Large Databases for Remote Sensing and GIS

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The utilization of remotely sensed data from aircraft and satellites have evolved over the years. Broadly, the steps involve image analysis, mapping, co-registration with other spatial and aspatial data sources and information extraction for decision support systems. Initially, each of these steps were independent activities, involving manual manipulation of analog data. However, with the advent of electronic imaging sensors, digital data has become available and the analysis, mapping, registration and information extraction can be done on computers. Computerization has been given a fillip by the complex demands of decision support system which need the handling of a wide variety of spatial and aspatial data sources. For example, the current demands of sustainable development requires the analysis of imagery, maps, demographic data, anecdotal information, etc. using complex models. To meet these requirements, we need versatile data bases which can efficiently handle a plethora of data types with varying formats. The problem can be subdivided into two major areas. The first relates to remotely sensed data itself and the second to all other data such as maps, statistics, text, images etc.

Remotely sensed data has several dimensions. It is characterized by area imaged, date and time of imaging, spectral bands, spectral and spatial resolutions, calibration and many other parameters related to the sensor, platform and orbit. Currently, a data user needs to specify the first four items to acquire data. He then has a host of processing and presentation format options. Since the data user is usually not a physicist or a computer scientist, these multiple options can be confusing. Typically, a satellite like IRS-1C providesdata from three sensors in about 700 combinations and options of formats, processing levels, media choices, etc. The choice depends on the planned end use of the data and the system on which the data is to be analysed.

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To address these requirements we are proposing to develop a system which shall consist of a very large heterogenous image data archive with an efficient query and report system which will enable a user to select data of his interest. It will provide on-line advisory service on the best spectral band combinations for an application which could span over different satellites and sensors. It should also be able to search the data base for features of interest. Further, based on the users request the system should be able to identify data subsets using suitable framing and mosaicing algorithms which optimizes the volume of data.

In an actual analysis scenario, the remotely sensed data analysis requires simultaneous use of collateral information in the form of maps, other imagery, statistics, etc. Today most Geographical Information Systems (GIS) and Image Analysis Systems (IAS) provide interoperability but the data bases are maintained separately as the data structures are different. There is a need to design integrated data bases so that it Is seamlessly accessible by both the GIS and IAS. We are developing a multimedia database as the first step to a fully integrated system.

Finally, the analyzed outputs form an input to decision making systems. Since decision making is increasingly becoming decentralized it is proposed to implement a National Resources Information System, NRIS which will have GIS data bases at each level of decision making. Initially, these will be located at district headquarters and state capitals. A typical district data base will include about 100 MB of data in the form of interpreted imagery, maps, statistics, etc. These data bases can be accessed remotely, say from the State Capital. Ultimately it is proposed to make the data bases accessible, at the local level, down to a village. For sectoral users similar distributed databases are planned for major projects and operational units. Standardization of database structures, access methods and tools and analysis systems are major issues.

We anticipate that with the availability of advanced database tools, GIS, IAS and visualization tools such complex systems can be realized over the next five years.