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Article

Automated Extraction of Image Features from Geospatial Imagery in form of Grids and Identification of Images using its Corresponding Grid-id

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I N F O

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A B S T R A C T

This paper advances a new approach to implement spatial modeler scripting to subset the image using shapefile and searching technique for image subset, the employed professionals at MRSAC were facing the problem while performing the process of image sub setting and searching different subset images. They have to import the grid repeatedly while perceiving the image and plotting the region which needs to be clipped. After sub-setting the image, if any mismatch or improper clipping is observed then the complete process needs to be restarted from scratch, which would not be preferable while working with large datasets consisting many different images. To improve this work, flow an operative method has been designed known as spatial modeler for doing the task in an effective and sensitive manner. The clients also have to search for the set of clipped image, the employees at MRSAC search the folder manually which takes a considerable amount of time, to minimize this practice a searching mechanism also needs to be designed and implemented to search the image subset using its unique grid-id.

Keywords: MRSAC (Maharashtra Remote Sensing Application Centre) ERDAS Imagine, Raster Data, Vector Data, Spatial Modeler, Shape File, Grid, Sub-Setting, Remote Sensing.

Introduction

Preamble: Over the past decades, manually sketching polygon and clipping the image individually for generating a subset in ERDAS imagine (remote sensing software) have become the dominant approach to subset the image using shapefile and maintaining a structured file directory to store subset images. Remote sensing refers to the acquisition of information on a given target without making contact with the target. It uses the entire electromagnetic spectrum, ranging from short wavelengths (for example, ultraviolet) to long wavelengths (microwaves). Two volumes of this set of books describes the physical concepts of the principal remote-sensing techniques used for the observation of continental surfaces as well as analysis methodologies and the interpretation of measurements and images (Optical Remote Sensing of Land Surfaces:[1]

As the generalised definition concludes that Remote sensing is that the science of deed data regarding the layer while not really being up-to-date with it. This method is completed by sensing and recording mirrored or emitted energy and procedure, analysing, and applying that data. within the method of remote sensing it involves associate degree interaction between incident radioactivity and also the targets of awareness. this can be demonstrated by the employment of imaging systems wherever the subsequent seven parts area unit concerned. The remote sensing additionally includes the sensing of emitted energy and also the use of non-imaging sensors.[2]

Motivation

Need of Efficient way of processing Geospatial Image for remote sensing industries and MRSAC. Management of various data File. Reducing manual workload for image sub-setting in ERDAS application.[3]

Aim: This research paper primarily aims on the image sub-setting and searching different subset generated from original image. The main purpose of image sub-setting in GIS is to save specific region or location which needs to be processed efficiently and also to save storage space on the client computer. After sub-setting an image different sub images are generated, to search for specific cropped image an efficient searching mechanism has been developed.[4]

Objectives

- To provide an interface for geospatial image clipping and sub setting.
- Accurately integrating shape file with image file.
- Developing a spatial modeler to minimize the time required over manual procedure and also to make process proficiently accelerated and accurate.[5]

Scope: The proposed system can be implemented on any image format used in remote sensing and other industries working in the field of remote sensing.

The planned system provides solution for government agencies like MRSAC and others working on remote sensing data.

These seven parts commissioned below, comprise the remote sensing method from setting out to finish.

1. The Energy supply or Lighting- terribly 1st demand for remote sensing is to own associate degree energy supply that illuminates or provides magnetic attraction energy to the target of interest.[6]
2. The Atmosphere and Radiation- because the energy travels from its supply to the target, it'll are available in communication with and act with the atmosphere it authorisations over. This interaction might manifest itself a second time because the energy travels from the target to the sensing element.
3. Target Interaction-once the energy makes its thanks to the target through the atmosphere, it interacts with the target reckoning on the properties of each the target and also the radiation.
4. Energy Recording by the Sensor- once the energy has been dispersed by, or emitted from the target, we have a tendency to need a sensing element (remote - not up-to-date with the target) to gather and record the radiation.
5. Transmission, Reception, and process - the energy verified by the sensing element should be transmitted, typically in electronic kind, to a receiving and progression station wherever the information area unit processed into a picture (hardcopy and/or digital).
6. Image Interpretation and Analysis- the managed image is unstated, visually and/or digitally or electronically, to extract data regarding the target that was light.
7. Application- the ultimate part of the remote sensing technique is attained once we put on the data, we've got been able to extract from the mental imagery regarding the target so as to raised comprehend it, expose some new data, or assist in resolution a selected downside.[9]

Therefore, it becomes necessary to extract the Area of Interest from the images/ mosaics and this extraction method is understood as 'Sub-setting'.

There are two fundamental methods of storing this map info in digital form: raster and vector. These are covered in the next section: Introducing raster and vector.

Vector Data

Vector data is defined as the data in which the features are documented one by one, with shape existence well-defined by the arithmetical values of the pairs of xy coordinates.

- In this a point is distinct by a single pair of coordinate values.
- Also, a line is defined by a sequence of coordinate pairs defining the points through which the line is drawn.
- The area is defined in a similar way, but only with the first and last points joined to make a complete enclosure.

The vector data can be thought of as a list of values.

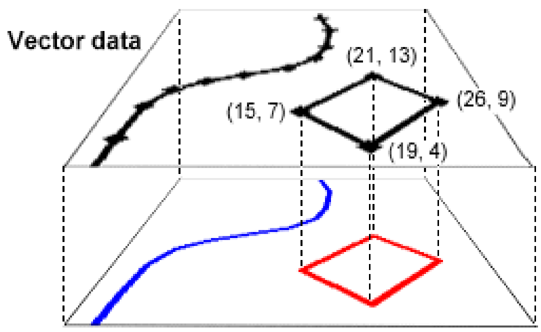

Figure 1.1 Representation of Vector data

As viewable in the example above the map characterises a building as a simple red rectangle. In vector data the position and shape of the construction is apprehended as a series of four pairs of numerical coordinates. To replicate the building in a GIS the computer recites these values and draws a line linking the coordinate positions. The vector version can also stock supplementary context data about these features – the attributes – a very significant aspect, which will be clarified in later chapters of the GIS files.[7]

Raster Data

In raster data the entire area of the map is sectioned into a grid of tiny cells. A value is deposited in each of these cells to characterise the nature of whatsoever is contemporary at the consistent location on the ground. Raster data can be believed of as a matrix of values.[8]

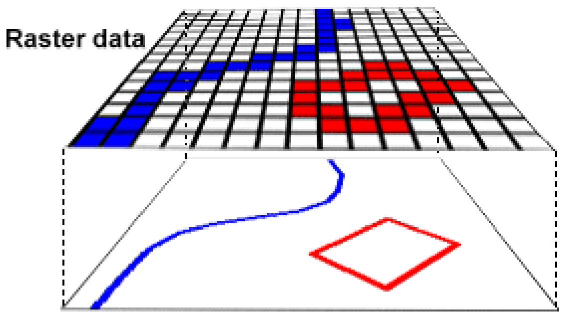

Figure 1.2 Representation of Raster data

The major use of raster data involves storing map information as digital images, in which the cell values relate to the pixel colours of the image. In the example above the data records the colour of the feature which occupies that part of the map surface; the values recorded in the cells are either white, blue or red. To reproduce the image the computer reads each of these cell values one by one and applies them to the pixels on the screen.

In similar way the remote sensing organizations get data in various format which they further need to achieve various operations on image like pre-processing, image enhancement, image classification, spatial feature extraction, measurement of geophysical parameters and more. First step when sub-setting a shapefile is to create an AOI layer based upon the vector polygon. Then noticing that a new AOI layer has been added to the Contents Pane and an AOI polygon has been created following the boundary of the selected vector polygon. User no longer need the Shapefile. The image under the AOI sometimes can make the AOI polygon difficult to see. User can change the style of the AOI, which creates a thick, dashed black and yellow line that is much easier to see over the imagery.[10]

In this procedure the input file has been cleared by default with the active image layer in the Viewer, but user will need to define the output file name. This permits user to define which AOI layer is used for the subset boundary. In this dialog, user have the option to select Viewer as the AOI source. User needs to be sure at least one AOI is selected in the Viewer with a bounding box around it before using this dialog. The first thing to notice is the colours are very different than the colours in the original image. The display colours are applied with a contrast stretch that is calculated from the image pixels statistics. As there are a lot less pixels in the subset image, the calculated stretched values are much different than the original image. User can easily apply the same colours to the subset image by saving the breakpoints from the original and applying them to subset. The breakpoints that describe the overextended pixel values are now useful to the subset image and the colours look undistinguishable the innovative image. User can now save the image with the breakpoints so each time you load this image, the colours will look identical to the original image.[11]

Methodology

This paper proposed a new method for sub-setting and searching the satellite imagery using ERDAS IMAGINE and a custom searching user interface

- A spatial modeller has been designed in which the sub setting process will be executed by using vector and raster data and being deal with according to the implemented python script.
- Spatial Modeler: It is a spatial modelling suite which provides a robust extensible processing architecture coupled with a responsive and intuitive user experience. The core engine is based on a Pull architecture, which means that no computation is done until the data is needed, providing the ability to have real time feedback of the results.
- The main use of a model is to create a self-contained functional piece that can be re-used in other solutions such as inside of another model, or published to ERDAS APOLLO or web services. It is similar to a function in a programming language.
- Raster Input: This dialog is used to define a raster object in Spatial Modeler. opens when you double click a Raster Input operator that has been placed on the Spatial Model Editor. Select a data type to use for the input data from this list. This dialog opens when you configure a Spatial Modeler operator port that supports the Simple Data Type, such as Data Type, Table Type, Matrix Type, Scalar Type. A Simple Data Type is one of Native Type, Binary, Integer, Float, Complex, String, or Color. From Inquire Box Click to define a subset area of the data by using the Inquire Box.
- AOI Input: Creates an AOI (area of interest). Double-click the operator to open its conformation dialog.

The Choose AOI dialog opens. The AOI to be output is saved on the Input port, which is hidden by default. It's the vector data in the form of shapefile.

- Python Script: Spatial Modeler comprises competences for generating and accomplishment spatial models in the Python scripting language, and for implanting a Python script in a spatial model. Spatial Modeler supports Python 3.4 only. Almost any spatial model that can be constructed in the Spatial Model Editor can also be created from a Python script, or a previously created model can be loaded from a .gmdx file. You can set model inputs from Python, then execute the model in the Python process, and read output values. The Spatial Model Editor also provides a Python operator that can execute any Python script whose inputs and output are the simplest data types: text string, integer, or floating-point number. Python scripts can access most of the functionality of Spatial Modeler, and can reuse that functionality in ways not easily possible in the Spatial Model Editor.

Significance of This Work

- The proposed work has presented an overview and some theoretical background on geospatial imagery and approaches for performing image sub-setting. Effective analysis of remote sensing imagery involves the identification of various targets in an image, & those targets may be environmental or artificial features which consist of points, lines, or areas. In this scenario targets may be defined in terms of the way they replicate or emit radiation.
- The geospatial Image sub-setting process automation: This comprises with successfully subset the image when spatial modeler in ERDAS imagine is executed with the given AOI and Shape file for the associated region.
- Less User Interaction: Spatial modeler is designed in order to reduce the manual user interaction which ultimately saves the time required for clipping and saving these processed images to complex locations, when this operation was achieved manually for each file containing huge amount of grids it use to be more time consuming.
- Sorted Sequential search: When saving many different data layers to a server or PC, files could potentially be lost and precious time wasted looking through hundreds of documents just to find a specific file. Reasonably it is critical to establish a strong and clear file structure before work begins. user can organize digital files in digital folders, much like paper files are stored within folders in a filing cabinet. All users' folders will be created in a file construction, which is simply a system for establishing your files in a logical way. In similar way as folders in a filing cabinet, which are generally prearranged alphabetically, user have a lot of suppleness in scheming an electronic file structure. User can also create folders within folders, called subfolders, to make the file structure fit the specific needs of your uses.
- The proposed system can be extremely beneficial for any organization working with satellite imagery in remote sensing sector which needs lot of dedication and focused efforts for quality work.

System Design

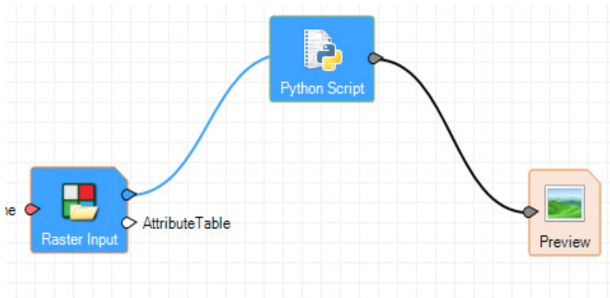

Figure 4.1 Architectural view of spatial modeler

This figure illustrates the actual working of the entire system. As the initial stage is concerned user has to run the ERDAS imagine program and follow the structured interface and load the spatial modeler. After which spatial modeler is fetched with the geospatial image (satellite imagery) the vector data and the vector data in the form of shape file is provided as input from a relevant directory. A python script consisting the code for process is been loaded along with the raster and vector data in spatial modelere. User need to specify the storage directory for storing the resultant subset image after execution of spatial modeler. As all required components are fetched to spatial modeler now the user need to activate the further process for clipping the original raster image by activating the spatial modeler so it can initialize the image clipping process. A progress bar is displayed while execution of the process takes place for a minute or two, as the process gets completed the user is notified by displaying a completion message for the subsequent loaded data. This entire process will generate the subset from the original image which can be viewed in the previously selected directory for output images.

Implementation

The figure 2 above briefly describes the work flow of the implemented system in consists of several different components enlisted as ERDAS (remote sensing software), Image data, AOI (Sharpe file), spatial modeler, python script, processed data, file storage, grid id, search module. The primary goal of implementation is to design a simple working system for reducing the work complexity associated with the individual task execution in ERDAS IMAGINE. Previously the working professionals at remote sensing centre were

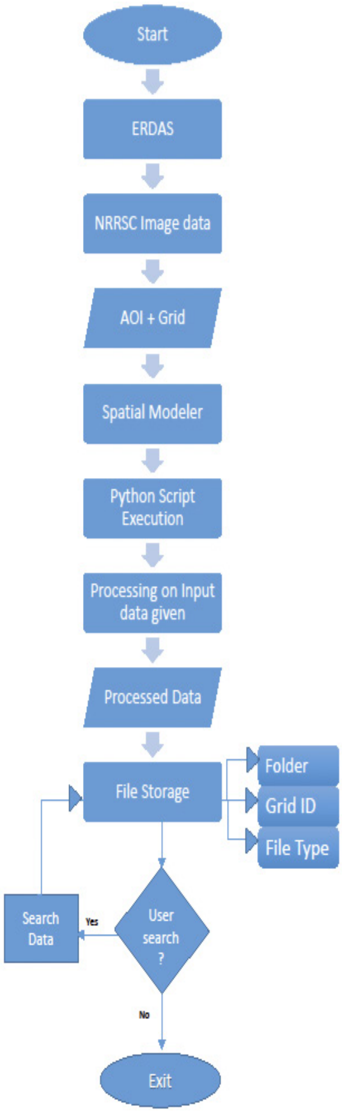

Figure 5.1 Block Diagram Describing the Work Flow

facing the problem while performing the process of image sub setting and searching various subset images. They have to design the grid redundantly with continuously observing the image and plotting the region which needs to be clipped. After sub-setting the image if any manual trace of mismatch or improper clipping is experiential then the complete process needs to be restarted from scratch, which would not be preferable while working with large datasets consisting several different images.

To optimize this work flow a effective method has been designed known as spatial modeler for doing the task in an effective and sensitive manner. The users also has to search for the set of clipped image, the employees at remote sensing centre search the folder manually which takes a considerable amount of time, to minimize this practice a searching mechanism also needs to be designed and implemented to search the image subset using its unique grid-id.

Future Work

The designed working module can be implemented in any sector working with remote sensing data. This paper primarily aims on the image sub-setting and searching different subset generated from original image. Image sub-setting is the process of retrieving just the parts of large images which are of interest for a specific purpose. The main purpose of image sub-setting in GIS is to save specific region or location which needs to be processed efficiently and also to save storage space on the client computer. After sub-setting an image different sub images are generated, if a user want's to search for specific cropped image an efficient searching mechanism should exist.

Conclusions

This paper presented an overview on extraction of image features from geospatial imagery image sub-setting in form of grids and identification using consistent grid-id which is observed as an essential feature required to efficiently get the work done.

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