

장면전환검출과 사용자 프로파일을 이용한 원격 비디오 학습 평가 시스템

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Remote Video Evaluation System Using Scene Change Detection and User Profile

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요 약

전통적인 원격 평가 시스템들은 학생 개인의 특성과 성향을 고려하지 않기 때문에 단순하고 획일적이라는 문제점을 갖고 있다. 본 논문에서는 이러한 문제점을 해결하고 비디오를 통한 평가를 위하여 장면전환검출과 사용자 프로파일을 이용한 원격 비디오 평가 시스템을 제안하고 구현한다. 비디오 문제 출제를 위한 장면 전환 검출을 통하여 키 프레임과 문제 출제 구간을 추출한다. 문제 출제 방법은 평가에 사용자 프로파일의 적용을 위하여 카테고리 기반 시스템과 키워드 기반 시스템을 합성한 방법을 이용하였다. 이 시스템을 통하여 학생들은 자신의 부족한 영역을 보충하고 관심 영역을 유지할 수 있으며 학업 성취도를 향상시킬 수 있다. 사용자 프로파일을 이용한 본 시스템은 사용자의 문제 풀이 결과에 따라 영역별 문제 수를 조절하고 평가의 질과 효율성을 최대화 시킨다.

1. 서론

The function of information processing on Internet can be widely divided into two functions of information retrieval and information filtering.

Information retrieval is a sequential process of searching and finding for the appropriate information from database according to user's requirement. Contents of the gathered information or data are adequately analyzed, processed, and stored into database.

Information filtering is the filtering of a dynamic information stream based on a long-term profile of the user's interest that was created and maintained by the system. Most of the personalized filtering systems automatically create and maintain a user-interest profile using machine learning techniques[2,3]. According to the main personalization process, information filtering is traditionally classified with three types such as

content-based, social and economic[4].

Recently in accordance with a rapid growth of Internet, one of the great changes of education is a remote evaluation system on Web. Remote evaluation system gives support to overcome many problems of the traditional evaluation system and the restriction of time, space and frequency, and guarantee objectivity, transparency and rapidity of evaluation. But it has a problem that system performs evaluation simply and uniformly. Those systems did not consider the personalized characteristic and propensity of individual students. User profile is a clue to solve this problem. Students are provided the filtered questions that matched with characteristics and ability of themselves, so that they can enhance both superior and inferior area[6].

This paper is organized by four additional sections. Section 2 states the scene change

detection for scene segmentation of question-making video. Section 3 presents a remote evaluation system using user profile. Section 4 presents the practical implementation and the use of remote evaluation system. Finally, Section 5 concludes the work and summarizes the future works.

2. Scene Change Detection

2.1 Key Frame Extraction

This paper uses JANGHAK-QUIZ program that broadcast in EBS to make a question using video. JANGHAK-QUIZ program perform evaluation of three round all, but this paper does to segment video for questions of the first round only. Areas of the segmented questions are classified with 5 areas, such as language, mathematics, society, science and foreign language, and those are used in making a question.

Structural features about the first round evaluation of JANGHAK-QUIZ program is summarized as following.

- (1) Always when make a question, question number and question content appears.
- (2) When question number and question content appear first time, blink effect of question number appears.
- (3) Question number and question content have fixed size.
- (4) Question number area has fixed color.
- (5) Question number and question content disappear at completion of making a question.

Based on above features, key frames of question-making scenes are extracted by using coordinate, size and color information.

2.2 Extraction of Question-Making Interval

Question-making interval is interval of question number and question content that is from its appearing to disappearing for making a question. Question-making scene is composed by extraction of question-making interval based on the extracted key frame. Question-making interval is extracted by computation of gray-level histogram difference(D_i) for question number area as Equation

(1).

$$D_i = \sum_{j=1}^{Bin} |H_i(j) - H_{i-1}(j)| \quad (1)$$

In Equation (1), $H_i(j)$ denotes j -th bin of the gray-level histogram of frame i . QMI (question-making interval) is extracted when gray-level histogram difference exist in threshold(D_T). In case is not so, it be the NFI (Normal Frame Interval). Detailed algorithm is shown as (Fig. 1).

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For (i = 2; i ≤ n; i++) {
     $D_i$  = gray-level histogram difference;
     $W_f$  =  $|W_k - W_l|$ ;
    If ( $D_i \leq D_T$ )  $F_i$  =  $QMI$ ;
    Else IF ( $D_i > D_T$  AND  $W_f \leq W_T$ )
         $F_i$  =  $QMI$ ;
    Else  $F_i$  =  $NFI$ ;
}
    
```

Fig. 1. Extraction Algorithm of QMI

3. An evaluation system using user profile

This paper proposes a new evaluation method that overcome the problems of traditional system by user profile. At first, a question bank database was constructed to evaluate student on Web at any time. Then questions are filtered by use of user profile. Finally, for an enhancement of evaluation efficiency, questions are made for an evaluation after due consideration of the personalized characteristic, the different of ability and the personalized interest. Overall system structure is shown as (Fig. 2).

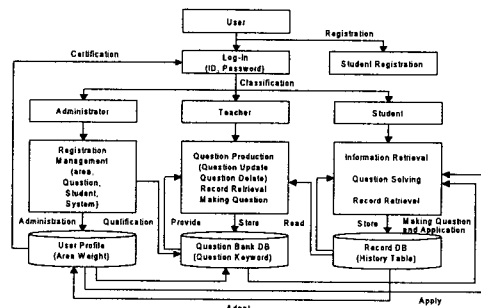


Fig. 2. Overall System Structure

3.1 A Proposed System Structure

In this paper, a proposed system improved upon the traditional evaluation system. It works a composed method of user profile systems as category-based with keyword-based. Information retrieval agents[5] is applied for making question using user profile. That is, the question retrieval and filtering method that was after due consideration of personalized characteristic and ability using user profile is worked to evaluate students. That was figured in 4 module as User Registration, Administrator Module, Teacher Module, Student Module.

3.2 Question Filtering Using User Profile

When user takes a test, question is filtered using user profile and provided to user. Questions of the areas are determined by computation of area weight. In this paper, question filtering used both category-based model and keyword-based model.

◆ Category-based System

The result of test can be greatly classified into right and wrong answer. The score of areas are obtained by sum of correct answers in the area. The total score is obtained by sum of area score.

This evaluation system tries to obtain the personalized characteristics of user from relative evaluation for each area. That is, after reflect this converting area scores by relative ratio that is not total score, impose number of question putting positive weight for weakness area in evaluation. This way talks as category-based system using specification technology because can specify number of question by area.

However, category-based system by this area classification is available quantitative analysis but qualitative analysis. It can become a factor that do user's interest to drop as that impose more weights about weak area to user in application.

◆ Keyword-based System

Keyword-based system seek for subject that is most serious interest in individual question that is details element more, and does this as keyword and

insert to question. And create new keyword profile by selecting keyword that come out most frequently for question that user sets right answer with result of test and by inserting this keyword data in queue that have stored existing keyword data.

When evaluate next time, make preferentially a question that has user's interest thing which reflect keyword profile again in number of question for each area that is allocated by category-based system. This paper uses *LIKE* sentence of standard SQL rules that is provided in MySQL.

4. Implementation of remote evaluation system

4.1 Environment

Remote education evaluation system that implemented in this paper used Apach-web server to use TCP-IP environment in Pentieom4-1.3GHZ specification. Scene change detection is implemented by Visual C++6.0 for EBS JANGHAK-QUIZ videos. MySQL is used to construct medium size database system under general Windows 2000 Server, and did so that can access database through PHP3.

4.2 Scene Change Detection

Video data for scene change detection used the first round videos of EBS JANGHAK-QUIZ programs. Key frames are extracted by using the structural features such as coordinate(position), size and color information of question making scene in video. Scene change detection is performed as shown in (Fig. 3).



Fig. 3. Scene Change Detection

Following <Table 1> shows reference values and threshold values of question number region's

position, size, mean gray-color and time window frame for scene change detection.

<Table 1> Threshold Values for Scene Change Detection

features	(RV)Reference Value	(TV)Threshold Value
position(x, y)	25, 171	RV±1
size(area)	1739	RV±83
mean-gray color	170	RV±10
W_T	60	RV±5
D_i	100	RV±10

In <Table 1>, RV is the reference value that is standard value of the question number region, and TV is the threshold value that is the thresholding region for RV. IF every feature exists in range of threshold value, question key frame and question frame interval is extracted.

4.7 Comparison and Estimation

Comparison and estimation of characteristics between traditional evaluation system that is wholly simple and proposed system in this paper that is new and creative is shown as <Table 2>.

<Table 2> Comparison and Estimation

Item	Traditional System	Proposed System
form of evaluation	wholly uniform	differ from individually
number of question per area	wholly same	differ from individually
base of evaluation	question-maker	personalized characteristics
priority of evaluation	have no priority	have priority of weak area
question media	text	video
evaluation purpose	general study achievement	enhance of study achievement

As appear in above <Table 2>, the most important purpose of evaluation system using user profile is not that evaluate simple studying achievement degree as traditional evaluation systems but that individual students receive more question that is come in own weak area and improve studying achievement degree, and did so that this studying achievement also may be evaluated.

5. conclusion

This paper proposes an efficient remote evaluation system that is matched well with personalized characteristics of students using

information filtering based on user profile. Question-making method that combined category-based system with keyword-based system is used for applying user profile in evaluation. Also, this paper proposes a key frame extraction method of question-making scenes based on coordinate, size and color information of question number region for making a question in forms of video. Question-making intervals are extracted using gray-level histogram difference and time window. Through this system, students can both supplement their inferior area and preserve their interest, and then enhance their study achievement. Specially, using user profile, it controls number of question by area according to user's question solving result and maximized quality and efficiency about test evaluation. And it give many helps that coach students using weight information about user, and did so that can induce interest for study using user interest keyword.

In future, it is considered that need about extension of system that can make a various questions using multimedia and wide research for the intelligent information retrieval and filtering method.

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