Construction of an Application-Oriented Production Internship Teaching System for Remote Sensing Science and Technology

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Abstract: In order to implement the teaching concept and teaching principle of "learning to use" and "learning to be useful", give full play to the innate advantages of remote sensing science and technology majors in the field of agricultural monitoring, construct a production internship teaching system oriented to agricultural applications, and form the teaching objectives, teaching tasks and teaching evaluation system under the new system, give full play to the professional knowledge and skills of remote sensing science and technology majors, and make students gain recognition and satisfaction of serving the society during the internship and practice process, and fully mobilize students' learning enthusiasm.

Keywords: production internship; remote sensing; application-oriented; agriculture; teaching system;

1 Introduction

Heilongjiang province is China's most important grain production base, grain production accounted for 11.5% of the country's total output, and for 11 consecutive years ranked first in the country, to ensure national food security has made an outstanding contribution. 2023 September, General Secretary Xi Jinping pointed out during his visit to Heilongjiang: we should focus on the development of modern large-scale agriculture, accelerating the modernization of agriculture and rural areas, and be a good national food production and supply of steady production 'ballast', is the primary role of the Northeast, and the importance of coordinating the promotion of scientific and technological agriculture, green agriculture, quality agriculture, brand agriculture.

One of the central thrusts of the promotion of scientific and technological agriculture is the realization of automated agricultural monitoring based on remote sensing technology. Remote sensing technology can provide the morphological and spectral data needed for crop growth monitoring and can be applied in such areas as crop growth monitoring, soil fertility determination, soil moisture monitoring, pest and disease monitoring, planted area statistics, grain yield estimation, disaster yield reduction estimation and crop cultivation planning [1].

Harbin Institute of Technology (HIT) is to adheres to the educational philosophy of focusing on aerospace and serving national defense. HIT is rooted in the northeast, for the development of

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science and technology and economic development of Heilongjiang has made outstanding contributions. Currently, the production internship of remote sensing science and technology majors in our university is mainly based on the traditional teaching material ideas, step by step. The content of internship is for simple technology indoor training, basically belongs to the understanding of the basic theory of remote sensing to remote sensing data cognition, as well as learning the corresponding remote sensing software, and then complete the qualitative and quantitative analysis of remote sensing data, such a traditional internship process is mostly validation [2-3], ignoring the professional skills in the main battlefield of the national economy in the actual operation of the internship process in which students are in the process of passive indoctrination, which restricts the student's Subjective initiative and creative thinking in the flexible application of experimental internship, so that the students remote sensing application skills and actual production disconnect, after graduation can not do the combination of learned knowledge and practical. Therefore, if we build a new remote sensing teaching internship mode by combining the needs of agricultural application, carry out inheritance and reform and innovation in teaching internship content, teaching internship method and teaching internship idea, we can adapt to the needs of the development of the road of combining production, learning and research in the context of the current demand for scientific and technological agriculture in our province (Heilongjiang), and cultivate excellent graduates who are more capable of serving the main battlefield of the construction of the national economy.

Therefore, in order to give full play to the importance of scientific and technological agriculture and to promote the teaching concept of learning to use and learning to be useful, it is proposed to construct a production internship teaching system of remote sensing science and technology based on the agricultural application orientation in the cultivation system of remote sensing science and technology, and to form the teaching objectives, teaching tasks and teaching evaluation system under the new system.

2 Application led production internship teaching objective system

At present, the teaching objectives of production internship in remote sensing science and technology are mainly set in cultivating students' ability of remote sensing data generation, acquisition and full-process data processing, and they do not care about the direction of application and application prospect after data processing, which makes students lose confidence in the usefulness and application prospect of the course. In order to improve the status quo and enhance students' interest in remote sensing production internship course, we take remote sensing agricultural application as the starting point and carry out reforms and innovations in the construction of the teaching objective system, and the new teaching objectives include the construction of three aspects, namely, having the cognitive ability of the whole process of remote sensing data, having the ability of solving practical problems in the practical content, and having the ability of independent and autonomous innovation.

2.1 Having the ability to recognize the entire process of remote sensing data

Constructing the teaching target system of remote sensing production internship oriented to agricultural applications firstly to cultivate students' cognitive ability of the whole process of remote sensing data processing. Remote sensing data processing, including data processing oriented to agricultural remote sensing applications [4], should be built on the basis of all remote

sensing basic data processing. Although the cognitive ability of the whole process of remote sensing data processing is the main task in the traditional remote sensing production internship training, the task is still the foundation of the application-oriented production internship and cannot be abandoned.

2.2 Practical content with the ability to solve practical problems

The construction of an agricultural application-oriented remote sensing production internship teaching objective system needs to cultivate students' ability to solve practical agricultural demand problems. Compared with the application needs in traditional production internship, the agricultural monitoring needs are more practical and easier to understand, and the agricultural remote sensing monitoring application needs are more complicated. Take crop growth monitoring as an example: to build a good crop growth monitoring model, it is necessary to obtain the necessary parameters such as crop height, crop leaf width, crop chlorophyll concentration, etc., and the extraction of these parameters needs to be solved at multiple levels, which on the one hand, requires that the sensor equipment has the ability to extract the height and spectrum of the crop, and at the same time requires that the sensors have a higher spatial resolution, which makes the data come from Multiple sensors (LiDAR, multispectral, hyperspectral, high-spectral) [5]; on the other hand, from the acquired multi-sensor data to the required parameter extraction, the middle involves multiple processing steps and multiple principles, and many principles are not taught in the previous remote sensing courses, which requires one's own hands to consult the relevant information to write the relevant programs. It can be seen that the demand-driven approach of the students to solve the problem will be more intuitive and directional, which is conducive to improving the hands-on ability of the students.

2.3 Having the ability to innovate independently and independently

Agricultural application requirements are often complex and diverse, and with further refinement of the requirements (including the refinement of the use of data, the refinement of the monitoring crop, the determination of the monitoring location, the determination of the monitoring time period), it will lead to the emergence of new problems in the traditional general processing mode and method. In addition, the conditions of each field experiment will change, resulting in a certain deviation of data from the needs, all of which require students to be independent and innovative in order to solve specific agricultural application problems more effectively.

3 Application led production internship teaching content system

In this paper, we will construct a remote sensing production internship teaching content system dominated by agricultural application from three aspects: checking the omissions and filling the gaps in the professional basic knowledge system, dealing with professional basic experiments in the whole process, and professional comprehensive experiments oriented to practical applications [6].

3.1 Identify and fill in gaps in the professional basic knowledge system

Agricultural application-oriented production internship will face more difficulties than traditional production internship, including the need to use more types of data, carry out pre-processing of multiple types of data, extract more data features, and carry out analysis of multiple types of applications. Solving these difficulties requires us to acquire more professional knowledge in advance [7], to check and fill in the gaps in our existing basic professional knowledge, and to increase the teaching sessions of the missing knowledge in the early stage of production internship.

3.2 Professional basic experiments for whole process

Remote sensing teaching internship is divided into four parts, including data acquisition, data preprocessing, data analysis and information extraction, and expression and application of the resultant information, of which the data acquisition part sets up remote sensing internship projects, such as spectral measurement of features, acquisition of spatial coordinates and spatial data acquisition [8], with reference to such application needs as microscopic crop monitoring, determination of soil fertility, monitoring of soil moisture and monitoring of pests and diseases in precision agriculture; In the data analysis section, with reference to the application needs of crop cultivation statistics and yield estimation, regional crop pest and disease monitoring, and crop cultivation planning in agricultural applications, remote sensing internship projects such as remote sensing quantitative inversion, mixed pixel decomposition, and vegetation index calculation are set up; for the remote sensing data processing part of the internship program, combining the coupling needs of micro- and macro-agriculture, we designed remote sensing image preprocessing, multi-band calculation, image classification and data fusion, etc.

3.3 Professional comprehensive experiments for practical applications

Here we take crop estimation as the theme for the professional comprehensive experiment, which will be divided into the following six links:

(1) Obtain crop remote sensing data. Remote sensing data can be acquired by satellite, aircraft, UAV or other platforms. These data include multi-spectral images infrared images, high-resolution images and so on. Through remote sensing data, we can obtain the growth of crops, chlorophyll content, vegetation index and other information [9].

(2) Pre-processing remote sensing data. After obtaining remote sensing data, it is necessary to pre-process the data to improve the quality and usability of the data. Preprocessing includes processes such as removing cloud shadows, atmospheric correction, and radiometric calibration. These steps can eliminate interfering factors and accurately reflect the growing conditions of crops.

(3) Extraction of crop features. In the preprocessed remote sensing data, it is necessary to extract the features related to crop yield commonly used features include vegetation index, leaf area index, moisture index and so on. These features can reflect the growth and health of crops.

(4) Establishment of yield estimation model. After extracting the features of crops, we need to build a yield estimation model to estimate the crop yield. The yield estimation model can be based on machine learning algorithms, such as support vector machine, random forest, and so

on. By training the model, we can establish the relationship between crop yield and remote sensing features to achieve yield estimation.

(5) Validate and evaluate the model. After establishing the yield estimation model, the model needs to be validated and evaluated. The purpose of validating and assessing the model is to test the accuracy and reliability of the model. Commonly used methods include cross-validation, root mean square error and so on. By validating and evaluating the model, we can get the accuracy and error range of the model.

(6) Estimating crop yield. Through the established estimation model, we can use remote sensing data to estimate the crop yield. According to the crop characteristics extracted from the remote sensing data, combined with the estimation model, we can get the result of crop yield estimation. This result can be used for crop planting management, decision support and so on.

(7) Analysis of results. Analysis of the results can help us understand the growth of crops and yield trends, providing a scientific basis for agricultural production At the same time, the results of yield estimation can also be used in agricultural insurance, agricultural subsidies, etc., to provide farmers with appropriate policy support.

3.4 Innovative content exploration experiment for free rein

In order to better improve students' hands-on ability and innovation and exploration ability, remote sensing production internship will set up a free play of innovative content exploration experiments, so that students go to the field to find out the actual problem, through the school-enterprise joint training in the enterprise to obtain the actual agricultural demand problems [10]. Through the students themselves to find out the problems, propose solutions, carry out experiments, write their own programmes to deal with the mode, improve the students' initiative and practical problem-solving ability in the internship [11].

4 Teaching evaluation system combining application and practice

The construction of the evaluation system of production internship teaching for remote sensing science and technology based on agricultural application orientation includes two parts, the evaluation standard that combines the degree and ability of practical problem solving and the evaluation system that is oriented to the core of practical innovative thinking. Among them, the evaluation of innovative thinking ability is mainly judged by the experimental design of free play innovation and exploration, and the ability to solve practical problems is mainly judged by the degree of completion of professional comprehensive experiments and experimental results [12]. In addition, the production internship can be combined with the school-enterprise joint training mode, the actual problems faced by enterprises as the assessment topics, and the actual application of personnel to give the score evaluation.

5 Conclusions

According to the training requirements of the production internship course in the training programme of remote sensing science and technology, combining with the existing remote sensing data acquisition experimental equipment, combining the content of internship and the

needs of Heilongjiang agriculture, not only can enable students to systematically master the basic knowledge and methods of remote sensing experiments, cultivate the students' theoretical-connecting with practical thinking and rigorous and practical scientific research attitude, but also stimulate the students' professional interest, enhance their awareness of the usefulness of learning and promote the students' interest in the field [13]. It can also stimulate students' professional interest, enhance their awareness of the usefulness of learning and promote their active learning [14]. At the same time, it also deepens the application of remote sensing technology in agriculture in Heilongjiang Province. The new internship design from the books into the actual production of society, fully integrated with the needs of the actual production, to ensure the benign implementation of the remote sensing professional curriculum content system, creating a new way of combining production, learning and research.

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