



Design of Online Teaching Platform for Packaging and Printing Course Based on Joint Image Denoising

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Abstract. With the development of modern technology, online teaching platform began to appear, but the traditional design of the platform function is not perfect, resulting in the presence of noise when the platform displays teaching images, affecting students' interaction in the platform, so the design of online teaching platform for packaging and printing course based on joint image denoising. This design plans the overall design scheme in advance, sets the corresponding teaching interaction function according to the results of the basic module division of the platform, and optimizes the packaging and printing teaching information combined with image denoising method. Experimental results: compared with the traditional platform, the design of the platform in the display of teaching images, image peak signal-to-noise ratio is higher, clear teaching images stimulate students' learning enthusiasm, so as to strengthen the communication and interaction in the teaching platform.

Keywords: Joint image denoising · Packaging and printing course · Online teaching platform

1 Introduction

As the basic technology platform of online learning, online teaching platform supports the development of distance learning, a variety of online learning activities and informal learning [1]. The main function of online teaching platform for packaging and printing course is to provide a channel for teaching interaction and teaching resource sharing between teachers and students. With the development of information technology, the teaching resources of packaging and printing course become more and more diverse, but generally speaking, it mainly includes the following two kinds of teaching information: first, packaging and printing course information. It includes course introduction, syllabus, teaching results, teaching calendar, reference materials, timetable and teacher information. Second, packaging and printing classroom resource information. Including coursewares, exercises, assignments and micro course videos [2]. From the traditional learning management system to the large-scale open online course platform, the network teaching platform is also constantly adapting to the development and requirements of

information technology and learning environment. Therefore, aiming at the basic content of packaging and printing course, a new online teaching platform is designed based on the joint image denoising method [3]. Based on the way for students to obtain and download the information of packaging and printing course resources: mobile client and browser, the interactive classroom teaching activities are constructed. The activity is divided into two levels. Firstly, the designed platform should be combined with the Android mobile phone client software used by students to realize students' interaction in class; Secondly, the designed platform is combined with campus platform such as web forum to realize students' interaction after class.

2 Overall Design of Online Teaching Platform for Package Printing Course

Therefore the platform shares the packing printing curriculum teaching material, first needs to organize the document, organizes the document form from the student user end. Student users can use the Android mobile client and browser to access or download information based on the course and the modules below, which is straightforward and convenient for users. Considering the convenience and shortcut in the organization of server files, we need to set up the corresponding course directory. Among them, the folder "00 _ course" stores package printing course materials, including course introduction, teaching results, teaching calendar and other information. The second level catalogue under "01 _" is the name of the teacher, and the third level catalogue is the courseware corresponding to the teacher. 02 ~ 09 are the corresponding project files under the course, and their three-level directories are the corresponding files under their respective directories. The "10 _ pictures" are some of the teaching files used in the course for packaging and printing pictures. By strictly prescribing the organization form of course materials, the server side can add new course contents, put the new course resource files according to the catalog mode above, and save the catalog of the files to the database conveniently, so that the teaching platform has a good expansibility. Online packaging printing teaching platform, mainly through the use of browsers to complete specific operations, so a dual-mode online teaching platform, taking full account of mobile Internet and intelligent terminal equipment, in teaching plays a good interactive and promotive role, and enhance the enthusiasm and initiative of students. The overall architecture of the mobile Internet-based online teaching platform for packaged print courses is shown in Fig. 1 [4–6].

The server of teaching platform is mainly composed of three parts: network server, application server and database server. The IIS server on Windows platform has the functions of both network server and application server. Teaching platforms target two categories of users: Android mobile clients and PC browsers. The former accesses the teaching platform through mobile client software and the latter accesses the teaching platform through browser software installed on the computer. The design of the online teaching platform, requires the design of two major functions: one is the packaging printing course teaching materials sharing function, and the other is the packaging printing course student interaction function. Classroom interaction is mainly classroom questioning and online testing functions. According to the overall design framework, design a new online teaching platform.

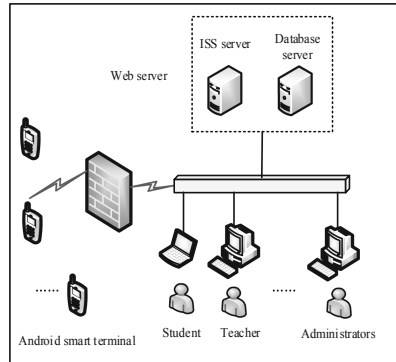


Fig. 1. Framework diagram of package printing teaching platform

3 Design of Online Teaching Platform for Package Printing Course Based on Joint Image Denoising

3.1 Partition Platform Basic Modules

The teaching platform of packaging and printing course adopts modular design method. The modular design mentioned here is different from the software module design, which refers to modularizing the code with relatively independent functions in the software design of an application system to facilitate code reuse, such as user interface module, data access module, etc. Here the modular design, is to consider the teaching function, the entire system layered modular design. Such as the presentation of teaching resources, can be divided into text presentation module, video, audio presentation module; communication can be divided into online communication, non-online communication module. Each function module is closely related to the target, design method and layered model of the platform design, which is helpful for the flexible operation in the actual development and meeting the specific requirements. Reduce the complexity of platform design. First, the teaching information module is designed. Teaching Information provides all kinds of information about packaging and printing courses, including the latest packaging and printing design concepts, the latest teaching documents issued by the school, computer classroom scheduling announcements, practice course schedule adjustment information announcements, etc. Packaging printing consultancy for learners to provide the latest design concepts, in addition to provide students with packaging printing course knowledge introduction, expand students' extra-curricular knowledge. Teaching information provides management service information such as undergraduate teaching plan, textbook receiving and dispatching, course arrangement, result inquiry, etc.

Next designs the teaching resources module. One of the characteristics of the teaching resources module is the rich and diverse forms of expression, which helps to stimulate students' interest in learning. Another characteristic is that the resource design is comprehensive, systematic and logical. For a practical operation, students can not only find video resources in the classroom video, but also find FLASH animation in the animation. The resource navigation module provides the link of each university's package printing teaching system. Students can directly log in the system to select the corresponding practical courses according to their own needs. After the course, students can inquire about the results of the courses. Teachers can also through the link, enter the packaging printing teaching system, view the students' choice of classes, input students' practice course test results. In addition, the link of visual communication and design network platform of some domestic universities is also established to let teachers and students share excellent teaching resources of other schools. Using this module to provide students with comprehensive information in the form of text and pictures, it helps students to understand the objectives and specific contents of packaging printing course.

At the same time design download area module. The practice report is a comprehensive summary of the practice course. It is the basis for the teachers to evaluate the students' mastery of the course of package printing. Students can download printed test reports in the Downloads section. In order to unify the format of students' study report and facilitate teachers' correcting the practice report, the paper provides a standard and representative student's practice report as a reference template. Packaging and printing teaching module, mainly to encourage teachers to learn all kinds of application software, because the construction of resources is a huge project, for teachers familiar with packaging and printing teaching, if they can master these software, the construction of resources will play a considerable role. Certainly these software students may also carry on the click download, carries on the expansion study. Package Printing Course Test Paper: This section is not the main resource of the platform and is available to students for the Theory Course of Package Printing.

Finally, the interactive space module is designed. Interactive space has many functions, such as communication, cooperation and message. It is an interactive environment between students and teachers, students and students, teachers and teachers. Give full play to the initiative of both teaching and learning, give play to the initiative and creativity of students. In this module set up online Q&A, which is the communication module between teachers and students, students can raise questions in practice class or outside the practice class. Answering questions can be divided into in-class answering questions and after-class answering questions. Teachers can either synchronize answers or respond to questions when they have time. The Package Printing Course Forum provides a space for students and teachers to communicate and discuss. The discussion and exchange of the forum is not limited to the content of the learning topic, but can express opinions, discuss experience, exchange and learn from each other. Students in the forum can search by packaging and printing designer, topic and category, and can also participate in the

Q&A. You can also add topics of interest to your favorites. The forum will rank the posts with replies to questions.

3.2 Setting up Interactive Functions of Teaching Platform

There are mainly three participants in the interactive teaching platform: students, teachers and administrators. In the design of students' activities, students can use the learning function provided by the platform to assist learning. Students can check the homework after the teacher assigns the homework, submit the package printing picture design homework, and then use the platform to judge and feedback the results to students. Students review their history assignments, review key design topics, and check the problem sets to see how they operate. Using the statistical function of the platform, students can get the statistical results of the recent course of packaging and printing, and arrange the learning plan better. Students use the cloud storage space to save excellent learning attachments on the platform and share them with other users. In the process of using the platform, students can enter the chat room, communicate with other teachers and students in real time, and solve the puzzles in the course of packaging and printing through the wisdom of the group. In the design of teacher's activity function: realize the teacher's online editing function, input high-quality questions into the question bank. The teacher selects the test questions in the question bank, publishes these questions by the assignment form to the student end, guides the student to study [7–10]. Teachers can view the history of homework and homework statistics, the number of students to complete each task and error steps to understand, so as to more targeted adjustment package printing teaching. Teachers use cloud storage space to share learning attachments with other users. At the same time, teachers can also enter the chat room to communicate with the students in the room. In order to ensure the quality of the cloud learning resources, the administrator should audit the questions edited by the teachers online, and then these questions can be input into the question bank. Therefore, the design of the online editing platform, the library to the different categories of teaching materials management packaging printing materials, and packaging printing materials under the database for basic operation. When the administrator maintains the basic information of the whole platform users, he or she has the right to input the topic directly into the item bank.

Through the above steps, the characteristics of the activities of the three participants in the platform are analyzed, and the functions of the platform are set up. Homework management module provides teaching space for teachers and students. Teachers spread the knowledge of packaging and printing by assigning homework. Students think independently by doing homework. At the same time, teachers look at the history of homework, the students have done homework analysis to understand the correct rate of students to complete the homework. But the student then inspects in the packing and printing work the operation mistake part, strengthens to the knowledge which is easy to omit. The question bank management module provides teachers with the scene of designing learning tasks, teachers edit the questions and input the high-quality questions into the

questions bank. Administrators to review the subject to ensure the quality of the subject. Also asked to manage the packaging and printing of teaching materials, including the updating and elimination of teaching materials, teaching materials corresponding to the problem of real-time maintenance. The platform management module helps administrators to manage the users of the platform, modify user permissions and roles. The resource management module provides a learning attachment sharing platform for teachers and students. Teachers upload packaging and printing learning attachments to the platform, students download attachments and save them to personal space. At the same time online chat module for teachers and students to provide a platform for instant messaging, students in the process of using the platform, access to online chat rooms, and online teachers and students at the same time, to exchange packaging and printing design process difficulties and skills [11].

According to the storage form of teaching interactive platform resources, known learning attachments are mainly Word, PDF, PPT and other documents, and there are also a small number of video files, intelligent extraction of resource features, documents can be printed by packaging the main word frequency of teaching content, statistics of main features, but video and other streaming media files can not be extracted. Since intelligent extraction is difficult and inaccurate, it is necessary to design a matching model by combining the features of resources with student users to ensure that resources are valuable to students. Therefore, the platform resource management module uses content-based push technology to establish a student resource model:

$$\lambda q = (x_0, x_1, x_2, x_3, x_4, x_5) \quad (1)$$

In the formula: λ represents the value of students' knowledge depth; q represents the value of resource knowledge depth. The calculation method of matching parameters of each index can refer to the following equations:

$$\begin{cases} x_0 = (u_0, u_1, u_2, \dots, u_n) \\ x_1 = (v_0, v_1, v_2, \dots, v_n) \\ \dots \\ x_5 = (z_0, z_1, z_2, \dots, z_n) \end{cases} \quad (2)$$

In the formula: $x_0, x_1, x_2, x_3, x_4, x_5$ respectively represent the subject content involved in the packaging and printing course; $(u_0, u_n), (v_0, v_n)$ 以及 (z_0, z_n) respectively represent the value of knowledge points covered by each packaging and printing teaching course, these values are 0 or 1, where 0 means that the knowledge point is not included, and 1 means that the knowledge point is included. Through the vector group, the knowledge breadth matching model of students and resources is established, and the resource push problem is concretely transformed into the matching degree calculation of students'

knowledge model and resource knowledge model. For the similarity calculation between two vectors, this paper uses the angle cosine formula to calculate the similarity between two vectors. If the breadth of knowledge of students and resources is set to sum, there are three problems.

$$\cos \alpha = \frac{AB}{|A||B|} \quad (3)$$

When the angle is larger and the cosine value is smaller, the matching degree between students and resources is lower, so as to set the interactive function of teaching platform [12–16].

3.3 Optimization of Packaging and Printing Teaching Information by Combined Image Denoising Method

According to the wavelet coefficients corresponding to the image information and noise, the joint image denoising method performs image denoising on different decomposition scales. From a mathematical point of view, the denoising problem of joint image denoising method can be regarded as a function approximation problem. This method uses certain technology to process the wavelet coefficients of noisy image signal in wavelet domain, filter out the wavelet coefficients corresponding to noise as much as possible, and retain the wavelet coefficients corresponding to image signal as much as possible. In order to achieve the purpose of image de-noising, inverse transform reconstruction is used. In this process, the main purpose is to make the denoised packaging printing image as much as possible to achieve an optimal estimation of the original packaging printing image. Its formula expression can be described by the following formula:

$$\begin{cases} s = s_1 + s_2 \\ \beta_{opt} = \arg \min(\|\beta(s) - s_1\|) \\ s_{opt} = \beta_{opt}(s) \end{cases} \quad (4)$$

In the formula, s represents the noisy image information, s_1 is the original image information, s_2 is the noise, β is the mapping from the actual image information space to the wavelet function space, and the optimal solution [17]. The joint image denoising method can be regarded as finding the best mapping. The conventional median filtering method is effective for impulse noise denoising, but it is greatly influenced by the size of filter window. When the filter window is small, the image edge feature can be well protected, but the denoising ability is limited. When the filter window is large, the denoising ability can be strengthened, but the protection of image edge feature is weakened. Therefore, there are some contradictions between the ability of protecting image details and denoising, especially when there is a lot of impulse noise. According to the existing research data, when the intensity of impulse noise is more than 0.2, the effect of conventional median filter is poor. In order to solve the problem that the conventional median filter window is fixed and invariant, resulting in the contradiction between the

denoising ability and the protection of image details, the joint image denoising method is used to continuously adjust the size of the filter window, and when the current image pixel value is determined as noise, the median value is used to replace it; when the current image pixel value is determined as noise, it remains unchanged, until the teaching platform is designed [18–20].

4 Experimental Research

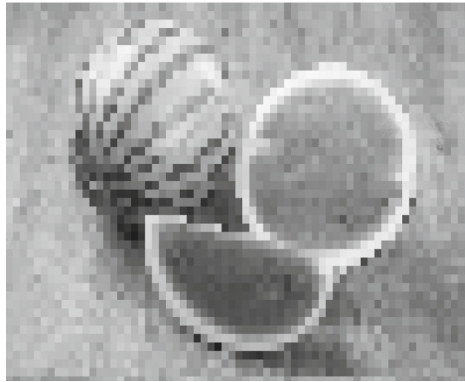
In this experiment, the system is divided into three parts: Hadoop cloud processing platform; HBase distributed massive information database, as well as teaching management control system, using the above system to build the experimental test environment. The test environment is supported by JDK and Tomcat. Download `jdk-7u80-linux-i370.bin` and `apache-tomcat-9.0.17.tar.gz`. Configure the IP address and host name of each test machine, and install `openssh` server to ensure the normal operation of the system program. At the same time, Download `hadoop-1.8.1.tar.gz` installation package to build the running environment of packaging and printing online teaching platform. After completing the above operation, we need to install and configure HBase database. In this step, we need to download the `hbase-0.94.12.tar.gz` installation package, distribute it to all stages of the cluster, implement the decompression program, and then modify the configuration information of `hbase-env.sh`. Select the corresponding packaging and printing test image for the teaching platform, which is mainly website image, to test whether different online teaching platforms can improve the signal-to-noise ratio to more than 75%. In order to facilitate comparative analysis, two groups of traditional platforms are selected as the control group. Traditional platform a is designed based on binary method, and traditional platform B is designed based on clustering mining algorithm. Using the way of comparison, according to the different signal-to-noise ratio of three groups of methods, test the noise reduction effect of different platforms for images, so as to demonstrate the interaction of students using the platform under different signal-to-noise ratio conditions.

4.1 Noise Reduction Effect Test

In order to test the denoising effect of different teaching platforms, $256 * 256$ images are selected as the test objects, and impulse noise is added according to the image resolution (Fig. 2).



(a) Original image



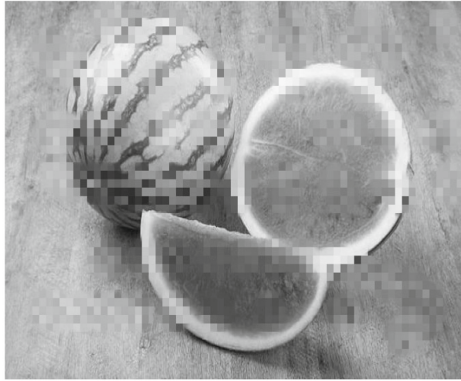
(b) Noisy image

Fig. 2. Experimental test conditions

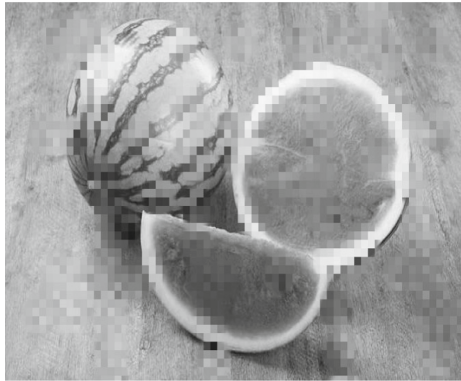
The designed teaching platform is taken as the test object of the experimental group, and the two traditional teaching platforms are taken as the test objects of the control group A and the control group B respectively. Set the noise density to 0.2, use three teaching platforms to display the teaching image of printing and packaging course, test and analyze the display effect of the same packaging printing image in the three platforms. There are five groups in the experiment. Because the test results are highly similar, only one group of images is given denoising effect, as shown in Fig. 3 below.



(a) Experimental group



(b) Control group A



(c) Control group B

Fig. 3. Display effect of teaching pictures on different platforms.

In Fig. 3 the image denoising effect of the experimental group platform is better than the feedback effect of the control group. It can be seen that the experimental group platform has a good denoising ability, which can maximize the retention of image details, make the image clearer and meet the teaching requirements. The peak signal-to-noise ratio (PSNR) of 5 packaging and printing design images in the three platforms is calculated. The results are shown in Table 1 below.

Table 1. Statistical table of image peak signal to noise ratio

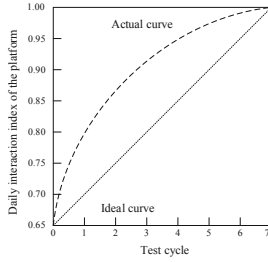
Picture number	Experience group	Control group A	Control group B
01	76.0073	70.4535	68.4624
02	76.0521	70.3699	68.4547
03	76.0329	70.4641	68.4439
04	76.0094	70.4659	68.4528
05	76.0225	70.3882	68.4525

By calculating the average PSNR of the three test groups, it is found that the experimental group is 5.5965 db and 7.5715 db higher than the two control groups respectively.

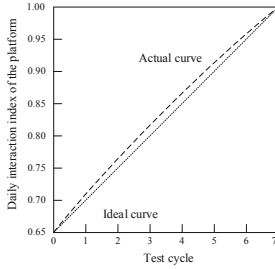
4.2 Teaching Effect Test

In order to further verify the teaching ability of the teaching platform, 100 students were randomly selected to use three groups of teaching platforms for online learning of daily packaging and printing course. The interactive effect of students in the platform is shown in Fig. 4 below.

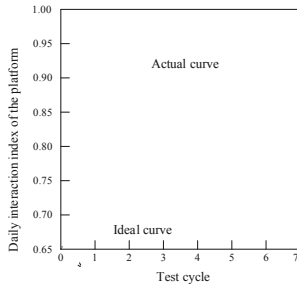
Figure 4 shows the design of the teaching platform, students on the platform to exchange the number of discussions significantly higher than the two control groups, that the performance of the platform is better, to meet students' learning needs for packaging printing courses, students with a more positive attitude to complete learning tasks, at the same time in a more active state, online interaction with other students and teachers on the platform, packaging printing courses to the implementation of the teaching. In the two control groups, the teaching image of package printing was not clear, which directly affected students' learning enthusiasm and reduced the number of interactions.



(a) Experimental group



(b) Control group A



(c) Control group B

Fig. 4. Student interaction with different platform applications

5 Concluding Remarks

The design of the platform in the division of the basic modules, this part can be explained again in the future, through more detailed module division, for the package printing course online teaching, provide a more perfect teaching platform, provide more advanced technology for students to learn.

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