TOWARD THE OPTIMIZATION OF PC BASED TRAINING FOR REMOTE SENSING AND GIS

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Commission VI, Working Group 2

KEY WORDS: Remote_Sensing, GIS, Education, Training

ABSTRACT:

Since 1992, the National Space Development Agency of Japan(NASDA) and the Economic and Social Commission for Asia and the Pacific(ESCAP) have been co-organizing the Regional Remote Sensing Seminar on Tropical Ecosystem Management every year in some country in Asia. In this seminar, the authors have been performing a three days PC based hands-on-training on remote sensing and GIS for beginners. This paper describes about the outline of the training and discusses about the optimization of PC based training for remote sensing and GIS.
The main objective of the training was to transfer not only knowledge but also technology of remote sensing and GIS to the beginners. Several software as well as data sets were prepared for the training and provided to the trainees on free of charge. The software were designed not only for training but also for practical data analysis. A large amount of data were stored in CD-ROMs for easy handling with PCs. All these situations allow trainees to smoothly step up from training to real analysis at their offices with their PCs after the training. For optimizing this kind of training, the training period, number of instructors, and number of PCs should be considered carefully.

1. INTRODUCTION

Now a days, many scientists and engineers from various application fields are starting to use remote sensing and GIS for the better understanding of global environmental changes. Though they are professionals in their own fields, many of them are beginners in remote sensing or in GIS. Moreover, for most of them, remote sensing or GIS is only a tool, and cannot afford enough time and budget to introduce sophisticated technology of remote sensing and GIS to their offices.
In order to promote remote sensing and GIS in Asian countries, since 1992, the National Space Development Agency of Japan(NASDA) and the Economic an Social Commission for Asia and the Pacific(ESCAP) have been co-organizing the Regional Remote Sensing Seminar on Tropical Ecosystem Management every year in some country in Asia. The seminar was held in Khao Yai, Thailand in 1992, in Kuchin, Malaysia in 1993, in Bali, Indonesia in 1994, in Subic, Philippines in 1995. In this seminar, the authors have been performing a three days PC based hands-on-training on remote sensing and GIS. This paper describe about the outline of the training and discuss about the optimization of PC based training for remote sensing and GIS.

2. CURRENT ASPECT OF PC TECHNOLOGY

The computer technology relating PCs have advanced dramatically within the passed few years. Thus, it has become possible to build powerful and economical systems with PCs for remote sensing and GIS training. Hardware/ software standardization is pushing technology transfer between different agencies and countries.

2.1 Hardware

2.1.1 CPU

Since image processing require a huge amount of calculation, CPU performance is a key parameter for constructing useful image processing systems with PCs. Nowadays, the performance of CPUs used for PCs are upgraded day by day. 32-bit CPUs such as Pentium with high clock speed of 100MHz or more are becoming common specification of PCs for office use.

2.1.2 Main Memory

Main memory size often affects the calculation speed of

PCs in image processing. Even though the CPU is same, the calculation speed is likely to be improved by increasing the main memory size. Cost down of RAMs is allowing users to increase the main memory size of their PCs to create better environment for image processing.

2.1.3 Display Ability

Displaying colorful images is a essential function in remote sensing as well as in GIS. In displaying images, the number of pixels and colors for display are limited by the resolution of the CRT display and the capacity of the display memory. Nowadays, most of the PCs can display at least 640 pixels x 480 lines on CRT with 256 colors or more. For remote sensing data analysis, full color(8bit x 3ch) display ability is required.

2.1.4 Data Storage/Exchange Media

Handiness, large memory capacity, compatibility, access speed are important parameters for selecting data storage/exchange media. Various kinds of media, such as floppy disk, MO, CD-ROM, 8mm tape, etc., are now used with PCs. Among these media, due to it's high cost performance, large capacity, and mass productivity, CD-ROM has become one of the most poplar data storage media for PCs. Various kinds of satellite data sets are now distributed with CD-ROMs.

2.1.5 Printer

Recently, low cost color ink jet printers are available in the market which are useful for making color hard copies of processed images in remote sensing and GIS.

2.2 Software

2.2.1 OS

Nowadays, most of the OS for PCs, such as MS-Windows, Windows95, MacOS, are using Graphical User Interface (GUI). The GUI allow users to operate PCs easily with mouse, icon, and windows. When a software is developed with GUI, the basic I/O operation procedure becomes similar to other software. This helps beginners to concentrate in learning about the main concept of the software.

2.2.2 Application Software

Various kinds of good application software for PCs are currently available in the market, which include ER Mapper, I2S, Imagine, Mapinfo, and ArcView2. Due to hardware advancement, the functions of these software are becoming close to those of workstations. However, it should be noted that good application software are not always good software for training. Beginners are often confused with various functions of the software. Moreover, not many beginners are able to buy these software for themselves.

3. CRITICAL MATTERS IN HANDS-ON-TRAINING

3.1 Computer Operation

When you are performing a hands-on-training to beginners in remote sensing or GIS, the main objective is to let them understand the concept of the technology. But, since you are using certain system for training, trainees have to learn the operation how to use the system first. So, if the operation of the system is too complicated, they are more likely to be learning how to use the system than the concept of the technology. To avoid this, the operation of the system should be as simple as possible.

3.2 Software Availability

As described in the Chapter 2, there are so many good software around which could be used for training. However, mostly, they are not free. Some are even quite expensive. If the trainees do not have the software or similar ones at their offices and do not afford to buy the software, they cannot utilize what they have learned at the training. They are soon likely to forget how to use the software, or how to use the technology for their works.

3.3 Data Set Availability

Usually, a data set used at a training is a small data set which can only be used for the training. If the trainees want to try the remote sensing or GIS technology to some other application, they need another data sets. But satellite data or GIS data are not cheap in general, and the beginners can not afford to buy those. Lack of data is a serious problem for the beginners of remote sensing or GIS.

4. PC BASED HANDS-ON-TRAINING

This chapter describes about the PC based hands-on-training which is organized as a part of the Regional Remote Sensing Seminar on Tropical Ecosystem Management. The main objective of the training was to transfer the basic technology of remote sensing and GIS to beginners. Total of around fifteen beginners are invited to the training every year from various countries in Asia, and eight to nine instructors perform the training. This is to make the number of the trainees per instructor to be less than three. One PC was given to every two trainees. Ideally, each trainees should have one PC. But, we have

come to know that one PC to two trainees is quite preferable after all. The two can help each other and result in better understanding than using it alone.

4.1 Curriculum

Due to limitation of budget, schedules of the participants, etc., the time period of the training within the seminar was set to three days. The schedule was as follows.

Day 1:
- (1) Introduction to the hands-on-training
- (2) Remote Sensing
  - (a) Introduction to remote sensing
  - (b) Image enhancement
  - (c) Geometric correction

Day 2:
- (d) Multispectral classification
- (e) Change detection
- (3) GIS
  - (a) Introduction to GIS
  - (b) Land resource allocation< part 1>

Day 3:
- (c) Land resource allocation< part 2>
- (d) Digital terrain model
- (4) Discussion

4.2 Software Packages

There are very good un-expensive training software such as IDRISI or ILWIS. They charge only minimum cost to maintain and improve their software. This is quite practical way to maintain a training software, and is accepted by many users. However, there are still strong needs for good public domain software for training.

In order to allow beginners to use remote sensing and GIS software freely at their offices, the authors have decided to prepare public domain software for remote sensing and GIS. Actually, within the frame work of the seminar, some of the authors and others have developed several software for training under the support of NASDA, UNCRD, etc. The main software packages are WinASEAN for remote sensing and GIWIN for GIS. The both software packages run on IBM PC compatible machines with MS-Windows. The software are carefully developed for the beginner's use. But at the same time, it can also be used for professional use. The user can easily step up from training to their daily work by using the same system.

The software are released through the frame work of the seminar as a public domain software for training. The ISPRS Commission VI working group 2 "Computer Assisted Teaching" is providing the software to users upon request on voluntary basis. The essence of the two packages are summarizes as follows.

4.2.1 WinASEAN

(1)Outline

WinASEAN is an image processing software for remote sensing developed by one of the authors Nguyen Duong and others of the National Centre for Natural Science and technologyof Vietnum under the technical cooperation with the Remote Sensing Technology Center of Japan (RESTEC) and the financial support from NASDA.

(2) Functions

The main functions of the WinASEAN are as follows.
- Preprocessing: Data conversion, histogram calculation, image enhancement, filtering etc.
- Image display
- Classification: Training area selection, training data statistic calculation, maximum likelihood classification, etc.
- Geometric correction
- Change analysis
- Bird eye view generation

(3)Hardware Requirement
- CPU: 386, 486 or above
- Math coprocessor
- Base memory: 640KB
- Extended memory: 3MB or more
- Floppy disk drive : 5.25 or 3.5 inches
- Hard disk memory : 80MB or more
- Super VGA color monitor
- 24 bits graphic accelerator for Windows environment
- CD-ROM drive
- Mouse
- Printer
- Microsoft Windows 3.1 or latter version pre-installed

4.2.2 GIWIN

(1)Outline

GIWIN is a GIS software package developed by one of the authors Fuhu Ren to facilitate the GIS overlay functions in land use suitability assessment and feasible resource allocation. By giving certain constraint, criterion scores and weights to each land related factor, automated allocation of land resource for competitive multiple objectives can be performed.

(2)Functions
- Data Management: file I/O, map display, image, etc.
- GIS Transforms:map category extraction, map overlay, image algebra and spatial statistics.
- LRA Model: map coding, relevant factor weighting, multiple criteria assessment and land resource allocation.
- Graphic Editor: map legend generator, graphic tools, drawing options.

(3)Hardware Requirement

- CPU: 80286, 386 or 486
- Base memory: 640KB
- Floppy disk drive : 5.25 or 3.5 inches
- Hard disk memory : 3MB for software installation
- VGA color monitor
- Mouse
- Printer
- Microsoft Windows 3.1 or latter version pre-installed

4.3 Data Sets

4.3.1 Remote Sensing Data Set

In order to perform multi temporal analysis, mutli temporal satellite data for some test site are prepared every year by NASDA and RESTEC. For the training of 1995, total of four MOS-1 MESSR images of Mt. Pinatubo were prepared. Also, MOS-1 MESSR images which cover most of the Philippines were collected and stored in four CD-ROM. This MESSR data set is not only useful for the training, but also allow trainees to analyze any place of the Philippines with the data set after the training.

4.3.2 GIS Data Set

As for GIS training, the GIS data set of Yokyakarta of Indonesia was prepared by UNCRD. The data set consist of administration map, land use map, slope map, elevation map, rain fall map, geological map, soil map, road network map, road accessibility map, and pollution density map. Each map is in raster form of 465 by 375 pixels with a pixel size of 200 x 200 meters. All the data are compressed and stored in a floppy disk with the software.

5. CONCLUSION

The computer technology advancement has realized the use of PCs for sophisticated training of remote sensing data analysis as well as GIS. Further the hardware/ software compatibility has allowed easy transfer of analysis system from professional users to end-users. The PC based hands-on-training performed under the frame work of the Regional Remote Sensing Seminar on Tropical Eco-system management is succeeding with the provision of public domain training software and data sets.

However, to allow effective training, a kind of feedback flow is necessary. First flow is the space & remote sensing organizations to provide hardware environment, software environment, data sets to the end-users. The second flow is the end-users to provide application results and technical advice based on application experiences to the space & remote sensing organizations. If this feedback flow functions correctly, the end-users may able to effectively utilize remote sensing data in their own fields for the better understanding of global environmental change. And the remote sensing organizations may able to refine/advance the support for end-users including another training, software, and data set.

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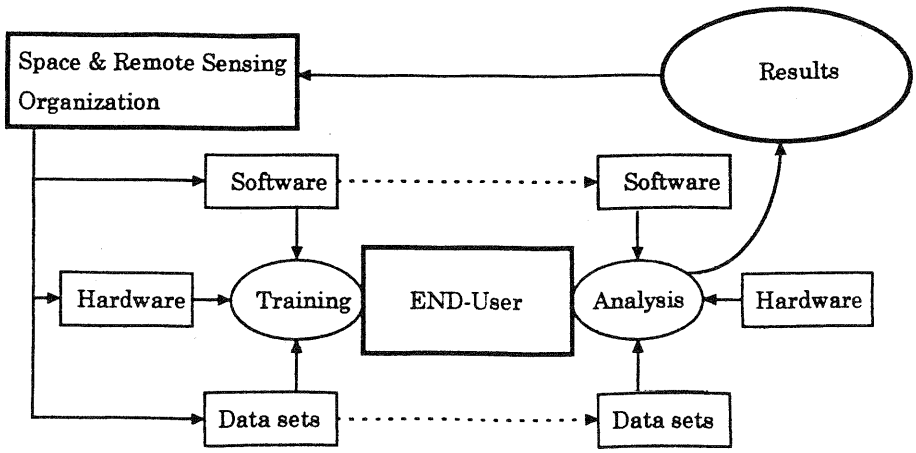

Fig. 1 Feedback flow of training