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Use of Personal Computer for Image Processing in Education of Remote Sensing

Taichi OSHIMA*

1. Introduction

The First Japanese Earth Resources Sattellite (ERS-1) is scheduled be launched in Winter of 1991. This ERS-1 is planned to be loaded with Side Looking Radar (SAR) and Optical Sensor (OPS). This is a new era in remote sensing technology in Japan and there is considerable interest in its future development.

Since the launching of the Japanese first Satellite MOS-1, the research and development of the personal computer has been executed parallel to the use of the large scale computer.

Recently, microcomputer technology has developed rapidly as a result of the development of integrated conductor (IC) and computer technology. In 1981, the Remote Sensing Technology Center of Japan developed image processing of remote sensing on a practical level. Distribution of Landsat data began with the 8-inch floppy disk. At the same time, image processing technology using the personal computer was accelerated in public. Presently, the 16-bits personal computer is now at the height of prosperity. The appearance of the 32-bits personal computer has recently been developed to operate with the same power as the super-minicomputer.

This paper describes the use of the personal computer for image processing in Education of Remote Sensing.

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2. Development of Personal computer in Japan

Ten years ago, there were more than ten classes of personal computers on the market. Among them was the Intel 8080 with one board personal computer of 8-bits. It was very popular. The clock is a 2-MHz, RAM 768 Byte and 512 Byte. At its greatest capacity it is 1-K Byte and more additions are optional. However, it was very difficult to use as a formal processor.

The first production of CPU in the world was developed and saled in the market by the Intel Co. in U.S.A.. This order of its development was done by Videcon Co., exporting maker of pocket computer in Japan. This development resulted in production of the first micro-processor (i4004) in the world. The Intel Co. (IC maker) succeeded in development of 8-bits microprocessor continuously after 4-bits processor. The remolded type one (i8080) is the main stream CPU of current 8-bits personal computer. The first production in Japan is uPD700 (4 bits, 2 chips) made in NEC Co. in 1973 and the interchangable uCOM8 (8bits) with Intel Co. was in market in the following year, 1974. In this way, the first personal computer kit TK-80 in Japan was on sale in 1976. In succession, Hitachi, Panacom, Sharp, Fujitsu and Toshiba were followed to sale their kit of personal computer. These years around 1977 and 1978, were in booming era of one-board personal computer.

In 1981 the Apple, Tandy and Commodore were on sale the personal computer at the same time and the IBM, Xerox and DEC participated too in 1981. PC 8000 in 1979 was on sale and sold in explusive popularity. This is the representative unit of the personal computer together with Apple II type.

In 1980, the graphic display was developed and the full-scale personal computer appeared on the market. In 1982, 16 bits machines appeared in series such as PC9801 from NEC and FM-7 from FACOM. We were in an age of prosperity of the 16 bits.

Then, the use of 16 bits machines with floppy disk drives became common and this made possible a high degree of technological calculation. The family computer with 8 bits also became popular during this time.

In 1986 'LAPTOP J3100' of Toshiba Co.Ltd. appeared on the market. This

become very popular in Europe and the U.S.A. The PC98LT followed. It might be said that this was the arrival of a new computer period. Compared to the previous ten years, the personal computer gained popularity in society largely because of the high quality of structual mechanisms which are adaptable to many fields. There are several types of personal computers which are far superior to the minicomputer some can be used as high quality process computers and for Engineering Work Stations (EMS). There have been amazing developments in the field of personal computers in the past ten years.

In the field of education, several junior and senior high schools have adopted the personal computer for student use. The Education Ministry is presently conducting surveys and tests for future implementation of camputers at the elementary level.

Nowadays, it is rare to find university students who have not had personal computer experience. We are indeed at the brink of a new computer age in which all people will have a personal computer at their homes.

3. Personal computer and Image Processing

Formerly, as the processing system for remote sensing data required a large scale capacity computer to manage quickly the large amounts of data, it was necessary to use a large capacity computer to perform this function. Therefore, only research institutes and specific organizations were capable of using them. But because of the many developments in the area of the personal computer, there are many models which can be used for the study of earth resouces, environment, weather, land planning, and etc..

In March of 1987, the Remote Sensing Technology Center of Japan began to distribute LANDSAT MSS data with 8-inch floppy disk. This provided on impetus to the development of data processing. The following Table-1 is a list of remote senseing system using the personal computer in Japan.

Table-1

HIDAS	Hiroshima Inst. of Technology
TRESS	HOSEI University
REMOTE－10	Remote Sensing Society of Japan
KT－9000	KIMOTO Co.Ltd.
LODIA (ENDIPS)	Remote Sensing Technology of Japan (NEC Co.)
MICRO CIPS	ABE Design Co.Ltd.
OM－SAT	OMODAKA DENSI Co.Ltd.
PIAS	Science Technology Agency (FACOM Co.)
u TIPE	Tokai University
MARSS	IBC Co. Ltd.
DSPT 9506	Toshiba
NIWS	NEC

The following Table-2 shows the configuration of hardware construction.

Table-2 Hardware configuration

	CPU-Set	Option 1	Option 2	Option 3	Language
REMOTE 10	PC-9801vm2 (16bits) u(640KB)	RAMboard PC-9801-41 Mouse	8"floppy disk PC-9881K	Frame Memory Super Frame (R,G,B each8bits) OPTICAL DISK	Basic Assembler
KT•9000	PC-9801(16bits) PC-8801(8bits)	CCD Camera CS-2000	Color display KD-9000(512X480 X4bitsX3Ch)	Mouse	Basic Assembler
LODIA	PC-9801series (16bits)	Frame board	8" floppy disk PC-9881K/N	Color image display Super frame	Basic Assembler
MICROCIPS	PC-9801series (16bits)				Basic Assembler
OM-SAT	PC-9801series (MS-DOS Uer3.01) (16bits)	Frame Board			C
PIAS	C-280(PFI) (MEM.512KB/MB URAM 384KB) FACOM 9450	20 MB Hard disk	8" floppy disk 8" floppy disk		Basic Assembler
u-TIPE	PC-9801	Hard disk 20 MB 5" floppy disk 8" floppy disk	Floating point Processor 18087.Mouse	Image display Nexus 5500 XY Tablet Super frame	Fortran Assembler
MARSS	PC-9801series	Display Printer,Floppy hard disk			Assembler
DSPT'9506	PASOPIA System PC-9801 System IBM PC/AT System	Frame memory Memory(2MB)	Color (white,black) Camera interface(1 Ch.or 2 Ch. A/D Change Board)		Fortran C
NIWS	PC-9801	Impp Develop. Develop support System	Remote Sensing image processing Software		C
KPUFAS	PC-9801	RAMboard Super frame	8087 Floating Point processor 18087 Mouse		C

By using CPU of personal computer, general data processing has become possible in remote sensing. However the processing speed, recording medium and capacity are still limited. The limited number of customers among the general public and reseachers are of concern to universities. This is due to limitation of processing time and image size.

Since the high speed image processor with VLSI (Very Large Scale Integrated circuit) has been developed in these past few years, the small-sized exclusive processor has become available on the market. This system uses personal computers as a host and image processing works are developed by the another image processor. As a result, the processing speed and image size become possible as supermini-type computer. For instance, DSPT9506, Toshiba hardware can be processed in 10 MIPS for image size 512x512 and it can process in less than 60 seconds the processing of LANDSAT images using the most likelyhood method with 10 categories. This can be of great benefit and is a recent new development in personal computer. NIWS of NEC Co. has also the same performance and researchers and users who are satisfied with these are increasing in number.

Remote sensing using the personal computer has developed remarkably in the past several years. Mr. Iizaka, of CCRS has proposed a CD-ROM (Compact Disk Read Only Memory) of data and furthermore, the introduction of a recording mediun into the optical disk. The Remote Sensing Center of Japan has developed an optical disks and Personal computer system.

4. Remote Sensing Education by Microcomputer

Speaking of the education of remote sensing in education, we have to think of the level, ability of students and what their usage needs are.

As mentioned in former chapters, there are many kinds of personal computers which are on the market, but generally speaking, we can classify them into three categories. The first is for the beginner who can be guided by pushing keys and the instruction manual. Secondly is for the computer for specific uses. That means a computer for use in professional fields. Third one computer is aimed at the more advanced persons not only education but in the one of research work. By using the personal computer they can write papers and reports using the algolithm which they think and develop by themselves.

The first one is managed in group oriented and pure educational settings by only simple response through text or instructions. The second is rather person oriented and their computer for their own specific data analysis. Software is given by the maker or other facilities. They don't need to develop it, but they need to understand minimum algolithm of the computer and language. The last third one is what students themselves write the program and develop the system for their research works and can link the another program such as GIS and CAD system.

Those which belong the first category are Lodia, TRESS, KT-9000 and so forth and the second are MARSS, KT-9000, MICRO-CIPS and so on. The third are u-TIPE, PIAS, REMOTE-10 and OM-SAT. The PIAS was developed by FACOM Co. with cooperation of Remote Sensing Technology Center of Japan under the leadership of Science Technology Agency of Japanese Government. This presents many menu which can be selected for specific purpose by users and also high speed processing and easy programming. The u-TIPE of Tokai University and OM-SAT of OMODAKA DENSI Co. are used for both education and research works because they have many flexible menu, especially u-TIPE has the most advanced functions based on MS-Fortran. The students can make program and system freely by themself and can link with the other universal computer such as IBM. Therefore the University are organizing the research cooperation with Asian countries. They use Fortran language on operating system and Assembler.

The standard system construction consists of :

1) CPU using 16 bits, 8 inches floppy disk drive, printer and high resolution display unit (600x400).
2) Optinal order can add memory frames and hard disk.
3) The mouse can be used for G.C.P. measurement.
4) As the graphic display unit, intermediate hue can be expressed by DITHER method in the analogue RGB monitor of microcomputer. The u-TIPE is using the exclusive color display with 640x400x3bits. The modern system using in 'REMOTE-10' can express 16, 670, 000 colors on the same screen with cheep cost by the full color board (640x400x8bitsxRGB). The microcomputer can now work with the same power as the exclusive processor unit.

As the optional peripheral, mouse unit, tablet, digitizer unit, X-Y plotter, dot matrix printer and image display are used. Each system runs on MS-DOS operating, but the data file control, Assembler are popularly used to speed up the processing time.

The program language is written in Fortran, Basic, Assembler and C. but some are using Basic interpreter, then it takes much time to processing the large amount of data. Therefore, the Basic uses for command input and simple calculation.

5. Conclusion

Remote sensing data can be used exclusivly not only for the specific analysis but also for the multiplying fields by combining with the GIS, social and topographic data. Both hard and soft ware studies are needed to use them for their own works, especially the foundamental knowledge is important to use their analysis effectivly. To do this, the education for image processing using personal computer is the most urgent problems.

As mentioned in this paper, the more the engineers need to use the data of remote sensing, the more need the engineer's training. They need to have knowledge about the general concept and gradually to make them understand step by step both hard and software. The contents of program depend upon level and ability of students and engineers.

At this moment, they both trainers and trainees need to understand to be in new era of development in personal computer and to take advantage of this good oppotunities in full scale. Especially development of optical disk and personal computer system enabled them to analyze the huge data of remote sensing. The REMOTE -10 already uses it in their daily program. In future, the third class of former chapter is becoming more popular among researchers especially for oversea cooperation projects. The standerdization of use of personal computer for image processing is in the important and urgent problems. They are now in turning point to popularlize the personal computer.

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Reference

1. NAS LANDSAT DATA ANALYSIS SYSTEM (LODIA)
   NEC AEROSPACE SYSTEMS. Ltd. 1986
2. MARSS USER'S MANUAL, IBC Co.Ltd
3. KT-9000 USER'S MANUAL, KIMOTO Co.Ltd
4. MICRO-CIPS USER'S MANUAL, ABE SEKKEI Co.Ltd.
5. OM-SAT SYSTEM CATALOGUE, OMODAKA DENSI Co.Ltd.
6. "Integrated Studies of System Analysis on Earth Observation for Practical Use" Science Technology Agency, 1984, 1985, 1986
   (Remote Sensing Technology Center of Japan)
7. A programable Remote Sensing Data Processing System using Personal Computer, Remote Sensing Society of Japan, Proceeding of Annual Society Convention, 1985 December
   Dr.Takeuchi, Mr.Cho and Dr.Takeda
   Remote Sensing Technology Center of Japan
8. Development of A Personal computer based on Image Processing System
   (7th Asia Conference of Remote Sensing)
   Dr.Fukue, Dr.Shimoda and Dr.Sakata, Tokai University
9. Development of a General Purpose Multi-Level Multi-Channel Image Processing System using Personal Computer (Image Eng. Conf. 1985 December)
   Dr.Masumi, Dr.Fukue, Dr.Shimoda and Dr.Sakata, Tokai Univesity

10. A Remote Sensing Data Processing System based on A Micro－Computer
(Asia Conf. of Remote Sensing)
Mr.Iizaka, Dr.Oshima and Mr.Miyashita
(CCRS, CANADA and Hosei Univesity)
11. On an usage of personal computer in Remote Sensing, BUTSURI TANSA Vol. 40 No.6 (1987)
Dr.Tanaka and Mr.Sugiura, Remote Sensing Technology Center of Japan
12. Interactive Training System using A Personal Computer
(16th ISPRS, Comm 4)
Mr.Kohei Cho (Remote Sensing Technology Center of Japan)
13. Optical Disk and Personal Computer System for Large Scale Multi－Spectral Data Analysis
Report : Mitsui Petroleum Chemistry Co.Ltd.
Mr.Sugiura, Dr. Tanaka and Mr. Aihara,
Remote Sensing Technology Center of Japan