Abstract—Information service system providing service according to the specific requirements of user, or user's personnel characteristics like subject, preference and usage etc. In university, different student have their own individualized information requirements, so the services provided by library must become initiatively though customization, and push function, which means a kind of customer-center. In This paper discusses the purpose and meaning of individualized information service of library, and also the index system of service performance evaluation are investigated. In view of the uncertainty problems in individualized information service capability evaluation, this article develops an evaluation model based on Discrete Hopfield Neural Network (DHNN). The paper also gives a concrete algorithm. The experiment result shows that the proposed method can resolve the uncertainty problem in evaluation process effectively. The feasibility of proposed method is testified also.

Keywords-Individualized Information Service; Capability Evaluation; DHNN; Recommendation System; Index of individualized information service

I. INTRODUCTION

Individualized information service in the information age means providing service that user may need initiatively though customization, system recommendation and push function, according to the specific requirements of user, or user's personnel characteristics like subject, preference and usage etc. It is a kind of customer-center service mode [1].

The appearance of this kind of service mode has changed the service mode of library in the old days that "whatever we offer, you'll accept", created the information service mode with mainly characteristics of individuality and interactivity that "whatever you need, we'll offer", thus individualized information service becomes the hot topic of library research and study both in China and abroad.

However, research at present mainly emphasizes on the issues about individualized information service theory, service technology, service mode, service system and the restriction factors exist in the service practice, ability evaluation for the library individualized information service hasn't formed a unified evaluation target system [2-4], and scientific evaluation methods hasn't been

found, which constrains the development of individualized information service. Therefore, it's urgent to adopt objective and reasonable quantized method to evaluate the ability of individualized information service, find out the existing issues and weak links and make effective improvement measures; these will have important practical significance for the improvement of the individualized information service ability.

This article comes up with an individualized information service capability evaluation model basing on the Discrete Hopfield Neural Network (DHNN), simulation data that expert used for evaluate service grade is used in research to test and evaluate the method.

II. DHNN MODE

Hopfield network is the most typical two-value feedback network model. It is one of the most models studied by people at present. The output of neuron only takes 1 and -1, separately indicating the neural is in inhibition and activation, and thus it can be called Discrete Hopfield Neural Network. DHNN is formed by monolayer with common neurons, and it is a kind of auto-associative neural network with study function, which can complete restriction optimization and associative memory etc. functions [5-7].

Suppose one DHNN consists of three neurons, with the structure shows in Fig .1.

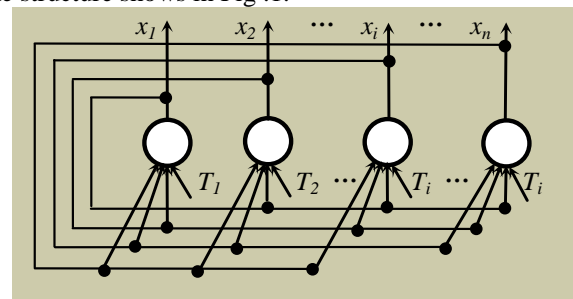


Figure 1. Hopfield Neural Network composed by three neurons

We can see from the structure of the DHNN that: it is a kind of two-value non-linear dynamical system which has multiple inputs and threshold values. In dynamical system, stable state can be interpreted as certain type of energy function whose energy value continuously

decrease during the movement process of the system, and is in the minimum value at last. Designing weight coefficient matrix of Hopfield Neural Network can realize stabilization of the network.

III. EVALUATION INDEX SYSTEM OF INDIVIDUALIZED INFORMATION SERVICE ABILITY

As evaluation system of the individualized information service ability is a complex system, issues like randomness, fuzziness of the evaluation factors and imperfect of index statistical data will be found in the evaluation process, these uncertain issues call for the

experts evaluate comprehensively for the individualized information service ability, according to their own experience and knowledge and the own qualitative and quantitative nature in index system.

Considering complexity and particularity of the individualized information service, evaluation for the library individualized information service ability can be done from service infrastructure and environment, information resource, service technology and mode, service effect four aspects [8][9].

TABLE 1. FIVE INDEX OF INDIVIDUALIZED INFORMATION SERVICE ABILITY EVALUATION

Grade 1 Index	Grade 2 Index	Details of evaluation
service infrastructure and environment A1	Individualized service space A11	Individual learning space, Group system working space, information service counter, rest area etc.
	individualized service workstation A12	Hardware resources: PC, high-end workstation, printer, scanner etc.
	Individualized information service system construction A13	Multilevel information service; dynamics and auto update ability; utilizability, operability of system, affinity of interface, storage of data information and organizational mode in system etc.
	Structure and competence of service staff A14	Allocation proportion of staff; reservation of related staff; knowledge capacity, innovation capability, communication and cooperation capability and professional ethics of staff
	Condition of user need A15	Need extent for individualized service of user and awareness of accepting the individualized service
Information resource A2	Comprehensiveness of information recourse A21	Volume of literature, rate of security, volume of per-capita contributed new literatures, proportion and quantity of data bank of each type
	Pertinence of information resource A22	Digital resource satisfied by specific user group or not, deepness and wideness of resource meet user's professional requirements or not
	Pertinence of information resource A23	Digital resource satisfied by specific user group or not, depth and scope of resource meet user's professional requirements or not
	Authority of information resource A24	Digital resource selected and processed by professional staff in accordance with related standard or not, whether evaluated and approved by experts in the same field or not
	Peculiarity of information resource A25	Digital resource whether has its own characteristic, development of self-build data bank with individual characteristic
Timeliness of information resource A26	Newness and timeliness of literature resource, digital resource, update cycle and speed of self-build data bank etc.	
Service technology and mode A3	Information acquisition and filtration technology A31	User demand whether can be acquired comprehensively, rapidly and accurately or not, extracting the literature and resource that most corresponding to user's demand though own international mechanism
	Feature extraction and disposal technology A32	Whether can extract user's feature vector accurately and classify to the user characteristic according to user's demand; Collecting external information according to user feature and dispose, organize and store it etc.
	Information mining technology A33	Ability of association analysis, cluster analysis, classification, prediction, variance analysis.
	Information customization and push technology A34	Convenience and flexibility of customization process; Automation, intelligent extent, and efficiency of data push
	Personal privacy protection technology A35	Whether personnel privacy protection mechanism and policy be considered in the service, whether key technology inset in service technology
Service effect A4	Satisfactory degree on service quality A41	User's satisfactory degree on the information volume, creativeness of information, timeliness, pertinence and availability of service in the process of individualized service.
	Satisfactory degree on service benefit A42	Use ratio, realized value (compare the value and created by service to consumption produced by achievement), social response (compare social response after service to created benefit) of individualized service.

In this article, we divide the ability of individualized information service into five grades: very strong (I), stronger (II), general (III), worse (IV) and worst (V). According to the research and evaluation to the individualized information service ability of 20 colleges and universities, combine with associative memory ability of DHNN, build DHNN library individualized information service ability evolution mode [10].

In the realization process, evolution index that several typical classification grades corresponding to is designed as the balance point of DHNN, study process of Hopfield neural network is the process that typical classification grades evaluation index gradually approach to Hopfield network balance point. After the

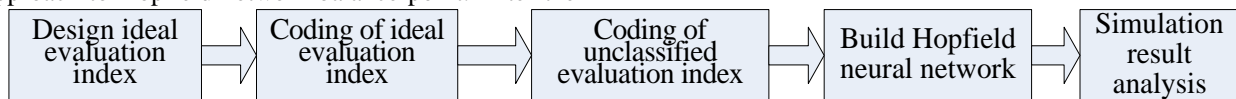


Figure 2. Flow chart of model building

A. Index Coding

This article studies the relationship between the ability and index of individualized information service ability of 20 colleges and universities libraries. Make

study completed, the balance point of Hopfield neural network is the evaluation index of every classification grade that corresponding to. When evaluation index of enterprise innovation that need to be classified is outputted, Hopfield neural network will use its ability of associative memory to gradually approach to the certain stored balance point, till the state no longer changes, this balance point corresponding to is the classification grade that we seek for.

IV. EXPERIMENT STEP AND RESULT ANALYSIS

Test process shows in Fig .2

the evolution index average value corresponding to every grade sample as the ideal evolution index of each grade, namely, as the balance point of Hopfield neural network [10], shown in Table 2.

TABLE2.FIVE GRADE IDEAL EVOLUTION INDEXES

	A11	A12	A13	A14	A15	A21	A22	A23	A24	A25	A26	A31	A32	A33	A34	A35	A41	A42
I	93	91	92	94	91	95	93	92	92	92	93	94	94	95	92	95	93	92
II	77	78	81	78	82	83	79	77	82	80	82	81	79	80	83	82	80	82
III	63	67	64	63	67	64	66	67	68	67	65	64	66	65	64	63	67	64
IV	45	49	51	55	55	49	46	51	52	51	48	50	52	54	50	49	51	53
V	27	33	32	29	27	33	30	26	31	34	29	30	35	34	33	30	31	32

As the state of DHNN neural network only has 1 and -1 two kinds, when the evaluation index reflected as the state of neural state, coding is needed. Coding rules are: when greater than or equal to certain grade index value, the neural state that corresponding to shall be set

as 1, or will be -1. Ideal 5 grade evaluation indexes are listed in Fig .3, * shows the state of neural is 1, means greater than or equal to the ideal evaluation index that corresponding to the grade, otherwise shall use x.

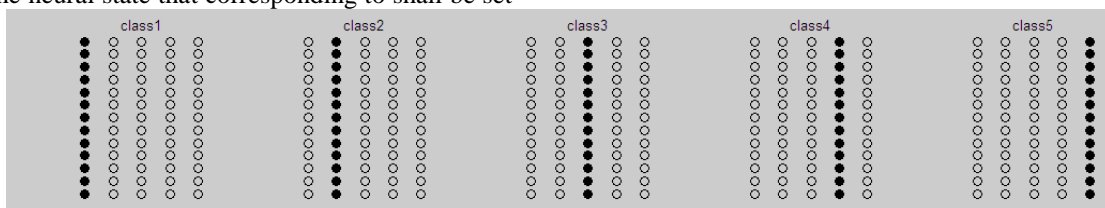


Figure 3. Ideal evolution index codes

Five unclassified individualized information service evolution indexes are shown in the table.3, getting the corresponding codes are shown in the second line of Fig .4 according to the above coding rules.

TABLE 3. FIVE UNCLASSIFIED GRADE EVOLUTION INDEXES

	A ₁₁	A ₁₂	A ₁₃	A ₁₄	A ₁₅	A ₂₁	A ₂₂	A ₂₃	A ₂₄	A ₂₅	A ₂₆	A ₃₁	A ₃₂	A ₃₃	A ₃₄	A ₃₅	A ₄₁	A ₄₂
1	96	92	85	89	93	87	94	76	98	94	97	88	84	78	93	92	91	88
2	70	88	75	82	96	79	89	80	84	85	83	81	77	91	85	86	73	87
3	60	75	68	67	57	74	76	83	69	75	64	68	69	70	53	69	67	64
4	45	49	51	55	55	49	46	51	52	51	48	50	52	54	50	49	51	53
5	27	33	32	29	27	33	30	26	31	34	29	30	35	34	33	30	31	32

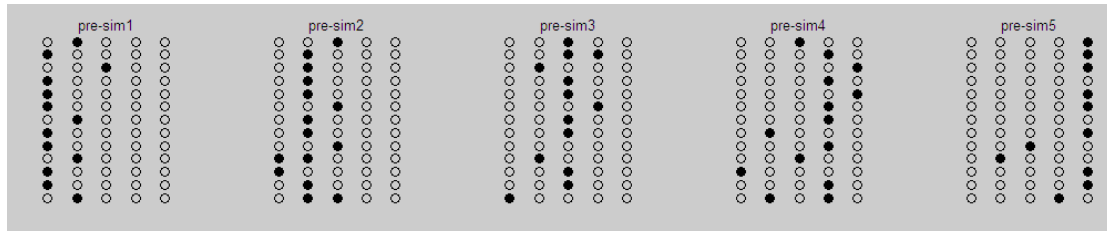


Figure 4. Unclassified evolution index code

B. Experimental Results Analysis

After designing five ideal grades evaluation indexes and codes, DHNN can be built using MATLAB own neural network toolbox functions, after that, Using the five unclassified individual information service evaluation index codes as the output of Hopfield neural network, after certain times studies, simulation result will be achieved. Comparing the simulation result to the real grade, reasonable evaluation for the model can be made.

Simulation results are showed in Fig .5, among these, the first line is corresponding to Fig .3, showing five ideal grade evaluation index codes; the second line is corresponding to Fig .4, showing individual classification evaluation index codes; the third line is the results that designed for DHNN classification; from Fig .5 we can see that the designed DHNN can classify effectively, thus can make objective and impartial evaluation for individual information service ability.

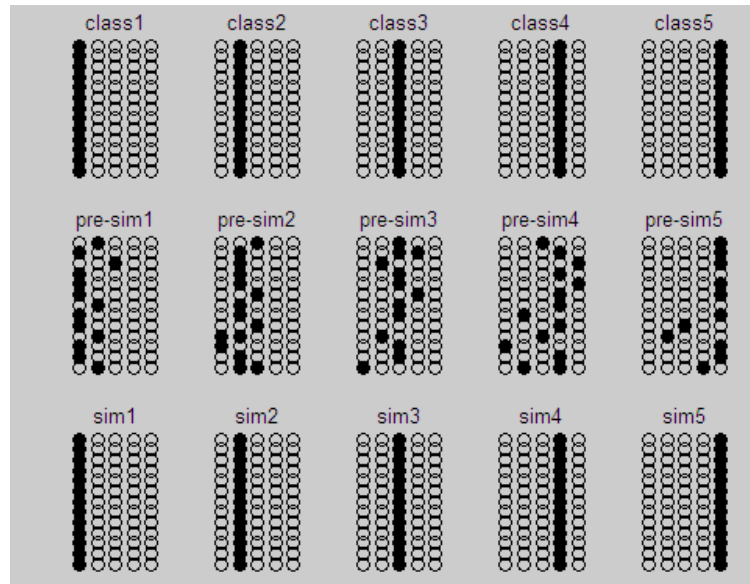


Figure 5. Classification result recognized by DHNN

REFERENCES

- [1] Information on <http://www.dlib.org/dlib/april00/mistlebauer/04mistlebauer.html>.
- [2] C.Jayawardana, K.P.Hewagamage, M.Hirakawa: Information and Technology and Libraries: Vol. 20 -4(2001).
- [3] J.J. Hopfield: Proceedings National Academy of Sciences Vol. 79 (1982), p. 2454-2458.
- [4] W.Y. CHEN: Journal of Systems Science and System s Engineering Vol. 4(1997), p.389-395.
- [5] K. Bart, in: Neural networks and fuzzy systems (Prentice-Hall Inc, 1992).
- [6] W. Zhao, X.H. Zhang: Information studies: Theory & Application Vol. 33-10(2010), p.66-69.
- [7] F.L. Qin: Journal of Library Science (2009-3), p.19-22.
- [8] F. Shi, in: 30 cases analysis of MATLAB neural network (Beihang University Press, 2010).
- [9] Conglian. Gu:Journal of Zhengzhou University Vol. 39-11 (2006), p. 75-78
- [10] CHEN Chen-Tung, TAI Wei-Shen: Information Processing & Management Vol. 39-6 (2003), p. 873-888