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Teaching Practice of Digital Image Processing Experiment Based on LabVIEW

Bo Li

School of Electronics and Electrical Engineering, Zhaoqing University, Zhaoqing 526000, China

Abstract: This paper discusses the experimental design, teaching methods and strategies of using LabVIEW in digital image processing teaching. First of all, the design and content of the experiment are described in detail, including the setting of experimental objectives and tasks, the preparation of experimental equipment and materials, the design of experimental steps and processes, as well as the specific introduction of the experimental content, such as image reading, preprocessing, filtering and edge detection. Then, it discusses the experimental teaching methods and strategies, including the ways of experimental guidance and demonstration, the cultivation of students' independent learning and practice, and the promotion of experimental discussion and analysis, which is conducive to the continuous improvement of the quality of digital image processing experimental teaching.

Keywords: LabVIEW; Digital image processing; Teach

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1. Introduction

Laboratory Virtual Instrument Engineering Workbench (LabVIEW), as a graphical programming environment widely used in engineering and science fields, provides a new possibility for the teaching of digital image processing with its intuitive interface and powerful functions. The teaching practice of digital image processing experiments based on LabVIEW aims to combine theoretical knowledge with practical application through experimental teaching, so that students can master the basic principles and technologies of image processing in operation and practice. In addition, LabVIEW's graphical programming environment helps students understand complex algorithms and concepts more intuitively. Therefore, the research on the teaching practice of digital image processing experiments based on LabVIEW is of great significance for improving the teaching effect and training high-quality talents.

2. Design of experimental teaching

2.1 Purpose and significance of the experiment

2.1.1 Cultivate students' practical ability

Practical ability is the ability of students to apply what they have learned to practical operation on the basis of understanding and mastering theoretical knowledge. In the field of digital image processing, the importance of theoretical knowledge is self-evident, however, only relying on theoretical learning can not fully grasp the essence of this field. By letting students operate and practice in person, experimental teaching can improve their ability to solve problems and use skills in the process of completing specific tasks. In this process, students can intuitively see the effect of digital image processing, and have a deeper understanding of the steps and methods of image processing. Through repeated practice and debugging, students can gradually strengthen their ability to solve practical problems, thus laying a solid foundation for future work in digital image processing or related fields.

2.1.2 To help students understand the basic principles of digital image processing

Understanding the basic principles of digital image processing is an important part of studying the field. However, digital image processing involves a lot of theoretical knowledge and complex mathematical models, which are often difficult for students to fully understand through textbook learning. At this time, experimental teaching becomes a very effective auxiliary means. Through LabView-based experimental teaching, students can directly manipulate images and observe the effects of different algorithms and processing techniques on images. For example, by filtering, enhancing, and feature extraction of images, students can directly see how these operations affect the quality and information of an image. In this course, students are able to gain a deeper understanding of the basic concepts, principles and techniques of digital image processing and are able to closely integrate theoretical knowledge with practical operations.

2.2 Selection and design of experimental content

2.2.1 Experimental content combined with curriculum theory

In the selection and design of experiment content, we must consider the close combination of experiment and curriculum theory. Theoretical teaching provides the basic knowledge and framework, while experimentation is the process of putting this knowledge into practice. In the teaching of digital image processing, the experimental content can cover image acquisition, preprocessing, segmentation, feature extraction, image enhancement and restoration. First, experiments can be designed to help students understand the basic properties and representations of images. Then, through the experiment of image preprocessing, students can learn how to process images to prepare for the subsequent processing steps.

2.2.2 The difficulty of the experiment and students' acceptance

In the design of the experiment content, it is also necessary to consider the difficulty of the experiment and the acceptance ability of students. Too simple experiments may not fully stimulate students' interest in learning, while too complex experiments may confuse and frustrate students. Therefore, the difficulty of the experiment should be gradually set to adapt to the learning progress and ability of students. In the initial stage, we can start with basic image operations and simple processing techniques, such as image gray conversion, histogram equalization, etc. With the growth of students' ability, the difficulty of experiments can be gradually increased, such as image segmentation, feature extraction and other advanced technologies [1].

2.3 Experimental resources and environment

2.3.1 Laboratory equipment and software configuration

In the implementation of digital image processing experiment teaching based on LabVIEW, laboratory equipment and software configuration is very important. First of all, the laboratory needs to be equipped with a sufficient number of computers to ensure that each student can have sufficient time for practical operations. These computers should have sufficient processing power to efficiently run the algorithms associated with digital image processing. Second, the LabVIEW software must be installed on the computer. LabVIEW is a graphic programming language, widely used in data acquisition and processing, is an ideal tool for digital image processing teaching. In the lab, it should be ensured that LabVIEW's version is up to date and that all the necessary plug-ins and toolkits have been installed to support the various functions of digital image processing. In addition, it is necessary to equip some external equipment, such as digital cameras, image scanners and printers, so that students can carry out the practical operation of image acquisition, analysis and output.

3.3.2 Experimental materials and auxiliary tools

Experimental materials are the key to achieve experimental objectives. In the teaching of digital image processing, a series of sample images should be provided for students to practice and test image processing algorithms. These sample images should cover different types and scenes so that students can learn the skills to work with a variety of images. At the same time, writing a set of detailed experimental instructions is also very necessary. The experimental instructions should contain the purpose, basic principles, operation procedures, expected results, and analysis of the experiment to help students better understand and complete the experimental task. In addition, the provision of auxiliary tools, such as textbooks, online tutorials and papers related to image processing, can also provide students with more learning resources. These AIDS can help students deeply understand the theories and methods of digital image processing, and stimulate their learning interest and innovative spirit [2].

3. Strategies for implementing teaching practice

3.1 Guide students to learn actively

3.1.1 Design challenging experimental tasks

In order to guide students to actively learn in digital image processing experiments based on LabVIEW, it is essential to design challenging experimental tasks. These tasks should be designed to push students to apply the theoretical knowledge they learn in the

classroom to solve practical problems. For example, a task could be set that asks students to use digital image processing techniques to improve a blurry image. This task not only requires students to understand the basic principles of image processing, but also requires them to master and apply the relevant tools and functions in LabVIEW. In order to increase the challenge, teachers can gradually increase the complexity of tasks, or set some open questions, so that students can exert their creativity and problem-solving ability [3].

3.1.2 Encourage students to ask questions and solve problems

In the course of the experiment, encouraging students to ask questions and solve problems is an effective way to stimulate their active participation and in-depth learning. First, teachers should create an open and inclusive learning environment where students feel free to ask questions and share ideas. This can be done by making it clear at the beginning of the experiment that the teacher is willing to answer questions, or by regularly checking on the student's progress. Secondly, when students encounter problems, teachers can guide them to find answers through independent thinking and discussion, instead of directly giving solutions. This approach can help students develop problem-solving skills and boost their self-confidence. Finally, in order to further encourage students to solve problems, some reward mechanisms can be set up, such as providing additional credits or other forms of rewards for students who solve specific problems .

3.2 Strengthen the combination of experimental teaching and theoretical teaching

3.2.1 Explain theoretical knowledge through case analysis

Integrating case analysis into experimental teaching is an effective way to strengthen the combination of experiment and theory. In the digital image processing experiments based on LabVIEW, teachers can choose some specific cases, such as image enhancement, image segmentation, etc., to explain the relevant theoretical knowledge. By using real image data, teachers can demonstrate the various steps of digital image processing and explain the theoretical principles applied in each step.

For example, when explaining image filtering, the teacher can first introduce the basic concepts and principles of filtering, and then select a specific image to show how to use the filtering tool in LabVIEW to remove noise. In this process, teachers can discuss in depth different types of filters (such as average filters, Gaussian filters, etc.) and their effects and limitations in practical applications.

3.2.2 Corresponding experimental results with theoretical knowledge

During the experiment, students will get a series of experimental results. In order to strengthen the combination of experimental teaching and theoretical teaching, teachers should guide students to relate these experimental results to theoretical knowledge. This can be done by comparing experimental results with theoretical predictions and discussing possible causes of any deviations. For example, when students use a certain image enhancement technique to improve image quality, they can first predict the effect of the enhancement and then compare it with the actual experimental results. If the results of an experiment do not match expectations, students should be encouraged to explore possible causes, such as parameter Settings, image characteristics, etc., and consider how to adjust the method to obtain better results.

4. Concluding Remarks

To sum up, the teaching practice of digital image processing experiment based on LabVIEW is of great significance in digital image processing teaching. Through practical operation, students can not only intuitively understand the principles and methods of image processing, but also improve their hands-on ability and problem-solving ability. Teachers guide and stimulate students' learning enthusiasm in the teaching process, which can better promote students' theoretical understanding and practical application. However, further research and improvement of experimental teaching methods are needed to meet the growing demand for engineering talents in the field of digital image processing, and to improve the effectiveness and quality of experimental teaching.

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About the author:

Bo Li (1989.08-), male, Han, born in Harbin, Heilongjiang Province, Master, experimentologist, School of Electronic and Electrical Engineering, Zhaoqing University, main research interests are virtual instrument and image processing.