Merge Technique for Automated Reconstruction of Large Image

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Abstract- This paper present an automated reconstruction high level architectural specification of image merging for satellite image capturing system, aiming at implementing a real-time satellite image processing system for merging more than one fixed size sequential images capture by a fix speed and unidirectional moving satellite camera to generate a large fixed size image. Also focuses on the key architectural by which a meaningful image can by produce from a satellite camera. An essential part of managing the architecture is a monitoring system by which it is able to monitor, track the speed and direction of a camera in real time. Considering this issue the paper propose a solution and presents a set of technique to be computationally efficient and reconstructed the image is acceptable accuracy.

Keywords – automated; architectural; merging; satellite camera**;**

I. INTRODUCTION

Automated reconstruction of images from a set of sequential satellite images has been one of the most challenging problems in photogrammetry and computer vision. There is an increasing demand for digital satellite image capturing, which can be used in many applications including town planning, wireless telecommunication and virtual tourist information systems. Manual digitization of images, which is the traditional approach, is a tedious and time-consuming task requiring trained operators and expensive equipment. As a result efforts have been made to develop semi-automated and fully-automated methods [1], which minimize or eliminate human interaction. While interesting results of semi-automated methods have been shown in practice and fully automated methods have not met desired requirements for being successfully used in practical applications. The difficulty of full automation rests in the complexities involved in generating images. The broad range of variety of images, undesirable objects (trees, ground holes, and mountain). In addition noise, low contrast, shadow in image data. The low accuracy or low density of height data are other important factors which may cause failure in an automated system. This paper undertakes some of the problems with image and height data by the fusion of the more than one sequential images and representing a total image of effective or selective area. Above ground imagery has been the most widely used source of data for the extraction (detection and reconstruction) of images. Information extraction from single images has primarily been based on feature grouping, and wall and shadow evidences [2-3]. With stereo or multiple overlap images, matching features across views have been used [4-5]. Feature extraction methods however, often fail to correctly detect many image features due to the aforementioned complexities in image data. Height data in the form of a Digital Surface Model (DSM), which is generated either by matching stereo or multiple overlap images, has also been used in information reconstruction methods [6]. Due to the complexity of images in effective areas, the DSM generated from image matching is very smooth, and the accuracy and reliability of height points are low, although the point density of the DSM from matching can be very.

However, satellite imagery is far from being satisfactory to merely confirm the presence or absence of nuclear activities. From a remote sensing perspective, the technical developments in sensor technology led to improvements as to spatial, spectral and temporal resolution. Taking this into account, the amount of data in the image archives of the IAEA will consequently accumulate more and more. Due to the fact that more data also involves a higher effort regarding image pre-processing, change detection, analysis and interpretation, computer based techniques could be of great value in this respect

In this paper, we introduce the idea of using a set of sequence images in a more straightforward procedure to refine dense image regions. A merge technique is developed in this work to produce an overall image from set of small images and height data for the refinement of incomplete image regions and reconstruction of planar image.

The rest of the paper is organized as follows. Section 2 discusses the theoretical background. In section 3 define the problem statement. Section 4 we propose the merging algorithm. Section 5 Simulation and Experimental result. In section 6 summarize the discussion and indicate some possible future work.

II. THEORETICAL BACKGROUND

Satellites are messengers and viewers in the sky those spread weather, town map, telephones calls, watch the weather, guide ships and aircrafts and carry out tasks that are impossible on the ground by capturing images from satellites at regular intervals and used by meteorologists to forecast information. We cannot get the entire information from a single snap of image from a satellite camera. The reasons are distance in-between satellite camera and the effective zone

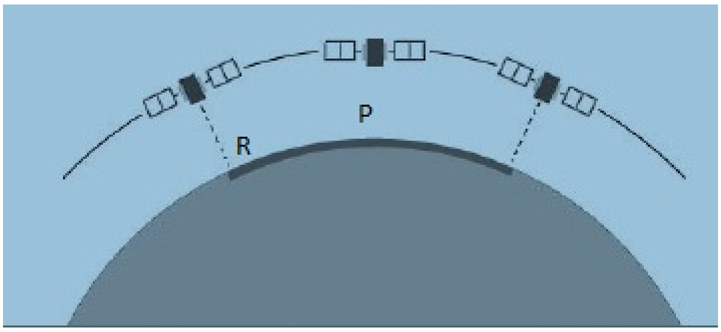


Figure 1. Region capturing by a satellite camera

In figure 1, let we consider the selected P=[pi] is a set of pixels in the effective region with corresponding luminance f(pi) and let R=(ri) be a partition of the image pixels into disjoint regions ri = belongs P from this partition a region adjacency graph G=(R,E) can be derived with E={(ri,rj)|SYE pk .ri,pi rj with pk being adjavent to pi}. Each edge can be attributed with a weight, providing a measure of dissimilarity between two regions. We will refer to this measure as the merging criterion.

The region-merging algorithm starts with an initial segmentation. This can be a trivial segmentation with each image pixel forming a region of its own or it can be the output of a preceding segmentation step. Then the algorithm proceeds by continuously searching for the edge with the lowest dissimilarity value and merging the two regions until a stopping criterion is satisfied (usually a threshold is defined and the merging process is terminated as soon as the minimum edge-weight exceeds this threshold). Note that after each step, the edge-weights of all edges outgoing from the merged region have to be recalculated according to the selected criterion [7,8] for efficient data structures and algorithms

A. Merging Criteria

A merging criterion consists of two parts: a region model, describing each image region with a set of features and a dissimilarity measure, defining a metric on the features of the region model. The range of possible region models reaches from simple models like uniform luminance up to texture, shape or motion parameters. In the following, we will concentrate on low-level features which are applied at early stages of the algorithm.

The better a region model matches the real image-data, the longer the minimum edge-weights remain small and the steeper is the relative increase as soon as the segmentation has reached its final state. This makes the segmentation process more robust to the selection of the fixed threshold for the stopping condition

B. Change detection of satellite camera

A satellite camera can move any direction with a random speed while taking a snap from the effective region. Change detection is the process of recognizing and quantifying temporal differences in the state of camera [9]. As we know digitation of an image is stored as a matrix form, when using satellite imagery from two acquisition times, each image matrix from the first time will be compared with the corresponding sequence matrix from the second time in order to derive the degree of change between the two matrixes. Most commonly, differences in radiance values are taken as a measure of change. A variety of digital change detection techniques has been proposed in the past few decades. Basically, the different algorithms can be grouped into the following categories: algebra (differencing, rationing, and regression), change vector analysis, transformation (e.g. principal component analysis, multivariate alteration detection, Chi-square transformation), classification (post-classification comparison, unsupervised change detection, expectation maximization algorithm) and hybrid methods. Reviews on the most commonly used techniques are given by i.e. [9, 10, 11, 12]. Many of the algorithms used for analyzing temporal changes are indeed not restricted to change detection.

In summary, there is a wide variety of alternatives having varying degrees of flexibility availability and significance, and only a few studies have been carried out for quantitatively assessing the different methods for one case study [13, 14, 15].

C. Pixel-based change detection

For the detection of changes on a pixel basis, several statistical techniques exist, calculating e.g. the spectral or texture pixel values, estimating the change of transformed pixel values or identifying In regard to the specific application of nuclear monitoring the most satisfactory results were carried out by the so-called Multivariate Alteration Detection (MAD) transformation [16]. The MAD procedure is based on a classical statistical transformation referred to as canonical correlation analysis to enhance the change information in the difference images and briefly described as follows: If multispectral images of a scene acquired at times *t1* and *t2* are represented by random vectors X and Y, which are assumed to be multivariate normally distributed, the difference *D* between the images is calculated by $D=a\mathrm{T}X–b\mathrm{T}Y$.

Analogously to the principal component transformation, the vectors *a* and *b* are sought subject to the condition that the variance of *D* is maximized and subject to the constraints that

$\mathrm{var}(a\mathrm{T}X)=\mathrm{var}(b\mathrm{T}Y)=1$. As a consequence, the difference image *D* contains the maximum spread in its pixel intensities and -provided that this spread is due to real changes between *t1* and *t2* therefore maximum change information. Determining the vectors *a* and *b* that way is a standard statistical procedure which amounts the so-called generalised eigenvalue problem. For a given number of bands *N*, the procedure returns *N* eigenvalues, *N* pairs of eigenvectors and *N* orthogonal (uncorrelated) difference images, referred to as to the MAD variants. Since relevant changes of man-made structures will generally be uncorrelated with seasonal vegetation changes or statistic image noise, they expectedly concentrate in the higher order components (if sorted according to the increasing variance).

Furthermore, the calculations involved are invariant under affine transformation of the original image data. Assuming that changes in the overall atmospheric conditions or in sensor calibrations are approximately equivalent to affine transformations of the pixel intensities, the method is insensitive to both of these effects. The decision thresholds for the change pixels could be set by standard deviations of the mean for each MAD or MAF/MAD component. Regarding automation a probability mixture model proposed by [17,18] was applied to the MAD or MAF/MAD variants. The techniques is based on an Expectation- Maximization algorithm to determine automatically the density functions for the change and no-change pixels and thence the optimal decision thresholds for discriminating change and no-change pixels. The application and expressiveness of the proposed procedure depends (among other things) on the spatial resolution of the imagery. When a change signal within nuclear sites is very significant in terms

of radiance changes, it can mostly be detected by the pixel-based analysis of mid-resolution multispectral image data. But when adopted to (spatial) high-resolution imagery, the results of the pixel-based algorithms are often limited. Especially if small structural changes are to be detected, object-based procedures seem to be advantageous. In comparison to the purely spectral-based features used within the pixel- based approaches, the inclusion of features such as the size or orientation of an object, its shape or texture and its relations to other objects on the same or at different scales, considerably extends the possibilities for image analysis.

D. Object-based change detection

Computer driven, object-based image analysis is in a first approximation comparable to visual perception. An image interpreter recognizes, along with the colour of an image, also the shapes, textures and coherent regions present within it, and associates meaningful objects and their contextual relations. A similar goal is intended in object-based image analysis, although the complexity and effectiveness of human perception is of course far from being achieved. The extraction of the objects from the analysed image occurs at the lowest level by segmentation, at which stage the primary segments should ideally represent the real world objects. The feature analysis provides the basis for the preparation of a ruled-based classification model resulting in a classified image. Analysing satellite image data in an object-based way generally extends the possibilities to detect changes between two or more dates. In addition to the change pixel measures listed before, object based change detection techniques can also estimate the changes of the mean object , such as shape and size, assess the modified relations among

neighbouring, sub- and super-objects and find out hanges regarding the object class memberships. Moreover, specific knowledge can be easily involved into the procedure.

Previous studies implying a combination of pixel and object-based techniques have already demonstrated the advantages of firstly pinpointing the significant change pixels by statistical change detection and subsequently post-classifying the changes by means of a semantic model of change related object features [19,20].

1. Object extraction

Given Definiteness Professional, the so-called multi-resolution segmentation uses homogeneity criteria based on spectral and/or spatial information and a scale parameter in combination with local and global optimization techniques. For image data of two acquisition times, the segmentation into object primitives could be carried out a) on the basis of the bi-temporal data set, b) by applying the segmentation parameters to the image data of one date and assigning the object borders to the image data of the other date, c) separately for the two times. When

using a common segmentation (a, b), the generated objects show object features, which are either apparently time-invariant, such as shape, or differ at the two dates, i.e. most of the layer values. Thus, the time-variant object features present the basis to detect changes of and within the objects between the two dates. Provided a separate segmentation (c) for the two scenes, also the shape features will vary in time.

III. PROBLEM STATEMENT

The use of high-resolution satellite imagery is increasing for a range of applications, particularly in the utilities industry. Satellite cameras are traverse above the sky and move with a fixed speed. While capturing imagery is not fine enough to distinguish cars, trees and power line towers and other objects also to map a town. Geo-image one of premier satellite imagery processing and services for satellite imagery. The problem of finding preprocessing methods which can be used on large images or maps that must be capture by pieces because they simply don't fit entirely the camera area, methods resulting in image merging, is an old one. However most of the approaches focus on merging the image based on pixel-content comparison, which is a very slow process for high resolution images, because a great number of picture-per-picture difference comparisons are required. This is simply because there is a difference in rotation angles between the two images and not only in plane displacement. The presented approaches are base on a new idea, of retrieving specific point-features in one image and "match" them in the other image.

IV. PROPOSED ALGORITHM

The proposed algorithms for image merging and recovery are based on two main scenarios that are encountered throughout the research institute. The first one is that of intersecting composing components of a document. This is the case of capture picture which are overlapping one another containing common information that can be used during the merging process. The intersections that occur in such cases are included in one of the following cases:

- horizontally overlapping – e.g. the case of the top/bottom parts of an area
- vertically overlapping – e.g. case of the left/right halves of a area

The second case that is discussed in this paper is that of non-intersecting parts of area that also need to be merged. The most common situations in which these problems are encountered are vertical separation of map components that need to be aligned and joint together before the actual digitization process.

In satellite image capturing and merging the following sceneries can occur

a. Capture the images at certain interval.

b. Finding the common area for two sequencing capture images and discard the common area from second image.

c. Marge two images to generate the result and repeat until desire location is covered or large image is generated.

The proposed algorithm can generate the large image from a set of sub part images in the following manner.

Satellite camera can take picture at a certain interval as we consider the speed of satellite is fixed then used matlab function imread() to read these captured images,

d(i,j-50,k)=a2(i,j,k)------(i)

equation (i)is used to generate the image a2 without the common area and function cat() is used to append the image a2 after a1 . the algorithm follow these steps until or unless the actual merge image is produced.

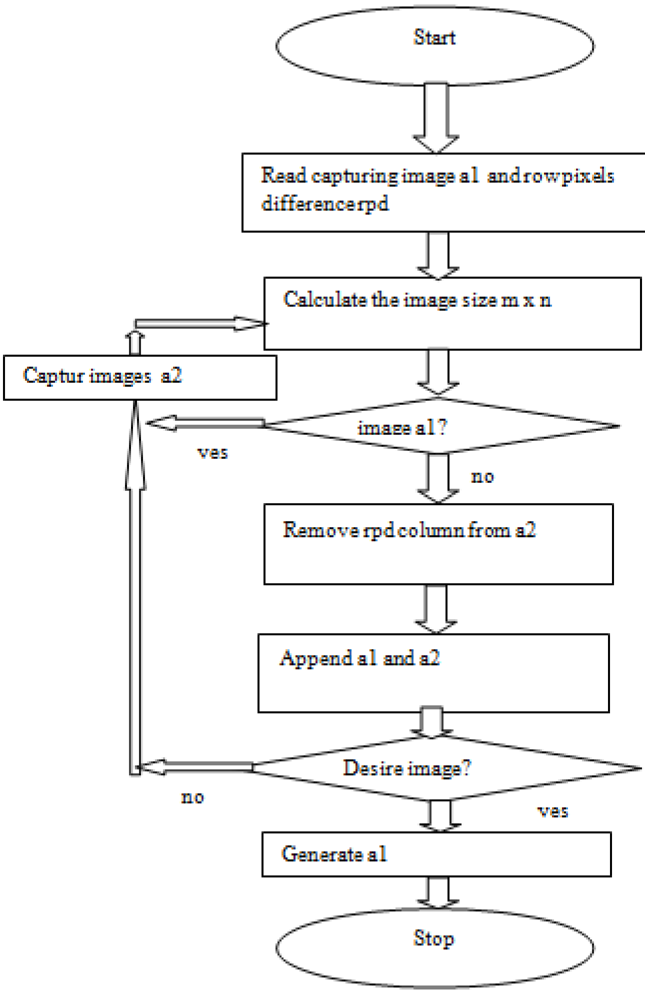
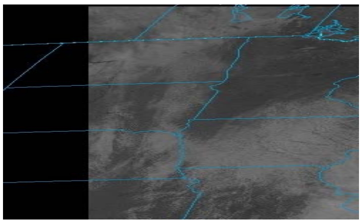
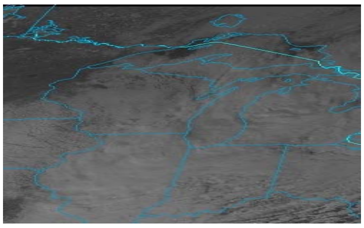


Figure 2. merging algorithm

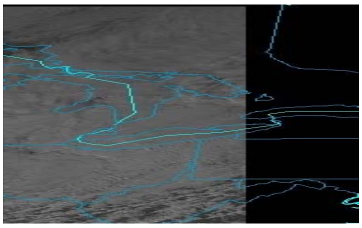
V. Experimental result



(a) First image



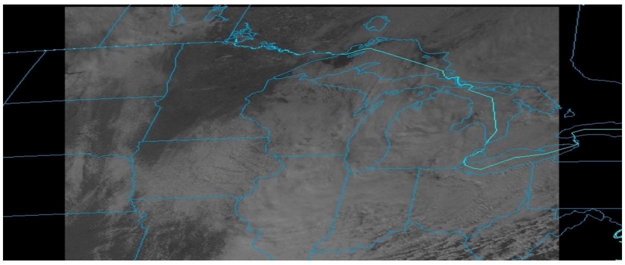
(b) Second image



(c) Third image

Figure 3. captured images

Satellite camera is moved at fixed speed and a fixed direction and captures the sub portion of target area. Let we consider that capture area of a satellite camera is 450 x 250 pixels , satellite camera capture a frame after moving the400 number of pixels and for two adjacent capture image common area 50 numbers of horizontal pixels, the merging algorithms should discard the common area from (b) and append after (a) again discard the common area from (c) and append after (a) and for vertically overlapping we use the same technique and only take the vertical pixels for common or overlapping area. Using this way we can generate map for a road or a large map where each trees and building can clearly visible or we can map a road. The algorithm generate a merged image shown in figure 4



VI. CONCLUSIONS

Merged algorithm in this paper has a row and column basis two most common scenarios for the images that have to be merged. If the sections are overlapping, comparison bands are chosen on the pair of images, and the algorithm attempts to obtain a function that matches corresponding entities in the two bands. When the capture images are non-overlapping, higher-order ,geometric computations are performed, obtaining the characteristics of the text and finding a line-to-line match. A positive match in text characteristics results in the linear translation coefficient necessary for the page sections' alignment. Despite of the input type, a single output large image is obtained, serving as a better starting point for any further processing task, such as logical structuring or content extraction, and eliminating the need for manual corrections.

VII. Future work

The current paper described method which can be used in large images that must be obtaining a set of sequence images. However, the described method used a content matching technique that is usable only after the recovery of the connected component in the image. For that, a binary conversion preprocessing phase must be performed . As a result the merging techniques may be adapted in a future project to operate directly into continuous color spaces like grayscale or true-color, to extract the connected components directly into these spaces, thus enabling them to be less sensitive to the errors of image binarization.

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