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TITLE:REMOTE SENSING:THE PROBLEMS INVOLVED IN DESIGNING SUITABLE COURSES

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ABSTRACT

When designing remote sensing courses for undergraduate and graduate students a large number of imponderables confront the prospective lecturer. What courses should contain remote sensing, of what standard and how much, to find the balance between theory and practical exercises are just a few of the large number of questions to be answered. This paper gives details of an approach to the teaching of remote sensing. The object is to identify the many variables and to suggest ways of resolving the difficulties and dilemmas encountered.

INTRODUCTION

The acceleration of the technological revolution in the post second world war period had a fundamental effect on Remote Sensing particularly with the introduction of satellites, space travel and the increasing availability of ultra fast computers.

The massive amounts of digital data, computer technology and the use of image producing systems using electromagnetic radiation outwith the visible range of spectrum, have significantly altered, widened and complicated the conventional fields of photogrammetry and image interpretation. The problem of processing the data is further complicated by the rapid pace of development often making new instruments obsolete before they reach the market.

The role of educational institutions is to instruct future scientists, technologists and technicians in the fundamentals and specific details of the new technology. Serious problems arise for the educationalists in several areas; such as the amount of necessary detail, depth of instruction and basic approach.

CLASSIFICATION

Traditionally the sciences and arts are classified such that they may be slotted easily into a department, faculty, school or any other sub-division of the institution's infrastructure. Remote sensing is by its very nature, multidisciplinary and hence cannot be so easily compartmentalised. Remote sensing uses imagery which was historically the domain of photo-grammetrists. But is photogrammetry the right discipline within which remote sensing should be taught? Whilst there may be serious disagreements, a strong case can be made for keeping remote sensing within a department already engaged in the teaching of photogrammetry.

A necessary qualification must be made insomuch that it is the information obtained by remote sensing which is referred to, not the information producing mechanisms.

Information collected by remote sensors is obtained in the form of imagery, tapes containing recorded impulses, recorded wave images or other graphical, digital or electromagnetic recordings. The quantitative or analytical photogrammetrist is equiped to convert the records into measure-ments, while the qualitative one is in the position to identify records converted into graphical form.

APPLICATIONS

The range of users varies from the non-mathematically oriented disciplines of town and regional planning, administrative studies, environmental protection, etc., to various fields of science such as agriculture, forestry, meteorology, geology and exploration, medicine and several aspects of engineering. While non-mathematical fields are restricted to the study of the qualitative remote sensing methods, the others are well equiped to deal with both the evaluation of qualitative and quantative data.

Individual disciplines do however, tend to be interested only in a narrow aspect of the information obtained whilst mapmakers, Photogrammetrists, and Cartographers wish to use most, if not all, the information. This in itself would be reason enough to justify the teaching of remote sensing within the photogrammetric "umbrella". Other disciplines may then have their limited, but specialized, teaching requirements met in a service subject context.

ANALYSIS OF PROSPECTIVE STUDENTS

Prospective students could come from any of the various strata of education, undergraduates from universities or colleges, or technicians at technical schools of secondary level. One school of thought supports the concept of a specialised, but complete, remote sensing unit to meet the requirements of all users. Another school favours the teaching, to each discipline, of an amount which is adequate to the needs of that particular profession. Whilst both have merit, similar cases from other newly created sciences have revealed the inadequacies of the specialist approach. Primarily these arise from the inability of any one scientist to fully appreciate and understand the problems of many other disciplines.

The other alternative suffers from the inability of some of the user disciplines to grasp the physical and metric aspects of remote sensing due to inadequate prerequisite studies.

Hence the best alternative would seem to be the provision of basic and comprehensive courses to interested professions, such as Photogrammetrists, some Cartographers and other disciplines, requiring a deeper understanding of the science and the establishment of narrower, tailor-made programs suited to the needs and requirements of disciplines interested only in certain aspects of remote sensing.

DEPTH AND MODE OF STUDIES AT UNDERGRADUATE LEVEL

The amount of remote sensing, the level of detail and complexity in a particular course should vary with the requirements of the discipline and the student's background. The mounting of an adequate course in any particular discipline does however, require considerable expertise in the specialised field concerned. Particularly in specialist fields, this expertise is often absent. While the ideal arrangement would be to have experts in the various disciplines, each teaching his own narrow field, this is economically not feasible due to the excessive number of staff involved. A possible alternative is to employ a number of experts as guest lecturers provided such experts are available.

In most educational institutions, however, a limited number of teachers are involved in teaching all the remote sensing. Thus, the academic level of the teaching is greatly dependent upon the amount of reading and self education of the staff involved. This self education is essential in remote sensing because of its rapid development and the vast amount of research material which is constantly being published.

ACTIVE AND PASSIVE REMOTE SENSING

From the aforementioned it follows that in general there are two types of remote sensing courses required.

1. A course for people actually involved in interpreting images and evaluating quantities from such images, i.e. 'active' remote sensers.

2. A course for people who should appreciate the potential of remote sensing methods, but need not be trained in the actual execution of the tasks, i.e. 'passive' remote sensers.

   In some cases the 'passive' could be converted to 'active' within a narrow spectrum of application suited to the needs of the trainee.

STUDIES AT POST GRADUATE LEVEL

It often happens that a person trained in another discipline, at undergraduate level, has placed strong emphasis on remote sensing and later wishes to specialize in that aspect. For such people, postgraduate courses involving significant course work are necessary. Because their interest is usually concentrated in a narrow field they usually lack basic theoretical knowledge and such course work can remedy this. Meanwhile, the specialisation can be obtained from the research topic which is inevitably a fundamental part of all postgraduate studies.

TECHNICIAN LEVEL TEACHING

The technician is usually required to perform certain tasks under the supervision of a professional. It is therefore important to train technicians in their particular field. They must achieve a high degree of skill and proficiency in performing their tasks without necessarily fully understanding the theoretical background. The emphasis of their training must be placed on the manual performance of actual tasks to the required standard.

EQUIPMENT PROBLEMS

Equipment is generally very expensive and well outside the financial means of most teaching institutions. This serious shortcoming creates a deficiency which is hard to overcome, as it is almost impossible to simulate the outputs of such equipment. The development of short courses giving practical "hands on" experience in organisations already owning such equipment does not prove to be satisfactory. Fortunately many tasks in the evaluation of remote sensing data can be performed by computers, now available in most educational institutions in countries involved in remote sensing.

REFRESHER AND SHORT COURSES

It would seem that short courses and workshops are ideally suited to people wanting to expand and update their knowledge. People in the work force find it difficult keeping abreast of the developments occurring in a computer and technologically oriented world. Remote sensing is developing

and expanding at an extremely rapid rate and it is impossible to keep up with the development. It is, therefore, impossible for the technologist/scientist, performing a full-time job, to do justice to the vast amount of new literature and research. As a result, the potential of many remote sensing techniques is not utilized simply because the user is unaware of what is available. Many applications, based on ill-conceived and misfounded assumptions, are doomed to failure. Some organizations are therefore discouraged from using remote sensing techniques even where the appropriate application of tools and technology could yield satisfactory results. The concept of short courses and workshops is possibly a step in the right direction towards redressing the ignorance and misconceptions presently prevalent.

Short courses and workshops for people, already in the work force, could be either of a general, introductory nature or could be designed to satisfy particular needs of a potential user community. For example: short courses could be conducted specifically for geologists, foresters or computer scientists, etc. Such courses would require various specialist lectures from the disciplines involved in any particular short course. It has been suggested, with significant supportive evidence, that general courses for multidisciplinary groups in effect cater for the lowest possible denominator and consequently do not satisfy the needs and requirements of the individual participants. A worth-while by-product of such courses is the companionship which develops as the interdisciplinary professions meet and by discussing common interests, develop new ideas.

CONCLUSION

Remote sensing educators, preparing others for the future, have a duty to provide students with a sound basis, a basis which may be built upon and adapted to cope successfully with that future.

Because of the common difficulties inherent in teaching remote sensing courses, remote sensing educators should meet on a national basis and discuss these many problems. With the diversity of background, interest and application of the participants, lively discussion could be expected, resulting in improvements, particularly in the areas of content and method, which could be incorporated into teaching programs.

In conclusion, courses consisting of basic principles and fundamental theory will always stand students in good stead. The facility of coping with development and change is essential and should be encouraged and used as the guiding premise when establishing remote sensing courses.