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A Frame work for road network extraction from remotely sensed high resolution Images

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ABSTRACT

Geospatial data differ accurately and precisely in the attributes as well as their temporal and spatial dimensions. The two approaches proposed for are road extraction based on Normalized Difference Vegetation Index (NDVI) and Fuzzy c means clustering. Image-based and vector-based algorithms are integrated for conflation. Road intersections and terminations of different types of are automatically detected by spatial contextual measure extraction algorithm. iterative relaxation algorithm (IRA) is mainly used for point matching (PM) based on the relative distance information in between the points. The Vector Road Iintersections which is matched to extracted point sets by a relaxation-labeling algorithm. A Rubber-sheeting Ttransformation is a local affined transformations, that subdivides the map areas into small pieces and applied local adjustments on every piece, also preserving topology in the process. At the end of Rubber-Sheeting transform there may be misalignment which is occurred in the Road segments. In order to solve this problem an active Contour Model (snake) which is used to deal with the residual displacement errors. Road network extraction is analysed and compared based on NDVI and Fuzzy C means clustering .This method can be extended for more information.

KEY WORDS: Geographic information system; Normalized Difference vegetation index; Fuzzy C means clustering.

1. INTRODUCTION

The initial focus of conflation was to eliminate the spatial inconsistency between two vector maps in order to improve the spatial accuracy of vector maps. Once the spatial Discrepancy is eliminated; it is possible and easier to transfer attributes among datasets to achieve geospatial data fusion. As the accessibility of geospatial information builds (GIS), there is a critical need to coordinate numerous datasets to enhance spatial examination. Be that as it may, following these datasets regularly start from distinctive sources and fluctuate in spatial precision, they frequently don't coordinate well to one another. What's more the spatial disparity is frequently nonsystematic such that a straightforward worldwide change won't tackle the issue. Manual redress is work concentrated and tedious and regularly not useful. However precisely coordinating geospatial information from diverse sources is a testing errand. Conflation is the procedure that joins two or more spatial representations of the same locale to create an unrivaled dataset that is superior to anything any of the first inputs in both spatial and trait perspectives. Through the conflation process, singular qualities of every source can be collected. For instance, a dataset with astounding spatial exactness however little property data can be coordinated with one rich in characteristic data yet of poor spatial precision to deliver another representation that is appeared in Figure 1. TIGER vector streets (strong blue) are superimposed on an airborne photo both spatially precise and characteristic rich. For instance, one across the board issue happens when vectors speaking to street sections don't line up with streets in foundation symbolism. Moreover, the spatial removal is regularly nonsystematic.

Figure.1. TIGER vector roads (solid blue) are superimposed on an aerial photograph.

2. RELATED WORK

Road extraction technique: A few calculations are utilized for removing streets from symbolism. At that point we see the overview on those calculations. Satellite picture contain a ton of data about the area and qualities of synthetic questions, for example, streets, structures, spans and so forth. Without elevated or satellite pictures gathering and overhaul of required data would be an extremely costly and tedious procedure. The objective of computerization is to build the rate and to bring down the expenses of extraction. Results of road extraction are usually stored in GIS and used for periodical update. There are two factors are needed to road extraction techniques.

- Resolution of images
- Interaction between algorithms and human operator.

It has two types of algorithms.

- Semi-Automatic
- Fully Automatic

Semi-Automatic algorithm that require help from human operator are called semi-automatic. The operator choose seed points and this algorithm connect by a path which is mostly likely a road. This seed points reduce the problem space of semi-automatic algorithms. In 1978, Lynn proposed a system for tracking road segments and finding potential vehicles in imagery of approximately 1 to 3 feet per pixel ground resolution (Karthik, 2013), Here, Road tracking could be accomplished by using cross correlation. The location of the correlation peak was used to maintain alignment with the road center and to generate a model for road trajectory. However, this approach turned out to be unsatisfactory because small alignment errors accumulated (Jasmin, 2015; Philomina, 2014).

In 1981, Fischler proposed a system for "detecting roads and Linear Structures in low resolution imagery using a multi-source knowledge introduction techniques" (Karthik, 2014). Here due to the suppression of small details roads are represented as lines with more or less homogeneous surface.

Drawback of this approach is,

- Roads in such representation can easily be confused with other linear structures in images.
- Low-resolution images do not contain information about roads such as width.

Advantage of this approach is,

- Low-resolution road extraction problem largely reduces to the general problem of line extraction.

In 1988, Mckeown and Denlinger were proposed a system for "Cooperative methods for road tracking in aerial imagery". The creators examine a framework for street following, ARF (A Road Follower) that uses different agreeable systems for separating data about street area and structure from complex elevated symbolism. This framework is a multilevel structural planning for picture examination that takes after for collaboration among low-level procedures and total of data by abnormal state investigation parts. Two low-level street following techniques have been executed: street surface composition relationship and street edge taking after. Every works freely to set up a model of the centerline of the street, its width, and other neighborhood properties (Karthik, 2014, 2015; Saravanan, 2014).

In Jan 1996, Geman proposed a system for "An active testing model for tracking roads in satellite images" (Filin, 2000), We contribute a fractional answer for the issue of separating critical 1D structures, particularly street systems, from medium determination satellite symbolism. Given a beginning stage and beginning course, we can track interstates over significant separations, for instance one hundred kilometers, without manual mediation. The tracker is adequately quick and stable to bolster the work of masters, for example, cartographers, and could be adjusted to break down other direct, deformable structures, which are especially unmistakable in remotely detected pictures (Vijayaragavan, 2014, Saravanan, 2014; Gopalakrishnan, 2014; karthik, 2014)

In Jul 1996, Barzohar and Cooper were proposed a system for "Automatic finding of main roads in aerial images by using geometric models and estimation" (Barzohar, 1996). This paper exhibits a robotized way to deal with discovering fundamental streets in elevated pictures. The methodology is to construct geometric probabilistic models for street picture era. We utilize Gibbs Distributions. At that point, given a picture, streets are found by guide (most extreme a posteriori likelihood) estimation. The guide estimation is taken care of by apportioning a picture into windows, understanding the estimation in every window through the utilization of element programming, and afterward, beginning with the windows containing high certainty gauges, utilizing dynamic programming again to get ideal worldwide appraisals of the streets present. The methodology is model-based from the start and is totally unique in relation to those showing up in the distributed writing. It produces two limits for every street or four limits when a mid-street hindrance is available.

Conflation Technique: The first conflation technology was developed in the year of 1988 named as **"**vector-to-vector conflation**".** It means integration of two road network of variable accuracy levels. Here, he discussed different strategies to partition space based on the matched entities and concluded that Delaney triangulation is the most appropriate partition mechanism used for conflation. Because the Delaney triangulation avoids the triangles with small angles (Karthik, 2014). In 1998, Cobb proposed a way to deal with perform highlight coordinating at the article level. For instance while contrasting two street sections, their methodology coordinates the street endpoints, as well as matches the Non spatial properties, for example, road names and widths (Cobb, 1998).

In 1999, Walter and Fritsch proposed a connection coordinating way to deal with find coordinated spatial items in view of the closeness of spatial articles at the geometry level (overlook to hub coordinating taking into account separate) and in light of the relations between the information sets. Disadvantage of this methodology is to require a human mediation to perform a beginning relative change between datasets (Jasmin, 2015). Then again, there are less research exercises on "vector to raster information conflation". That implies, for instance the coordination of street system and symbolism or street system and raster maps.

In 2001, Filin & Doytsher were proposed a direct conflation calculation to adjust vector and symbolism. Here, first all edges are identified in the symbolism (without utilizing existing vector information) and changed over to vector position. At that point their methodology coordinates the recognized focuses with the vector information to distinguish genuine street edges. For those recognized edges where there is no comparing edge identified in the symbolism, they will be changed by locales shaped by coordinated edges. Extricating include straightforwardly from symbolism and changing over to vector organization is a testing errand. There are a few calculations for removing streets. Yet, none of them give great results in all circumstances (Walter, 1999).

In the year of 2005, Flavie attempted to discover the intersection purposes of every single distinguished line in the symbolism, and after that match the intersection purposes of the street vector with the picture intersections. At that point the vector lines are moved by coordinated intersections. At last, their framework applies the dynamic shape model strategy to refine the coordinated street portions (Philomina, 2014).

Problem formulation:

Road extraction from imagery: A middle channel is valuable to the data pictures to evacuate commotion, as a result of its characteristic properties of decreasing tonal varieties while holding edges. The Normalized Difference Vegetation Index (NDVI) is regularly used to quantify vegetation sum. As the NDVI esteem develops, so does the measure of photosynthesizing vegetation present. NDVI is figured as

NDVI = (NIR-RED)/ (NIR+RED)

NIR→ Reflectance value of the near-infrared band

RED→ Reflectance value of the red band.

If NDVI> Threshold means, set that pixel value as 1 and remaining pixel as 0. Then search the pixel, which is having a value of 0 in the image, and place them in a array. Take the first element in the array for processing and find the surrounding pixels for that. Find the spectral similarity in between the surrounding pixel and the central pixels. Spectral similarity is the difference between the pixel values. If the spectral similarity is below the threshold means that pixel will be in the road. Otherwise the pixel will not present in the road. Figure 2. Shows the work flow of vector to imagery conflation process. All Candidate Road pixel has a different value of one and other pixel is set to zero.

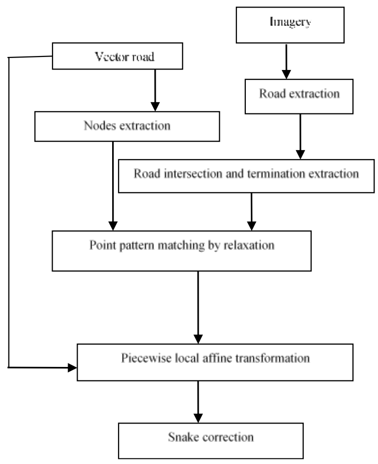


Figure.2. Workflow of vector-to-imagery conflation process

Finally, a morphological opening is useful to the Candidate Road Image to eliminate noise. These images are applied later in the external images energy function in the Snake Algorithm.

Extraction of Road Intersection and Road Termination: Termination and Road Intersection are extracted based on spatial contextual information. If a pixel has similarity pixels in four directions, that pixel will be in intersection of the four-way road. If a pixel will have similarity pixels in three directions means, it will be in three-way intersection road. Then if a pixel has similarity pixels in opposing two directions, that pixel will be in the middle of the road. Similarly if a pixel have similarity pixels in only one direction, that will be the road termination.

1 peak → Road Terminations
2 peak → Middle of road
3 peak → 3 way road intersections
4 peak → 4 way road intersections

Point Matching by Relaxation Labeling: Point matching are useful to see the messages from two different datasets as represented the same geographical object. Let A = {A1, A2…An} be a set of road intersection and termination from the Vector Road Map, and B = {B1, B2…Bm} be a corresponds set from imagery. Ai and Bj are corresponding points, for other point pair (A_h, B_k) their compatibility C(i, j; h, k) was defined as a function of how much the actual position of A_h relative to A_i differs from the desired position of B_k relative to B_j. The magnitude of the relative distance δ is calculated. Then the compatibility is calculated using the following equation.

$$\delta = D_{hk}' / D_{ih} \quad (1)$$

$$C(i, j{:}h, k) = 1/(1+\delta^2) \quad (2)$$

Pij represented as the probability which matches between A_i and Bj, then C (i, j; h, k) P_{hk} is used as a contribution to a new estimate of P_{ij}. Thus, a plausible relaxation formula is

$$P_{ij}^{(r+1)} = 1/n \sum_{h=1}^{n} \max \{C(i, j{:}\ h, k)\, P_{hk}^{(r)}\} \quad (3)$$

Where r = 0, 1, 2… is the iteration number. C (i, j:h, k) = 1 if h=i.

Piecewise Local Affine Transformation: An elastic sheeting change is a nearby relative change, which subdivides the guide territories into pieces and applies neighborhood modification on every single piece, saving topology simultaneously. Elastic sheeting strategies commonly subdivide the guide zones into triangular molded locales. One such triangulation technique is the Delaunay triangulation. Given an arrangement of information focuses, the Delaunay triangulation is an arrangement of lines associating every point to its regular neighbors. Utilize the coordinated street crossing points and street terminations as control focuses to produce the Delaunay triangulation and perform the nearby piecewise change. Along these lines, the positions of the vector streets have been incredibly made strides.

Snake-Based Position Correction*:* The snake is a dynamic form model affected by inward and outer powers. The interior power forces a piecewise smoothness requirement. The outside picture power pushes the snake toward notable picture highlights like lines and edges. The snake can be spoken to as parametric bend by

$$V(s) = (x(s).y(s)) \quad (4)$$

Where s is proportional to the curve length, and x and y are the curves coordinate.

The Snake's total energy function is composed of internal d external components, given by

$$E_{snake} = \int_0^1 E_{snake}(v(s))ds \quad (5)$$

$$= \int_0^1 E_{Internal}(v(s)) + E_{External}(v(s))ds \quad (6)$$

$$E_{External} = -E_{Image}(v(s)) \quad (7)$$

Where $_{EImage}$(v(s)) is the image intensity.

A snake has a grouping of focuses (v1, v2,….,vn). Expect that v1 and vn are end focuses that have been moved the right positions by the elastic sheeting change. For any middle of the road snake point vi, draw a line through which is opposite to line vi-1vi+1. Given a standard direction tomahawks, mark that heading i. check the quantity of street pixels on every side of vi along the line. In the event that the number on one side falls into a sure range, dictated by data about street width, move that point in the bearing. The fx and fy are characterized by the bearing

$$f_x(i) = 1,\ f_y(i) = 1 \quad \text{if} \quad 0 < \theta_{i.} \le \Pi/2$$

$$f_x(i) = -1,\ f_y(i) = 1 \quad \text{if} \quad \Pi/2 < \theta_{i.} \le \Pi.$$

$$f_x(i) = -1,\ f_y(i) = -1 \quad \text{if} \quad \Pi < \theta_{i.} \le 3\Pi/2$$

$$f_x(i) = -1,\ f_y(i) = -1 \quad \text{if} \quad 3\Pi/2 < \theta_{i.} \le 2\Pi$$

Where, $f_x(i) = \partial E_{external} / \partial x$ and $f_y(i) = \partial E_{external} / \partial y$

This task pushes the point in the right heading. Once a snake point falls on a street pixel, it will quit moving. Just the focuses out of sight will move.

Vector Road Map Updating: Enhancing the positional exactness while keeping the current characteristics makes a superior street dataset. By and large, the symbolism is more present than the vector information in light of the fact that conventional guide gathering and generation are tedious procedures. Recently built streets are regularly not appeared in vector datasets. The unmatched street crossing points from symbolism might give helpful pieces of information to programmed extraction of new streets from symbolism. These new roads also extracted by using spatial contextual measures. First the new roads are conformed as roads by normalized Difference Vegetation Index. Then the X and Y coordinate of the new roads in satellite imagery also calculated. Finally the same X, Y coordinates in vector road map also updated.

Automatic road updating in vector road map: Enhancing the positional exactness while keeping the current qualities makes a superior street dataset. For the most part, the symbolism is more present than the vector information in light of the fact that customary guide aggregation and creation are tedious procedures. Recently built streets are frequently not appeared in vector datasets. The unmatched street crossing points from symbolism might give helpful signs to programmed extraction of new streets from symbolism. These new roads also extracted by using spatial contextual measures. First the new roads are conformed as roads by Normalized Difference Vegetation Index. Then the X and Y coordinate of the new roads in satellite imagery also calculated. Finally the same X, Y coordinates in vector road map also updated.

Flow Chart: The workflow of road extraction based on FMC-Fuzzy C means Clustering is shown in Figure 3. FMC-Fuzzy C Means Clustering is a clustering method, which subdivides the image into two clusters. The two clusters are vegetation and non-vegetation areas. The non-vegetation areas contain roads and buildings. A median filter is useful to the input

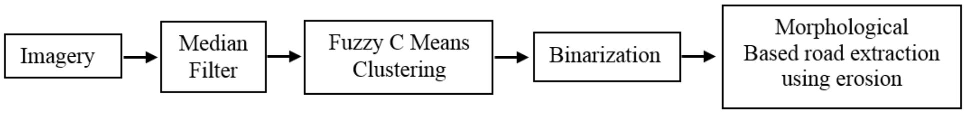


Figure.3. Road Extractions Based on Fuzzy C Means Clustering

Picture to uproot clamor, as a result of its characteristic properties of lessening tonal varieties while holding edges. Bunching is a system for unsupervised learning, and a typical method for factual information examination utilized as a part of numerous fields, including machine learning, data mining, design acknowledgment, picture investigation. In fluffy bunching, every point has a level of fitting in with groups, as in fluffy rationale, instead of having a place totally to only one bunch. Thus, points on the edge of a cluster may be in the cluster to a lesser degree than points in the center of cluster. In this approach, the given satellite imagery is partitioned into three groups. Vegetated regions and non-vegetated regions, which includes buildings and roads. Then Binarization technique is applied to the given image, which computes a global threshold automatically that, can be used to convert an intensity image to a binary image. Then using morphological based erosion technique erodes the unwanted portions of the image. Thus the roads are extracted automatically from the imagery.

3. RESULTS AND DISCUSSION

Two measures are utilized for the precision evaluation: accuracy and root-mean-square blunder (RMSE). The accuracy is characterized as the rate of length of street sections that fall inside of the cushion over the aggregate length of streets.

$$RMSE = \sqrt{\sum \frac{\left(x_{target} - x_{reference}\right)^2 + \left(y_{target} - y_{reference}\right)^2}{n}}$$

Satellite picture comprises of an arrangement of discrete picture components or pixels, each of which speaks to a sure measure of ground range on the Earth's surface. The electro-magnetic radiation got from the region is caught as the splendor estimation of the pixel. The experimental result of the conflation method is provided in this section. This method is implemented using MATLAB. Here the satellite imagery is chosen by the user. Corresponding vector map is also chosen for the process. Vector guide is an information structure used to speak to direct geographic elements. Components are made of requested arrangements of x, y facilitates and spoke to by focuses, lines, or polygons; guides join toward get to be lines, and lines associate with get to be polygons. Characteristics are connected with every component. Next the *x, y* coordinates of the vector map are given by the user, so that the particular area will be selected for conflation process. Green vegetation by and large reflects 40%–50% of the occurrence close infrared vitality, with the chlorophyll in the plants retaining 80%–90% of the episode vitality in the noticeable piece of the range. Vector guide is made from vector information, for example, street headings, street widths and street shapes. Satellite imagery contains more recent road data. Table.1. shows the illustration of area selection in vector map. Here the user gives the reference point and the target point of *x* coordinate, so that the particular area of vector map is selected. At the same time reference point and target point of *y* coordinate is also chosen by the user. Here blue line indicates the selected area of vector road map. This road map contains three road data. The user gives the selected area of satellite imagery. The middle channel is connected to the offered picture to evacuate clamor, in light of its innate properties of lessening tonal varieties while holding edges. At that point the vegetation sum is ascertained by NDVI system. NDVI (Normalized Difference Vegetation Index) is a basic numerical marker that can be utilized to break down remote detecting estimations,

Table.1. Selection of reference and target points

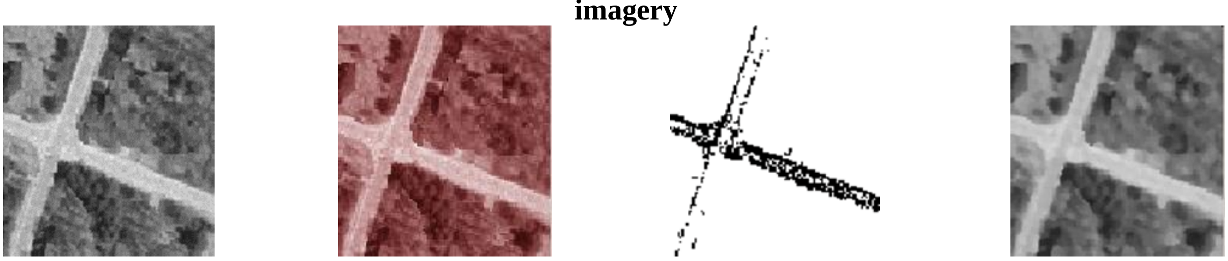
Reference and target points			
$X_{reference}$	X_{target}	$Y_{reference}$	Y_{target}
2.073	2.074	9.123	9.124

Regularly yet not as a matter of course from a space stage, and evaluate whether the objective being watched contains live green vegetation or not. Figure 4. (a) Shows a sample of an aerial imagery. Figure 4. (b) Shows the vector map of that aerial imagery. Here the blue line indicates the vector map, which is superimposed on aerial imagery. Then the spatial contextual information extraction algorithm is applied on the processed image. Figure 5.

Shows the illustration of spatial contextual information extraction. Vegetation and street surfaces have noteworthy distinction in ghastly reflectance qualities. Street surfaces for the most part have higher reflectance in the noticeable district and bring down reflectance in close infrared than vegetation.

Figure 5. (a) Shows the selected area of satellite imagery. This map contains four roads. Generally newly generated roads are presented in the satellite imagery but these roads are not presented in the vector road map. These newly generated roads also updated in vector road map during conflation. Figure 5. (c) Shows the illustration of vector road map updating. Next the road intersections and terminations is extracted in both the satellite image and vector road map. Figure 5. (d) Shows the finding the road intersections and terminations for selected area. Figure 6. (a) Show the illustration of road terminations and intersections are extracted from vector road map. Figure 6. (b) Shows the illustration of Road Intersections and terminations are extracted from satellite imagery. The vector road map contains two intersection points.

Figure.4. Road extraction based on NDVI : (a) Sample of an aerial imagery (b)Vector map of aerial imagery



(a) (b) (c) (d)

Figure.5. Extraction of spatial and contextual information: (a) Sample image (b) Find NDVI (c) Trace the road (d) Applying median filter

Here a blue line indicates the vector map, which is superimposed on aerial imagery. Vector Map (VM) is a data structure used to represented linear geographic features.

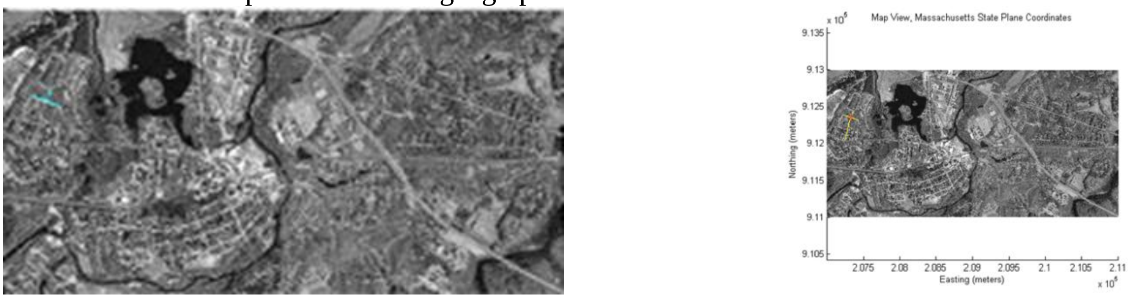


Figure.6. Extraction using Conflation : (a) Road based vector correction (b) Extraction of Road Intersections and Terminations in Vector Map

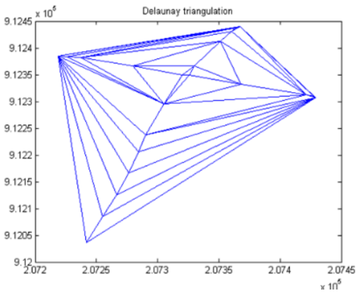


Figure.7. Delaunay Triangulation Transformations Graph

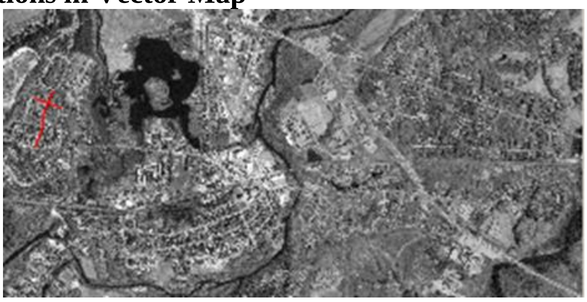
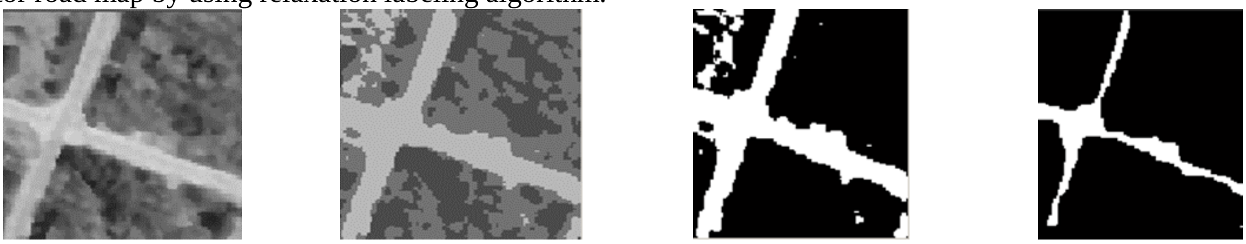


Figure.8. Conflated output using snake and refinement approach

Figure.8. Shows the final conflated output using NDVI approach. In this proposed approach road extraction is based on Fuzzy C Means Clustering method. Here also the user gives the satellite imagery. Corresponding vector map also given to the process. First an aerial imagery is selected. Then the vector map of that aerial imagery is extracted. But the satellite imagery contains only one intersection point. Therefore the vector map do not line up with satellite imagery. The intersection points from both map will be matched by using point matching algorithm. Then the matched point pairs will act as a control point to perform local affine transformation. An elastic sheeting change is a nearby related change, which subdivides the guide territories into pieces and applies neighborhood modification on every single piece, protecting topology in the process. Finally the snake algorithm is applied on the given image. The snake is a dynamic form model affected by inner and outer powers. The inside power forces a piecewise smoothness requirement. The outer picture power pushes the snake toward striking picture highlights like lines and edges. At long last, better street dataset is made with positional precision. Figure 7. Shows the Delaunay triangulation transformation graph. Attributes are associated with each feature. The user selects next automatic road tracing and mapping method (Kanniga, 2011, 2014; Karthik, 2013).

Figure 9. Shows the proposed method of spatial contextual information extraction. Here road extraction technique is a fully automatic approach. First roads are extracted by using Fuzzy C Means Clustering. Here the image contains two parts i.e, vegetation and non-vegetation areas. Non vegetated areas include roads and buildings. Then binarization method is applied on the extracted image. Binarization technique computes a global threshold automatically that can be used to convert an intensity image to a binary image. Mathematical morphology method is applied on the binary image. Here some unwanted areas are eroded using erosion technique. Figure 9. (b) Shows the illustration of automatic road extraction with Fuzzy C Means Clustering. In this fuzzy C Means road extraction technique extraction time is very less. Then Road Intersections (RI) and Terminations are obtained from the extracted road. Then these Road Intersections (RI) and Terminations are matched with road intersections and terminations of vector road map by using relaxation labeling algorithm.



(a) (b) (c) (d)

Figure.9. Spatial contextual information extraction: (a) Applying median filter (b) FCM - based road classification (c) Binarization (d) MM based road extraction

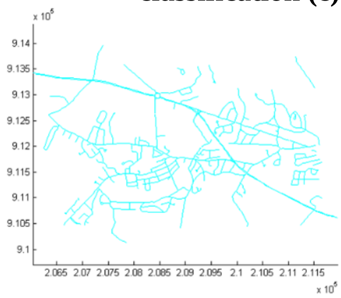


Figure.10. Vector road map

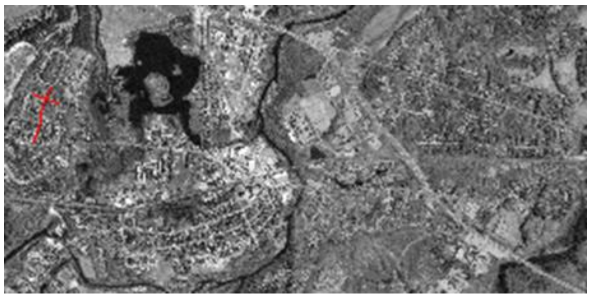


Figure.11. Automatic road extraction using Fuzzy C means clustering

An elastic sheeting change subdivides the guide regions into pieces and applies nearby modification on every single piece, protecting topology simultaneously. Toward the end of elastic sheeting change, there may be some misalignment happened in the street sections. The vector road map is shown in Figure 10. With the end purposes of every street in right position, snake rectification moves middle of the road street indicates the street picture. At last a superior guide is made with positional exactness. Figure 11. Shows the final conflated output using Fuzzy C means clustering. We can see that unique TIGER streets have poor positional exactness with a normal RMSE of 51.2 m. This conflation approach enhances the exactness essentially. Truth be told, normal RMSE is just 3.4 m. This is a mind blowing precision change. Execution time of road extraction is very low when compared to that of the previous method. In previous method execution time of road extraction technique is 265ms. But in this proposed approach execution time of road extraction time is 1.14ms.

Table.2. Performance analysis of road extraction techniques

Road extraction based on NDVI		**Road extraction based on fuzzy C means classification**	
Time Complexity of Road Extraction (ms)	RMSE (m)	Time Complexity of Road Extraction (ms)	RMSE (m)
223.281	3.99	2.641	3.99

Tests demonstrate our Vector-to-Image Conflation approach has fantastic execution. The positional precision was enhanced essentially from 51.2 m RMSE to 3.3 m. The enhanced TIGER streets with rich credits could prompt numerous new applications for elected, state, and nearby governments, and also for private mapping commercial enterprises. In this proposed system road extraction time is very less when compared to other previous approaches. Table II. Shows the comparison of time complexity between previous approaches and proposed system. Here time complexity of semiautomatic approach is 223.282 ms. But time complexity of automatic approach is 2.641 ms.

4. CONCLUSION

Street extraction from remote detecting pictures has its applications in cartography, urban arranging and activity administration and in modern improvement. Keeping in mind the end goal to assess the outcomes, we contrast the acquired street path highlight with a physically digitized reference street dataset. Existing vector roads and imagery are integrated and conflated. Enhancing the positional precision while keeping the current qualities makes a superior street dataset. The new roads generated in the imagery also updated in vector road dataset. Experiments shows that Fuzzy C means clustering approach has excellent performance than the approach based on NDVI. The positional precision was enhanced essentially from 51.2m RMSE to 3.4m, and the normal rightness expanded from 20.6% to 95.5%.

REFERENCES

Barzohar M and Cooper D.B, Automatic finding of main roads in aerial images by using geometric-stochastic models and estimation, IEEE Trans. Pattern Anal. Mach. Intell, 18(7), 1996, 707–721.

Cobb M.A, Chung M.J, Foley H, Petry F.E, and Shaw K.B, A rule-based approach for the conflation of attributed vector data, Geoinformatica, 2(1), 1998, 7–35.

Filin S and Doytsher Y,A Linear Conflation Approach for the Integration Photogram metric Information and GIS Data, International archives of photogrammetry and remote sensing, 33(B3/1), 2000, 282-288, 2000.

Gopalakrishnan K, Sundar Raj M, Saravanan T, Multilevel inverter topologies for high-power applications, Middle - East Journal of Scientific Research, 20(12), 2014, 1950-1956.

Jasmin M, Vigneshwaran T, Beulah Hemalatha S, Design of power aware on chip embedded memory based FSM encoding in FPGA, International Journal of Applied Engineering Research, 10(2), 2015, 4487-4496.

Kanniga E, Selvaramarathnam K, Sundararajan M, Kandigital bike operating system, Middle - East Journal of Scientific Research, 20(6), 2014, 685-688.

Kanniga E, Sundararajan M, Modelling and characterization of DCO using pass transistors, Lecture Notes in Electrical Engineering, 86(1), 2011, 451-457.

Karthik B, Arulselvi, Noise removal using mixtures of projected gaussian scale mixtures, Middle - East Journal of Scientific Research, 20(12), 2015, 2335-2340.

Karthik B, Arulselvi, Selvaraj A, Test data compression architecture for lowpower vlsi testing, Middle - East Journal of Scientific Research, 20(12), 2014, 2331-2334.

Karthik B, Kiran Kumar T.V.U, Authentication verification and remote digital signing based on embedded arm (LPC2378) platform, Middle - East Journal of Scientific Research, 20(12), 2014, 2341-2345.

Karthik B, Kiran Kumar T.V.U, EMI developed test methodologies for short duration noises, Indian Journal of Science and Technology, 6(5), 2013, 4615-4619.

Karthik B, Kiran Kumar T.V.U, Vijayaragavan P, Bharath Kumaran E, Design of a digital PLL using 0.35Î¼m CMOS technology, Middle - East Journal of Scientific Research, 18(12), 2013, 1803-1806.

Philomina S, Karthik B, Wi-Fi energy meter implementation using embedded linux in ARM 9, Middle - East Journal of Scientific Research, 20(12), 2014, 2434-2438.

Saalfeld A, Conflation, Automated map compilation, Int. J. Geograph.

Saravanan T, Sundar Raj M, Gopalakrishnan K, Comparative performance evaluation of some fuzzy and classical edge operators, Middle - East Journal of Scientific Research, 20(12), 2014, 2633-2633.

Saravanan T, Sundar Raj M, Gopalakrishnan K, SMES technology, SMES and facts system, applications, advantages and technical limitations, Middle - East Journal of Scientific Research, 20(11), 2014, 1353-1358.

Vijayaragavan S.P, Karthik B, Kiran Kumar T.V.U, A DFIG based wind generation system with unbalanced stator and grid condition, Middle - East Journal of Scientific Research, 20(8), 2014, 913-917.

Vijayaragavan S.P, Karthik B, Kiran Kumar T.V.U, Effective routing technique based on decision logic for open faults in fpgas interconnects, Middle - East Journal of Scientific Research, 20(7), 2014, 808-811.

Vijayaragavan S.P, Karthik B, Kiran Kumar T.V.U, Privacy conscious screening framework for frequently moving objects, Middle - East Journal of Scientific Research, 20(8), 2014, 1000-1005.

Walter V and Fritsch D, Matching spatial data sets, A statistical approach, Int. J. Geograph. Inf. Sci, 13(5),1999, 445–473.