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DESIGN AND DEVELOPMENT OF E-LEARNING SYSTEM USING INTELLIGENT TECHNIQUES

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ABSTRACT

An innovative adaptive and intelligent web based e-learning system, was designed, and developed here. There has been significant progress in the development of techniques to deliver more effective e-Learning systems in education.We present a description of the fundamental components of an adaptive learning intelligent algorithm designed to fulfil the objectives of the teacher and to develop a close relationship with the learner, monitoring and adjusting the teaching based upon a wide variety of analyses of their knowledge and performance. This is an important area for future research with the opportunity to deliver significant value to education. The development of improved learning systems in conjunction with trainers, teachers and subject matter experts will provide benefits to educational institutions.

I INTRODUCTION

Nowadays, Network and multimedia are the trendof the development of the modern education technology. With the rapid development of the network technique and the prevalence of the Internet, E-learning has become the major trend of the development of international education since 1980's, and the important access for the internationalization and the information of education. Although the modern distance modernization arouses a big reform on the education mode and education conception. However, the learners are in different age level, sex, and social role, their culture and education background, attention, interest hobby also exist a great difference. Giving corresponding teaching resources according to learners' characteristics to implement personalized learning is very difficult. According to the reasons mentioned above, thetechnologies of personality, association rules mining and collaborative filtering are applied in the paper. Based on it, a new intelligent algorithm is proposed. Furthermore, a new intelligent algorithm could apply in personalized E-learning system to support personalized E-learning better.

II METHODOLOGY

INTELLIGENT ALGORITHM

Association mining rules and collaborative filtering are applied in the paper. Intelligent algorithm is composed of two phases:

Step1: Using association rules algorithm to mining several categories of interested teaching resources for users.

Step2: Using collaborative filtering algorithm to recommend the specific teaching resource of interested categories.

Association rules mining

There are three steps for association rules mining algorithm:

Step1: generating frequent item-set l. if appearance frequency of item-set is less than min_sup, then the item-set is frequent item-set.

Step2: regarding to each frequent item-set l, all non-spatial subsets are generated.

Step3: regarding to each non-spatial subset of frequent item-set l, if

$$\frac{\sup port\_count(l)}{\sup port\_count(s)} \geq \min\_conf \quad (1)$$

Then the rule *s=>(l-s)* is generated. min_confrepresent the minimum confidence thresholds, support *count(l)* represents the number of transaction containing item-set *l*, support *count(s)* represents the number of transaction containing item-set s.

Teaching resources are classified as several categories. Then Basing on it, using association mining algorithm generates association rules. Left side item-set of the rules is the teaching resources category. Furthermore, the rules are selected and classified. The useful rules should provide the category of recommending teaching resources. Supposed *N* categories are obtained though association rulesrecommendation, like *S1,S2,S3,…,Sn.*

$S = \{S1, S2, S3, Sn\}$ is a set of all recommendation categories.

$N(S_n)$is all teaching reousours set of category S_n.

Collaborative filtering algorithm

The collaborative filtering algorithm is shown as follows:

Step1: Representation. Supposed input data may represent $m\times n$ user - item evaluating matrix *R*. m is the number of users, n is the number of item. $R_{i,j}$Is the appraisal value of ith user to jth item; appraisal value is related to the content. If the item is teaching resources in E-learning, then appraisal value represents user choose or not. For example, *1* represents that user choose the resources, *0* represents that user does not choose the resources.

Step2: Searching for the nearest neighbor set. Regarding to a user U, a neighbor set {N1,N2,N3,Ns} is generated and arranged according to the size of similarity. Even *U* does not belong to {N1, N2, N3, Ns} are arranged form big to small according to SIM (U, Ns).

Step3: Generating recommendation. After generating the nearest neighbor set, the interest degree of item and Top-N are calculated. Supposed user *a* and the corresponding option set I_a, the interest degree of item j is calculated according to formula 2

$$p_{a,j} = r_a + \frac{\sum_{u=1}^{n} w_{a,u}\left(r_{u,j} - r_u\right)}{\sum_{u=1}^{n}\left|w_{a,u}\right|} \quad (2)$$

Among them, $R_a$represents the average appraisal value that user *a* to item, U is the nearest neighbor set. W_jIs similarity between user and user, $R_{u,j}$is the appraisal value that user u to item j. $R_u$represents the average appraisal value that user u to item. The interest degree of user i to different items is calculated separately. N items that have higher interest degree and don't belong to item are taken as recommendation set Top-N.

After interested categories are obtained byassociation rules, we use the collaborativerecommendation. Namely, regarding to each$S_n \in S$,we use the collaborative recommendation in N(S_n). Supposed, regarding to eachS_n,Q teaching resources are recommended. Recommendation set is $I_t = \{ I_{t1}, I_{t2}, I_{t3}, I_{tq} \}$. Simultaneously the interest degree of each commodity is P(I_{t1}),P(I_{t2}), P(I_{t3}), P(I_{tq}).

We recommend resources according to below strategy. Because the user has different interest degree to each category, category weighting method is used to recommend commodities. Regarding to each P($I_{t,j}$) (t= 1,2,3,…,t j=1,2,3,…q) W(S_n) is the interest weight that the user to each category *n S* . Interest weight is calculated though confidence degree. Confidence degree is obtained though association rules.

$$F_{t,j} = w(S_n)p(I_{t,j}) \quad (3)$$

The size of $F_{t,j}$（t=1,2…t, j=1,2…q）is taken as the recommendation.

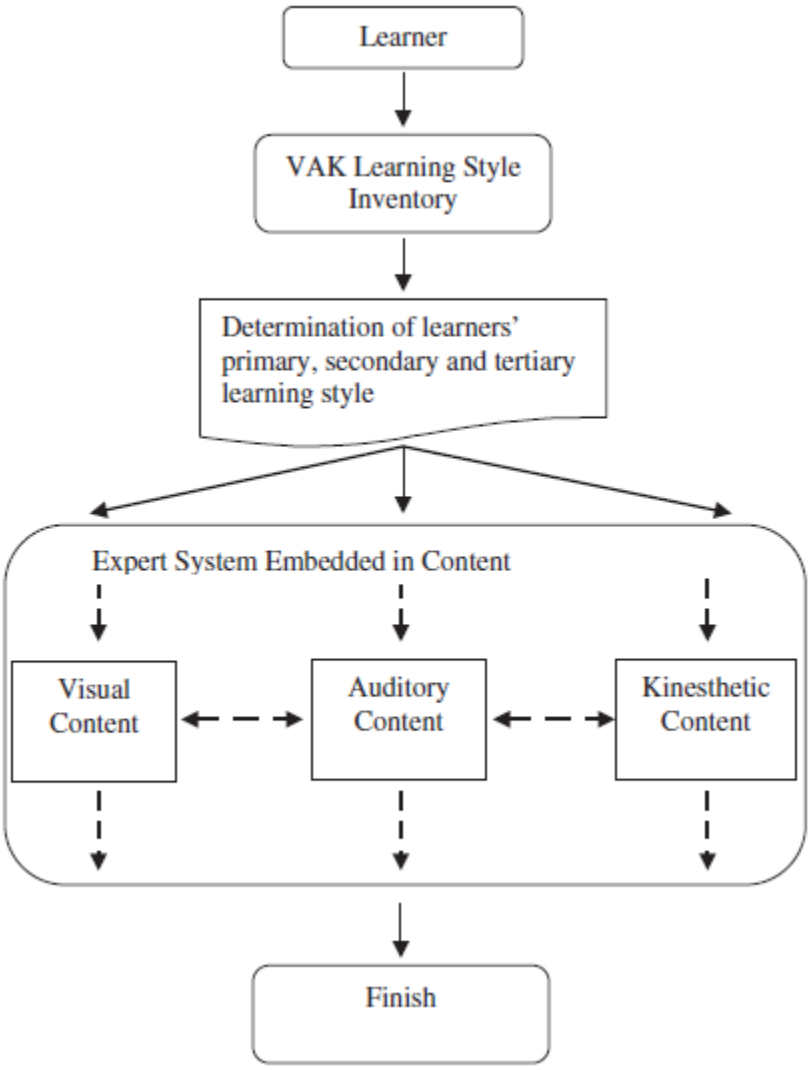
III IMPLEMENTATION

General architecture of intelligent algorithm is described in this section. Algorithm was designed as an adaptive and intelligent e-learning environment where content, which was individualized based on VAK learning style, is presented with the support of expert system. For integration and assessment of intelligent algorithm in real class environment, learners and teacher should register and log in to the system. Thus, initially, teachers and learners are required to register into the system. Teachers and learners may register using the links on the main page. Teacher

registrations are confirmed by system administrator. Teachers with their registration confirmed can login to the system using their nicknames and passwords. Learners who want to register here, select their schools and teachers in the first place. Registration information of learners who enter this information correctly is viewed on teacher page automatically. Each class' teacher can view his/her own learner list and confirm, arrange or delete when necessary their registration. Learners whose registrations are not confirmed by teacher cannot login to the system yet. These learners are given the message that their registration is waiting for the confirmation of their teacher. Learner who login the system firstly takes VAK learning style scale after his/her registration is confirmed by the teacher. VAK learning style scale integrated into site was developed by Gokdag(2004). Credibility and validity researches of this scale were made by researcher himself. Primary, secondary and tertiary learning styles of the learner whose registration is confirmed by teacher and who took thislearning style scale on his/her first login to the system are automatically calculated and recorded in database. This process is made for once and decides learning styles of the learners. Learners taking learning style inventory and whose learning styles were determined are automatically directed to the content of their primary learning styles. As a result of this guidance, each learner takes the LOs of their primary learning style in an order. Thanks to expert system buried in content, these learners are progressed in content of primary learning style. Learner progressing in primary learning style is now under the control of the system and all the control is transferred to the system from now on. Any learner taking the content of primary learning style within the system receives necessary tips and solution supports appropriately to primary learning style in LOs constituting the content with the support of expert system as well. Presentation of these tips and intelligent solution supports depends totally on the performance of the learner. By this structure, different learners in the same learning style may receive different tips and intelligent solution supports according to their performances. An expert system was used for designing Los in intelligent algorithmic learning site. Thanks to this expert system, it is checked whether any learner reached ''adaptivity point'' in LOs.

Expert system makes a decision about the learner at this adaptivity point. This decision is about whether the learner will be directed to next LO of primary learning style or the same LO of secondary learning style. Learner accomplishing the present LO is directed to the next LO of primary learning style. On the other hand, learner failing to complete the present LO and reaching this point is directed to the same LO of secondary learning style. Learner receiving the same LO of secondary learning style comprehends that there are various ways of thinking to solve the problems and complete the LO. Learner accomplishing the LO of secondary learning style is returned to the next LO of primary learning style. Learning failing in the LO of secondary learning style is directed to the LO of tertiary learning style regarding the same logic. Also, learner accomplishing the LO in this style is returned to the next LO of primary learning style and continues with the next LO. The case of learner failing in the tertiary learning style as well is reported to the teacher. Learner whose case is reported to the teacher is returned to the content of primary

learning style. In this way, learners may receive different contents in this site depending on their performances. Architecture of this browsing and adaptivity is shown below,



Architecture of intelligent algorithm based e-learning system.

Distribution of LOs according to subjects used in UZWEBMAT.

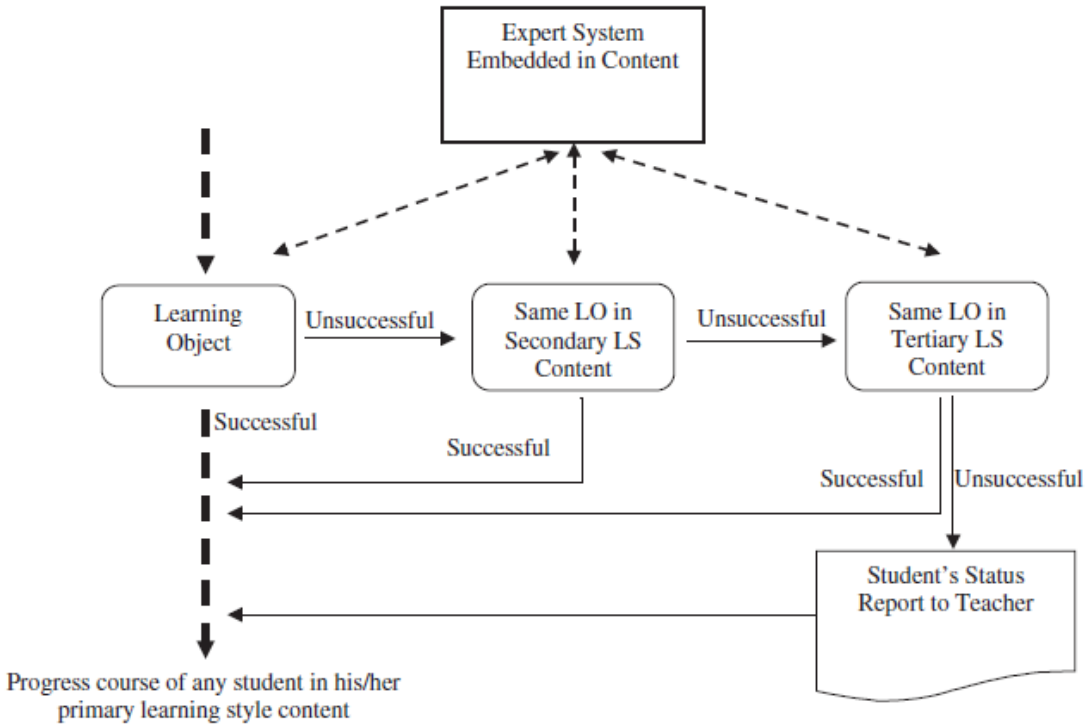
Subjects	Learning objects (LOs)
Permutation	Between 1–16
Combination	Between 17–27
Binomial expansion	Between 28–31
Probability	Between 32–53

IV RESULT

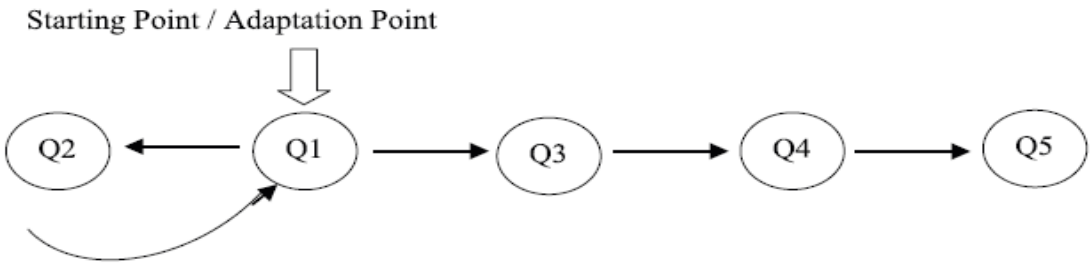
Two of LOs in intelligent algorithm based e-learning system content were randomly selected andsample screenshots from these are given. Below, informationregarding the selected sample LO is given.

LO_6: One of the LOs designed for permutation subject

LO_45: One of the LOs designed for probability subject



Schematic view of browsing support between contents of primary/secondary/tertiary learningstyles.



Scenario prepared for Activity_6 and presentation plan of questions within the activity.

This LO is one those developed for permutation subject. Above figure,shows the scenario prepared for LO_6 and the content of LO.There are five questions in total in the content of this LO. Learnertakes the first question within the LO initially. Learner correctlyanswering this question is directed to the third question. Learnercorrectly answering the third question is directed to the next questionwith the same logic. Learner correctly answering the third,fourth and fifth questions respectively will have accomplishedLO. Learner failing in the third, fourth, and fifth questions willget intelligent solution supports which will provide aid to solvethe problems. Learner directed back to the second question willget solution support and tips depending on his/her answer. Tipsand solution supports of the second question teach how to solvethe problem to the learner. Learner correctly answering this questionis directed back to the first question. ‘‘Adaptivity point’’ withinthe LO was determined as the first question. Decision point comesfor the learner returning to the first question and answering it forthe second time. If learner correctly answers the question thistime, ‘‘adaptivity point’’ decides about the accomplishment of theLO. In this sense, learner is directed to questions within the LOand expected to accomplish it. If learner fails in the first questiononce again, ‘‘adaptivity point’’ decides about failure of the learnerwithin the LO. As a result of this decision, learner will be directed.

V CONCLUSION

In summary, a new intelligent algorithm based onassociation rules mining and collaborative filtering is proposed in the paper. The algorithm is also applied in personalized E-learning. The results manifest that the algorithm can support E-learning better.

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