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Research Article

SATELLITE IMAGE PROCESSING METHODS TO IDENTIFY GREENSCAPES BUILDINGS AND WATER SHEDS FOR SMART CITY PLANNING USING IMPROVED K-MEANS METHODOLOGY

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Abstract

Urban areas in the world accommodates more than half of the population of the Earth now lives in urban areas. There a strong need to rethink in city planning in efficient and modern ways for automatic decision makers. The sustainable development of urban areas is a challenge to be resolved and requires new, efficient, and user-friendly technologies and services. A well planned smart city to have planned urban area which could create sustainable economic development and improvement in quality of life, economy, mobility, environment, people, living and government. Even a good small change would have big impact on these areas, improving the well-being of its citizens.This paper is the outcome of the research made in the direction of finding optimization solution for the urban planner to give quality in reaching excellence in allocation of these key areas that can be achieved through computerized pattern matching for better utilization of urban landscapes. This technique is also used for identification of green landscapes and watersheds using satellite images. The objective is to integrate smart devices and gadgets for planning which would enrich city infrastructure and computer vision techniques may have an important role in city planning.

Keywords : Urban planning, Image processing, Pattern recognition, smart cities, k-means

1. Introduction

Image fusion plays a great role in many areas like medical field, military application, wireless systems and satellite imagery. This image fusion uses multispectral and hyper spectral satellite image to obtain information on spectral and spatial details of the satellite image under consideration. The Image fusion is a method of merging two or more images to a single image. The basic requirements of the Image fusion is the resulted single image must contain all the important information from the initial images. The combined picture shows all the information accessible in the given picture. The Image combination assumes an incredible job in our everyday life, a portion of the utilization of picture combinations are in the restorative field we use picture combination to analysis and location of measured related issue and conditions. Furthermore, in the military field, we use picture combination for observation purposes to

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recognize the adversary interruptions. With respect to remote structures, the data encounters transmission stage, channel and gatherer stages where it encounters various sorts of clamor and its possessions. For example, in the transmission sort out, during the testing and quantization, the image is impacted by what is known as partner and quantization upheaval which is caused due to looking at botches. The image is affected enormously as changes in the characteristics of the image changed when data is transmitted through a channel. Another significant confinement is that of the brightening is caused because of short unique range that outcome from the kind of picture obtaining gadget. Numerous strategies for image improvement considering the spatial area is master presented, in any case, with regards to picture combination, the extent of picture upgrade stays to be managed. Picture combination strategies considering the noise factor and the light conditions are constrained which in any case has a more noteworthy extent of utilizations and centrality.

2. Digital Image Processing

The identification of objects in digital image would probably start with image processing techniques like noise removal, followed by (low-level) feature extraction to locate lines, regions and possibly areas with certain textures. The idea is to interpret collection of different shapes as single objects, e.g. vehicles on road, billets on conveyor belts or tissues and cells on a microscope. One reason this is often addressed as artificial intelligence problem is that an object can appear very different when viewed from an angle or under different lighting. The human sensory device plays those responsibilities in the main unconsciously however a Computer callsfor skillful programming and plenty ofprocessing energy to technique human overall performance in manipulating facts withinside the shape of a photograph through numerous feasible techniques

Recognizing object classes in real-world images is a long term goal in Computer vision. Conceptually, this is often challenging because of large appearance variations of object instances belonging to the same class. Further challenges arise from interclass [3] similarity in which instances from different classes can appear very similar. Consequently, models for object classes must be flexible enough to accommodate class variability, yet discriminative enough to sieve out true object instances in cluttered images. These seemingly paradoxical requirements of an object class model make recognition difficult. This paper addresses two goals of recognition are image classification and object detection. The task of image classification is to determine if an object class is present in an image, while object detection localizes all instances of that class from an image. Toward these goals, the main contribution in this paper is an approach for object class recognition that employs edge information only. The novelty of our approach is that we represent contours by very simple and generic shape primitives of line segments and ellipses, coupled with a flexible method to learn discriminative primitive combinations.

In recent studies it is shown that the generic nature of line segments and ellipses affords them an innate ability to represent complex shapes and structures. While individually less distinctive, by combining a number of these primitives, we empower a combination to be sufficiently discriminative. Here, each combination is a two-layer abstraction of primitives: pairs of primitives (termed shape tokens) at the first layer, and a learned number of shape tokens at the second layer. Structural constraints enforce possible poses/structures of an object by the relationships (e.g., XOR relationship) between shape-tokens. The herculean task in mapping urban landscapes from satellite images used for regional and local area planning bodies has the influences in urban expansion planning for future. It is true that its first use has been mainly motivated by security reasons, but new proposals are gaining attention in the society.

3. Literature Review

The detailed literature survey is made on selected from recent papers and they make substantial contributions in the use and/or development of real-time computer visionsystems in the areas of human activity recognition. Road images were identified by Visual image is taken for special case of the structure from motion problem that can be effectively used in the Advanced Driver Assistant Systems (ADAS) context for autonomous driving using FAST, BRIEF, Levenberg–Marquardt/RANSAC and a Kalman filter. Nam and Hong discussed aReal-time abnormal situation detection based on particle advection in crowded scenes described method to detect abnormal situation in crowded scenes that operates in real time being implemented in many of the recent applications. Chun et al. presented Real-time smart lighting control using human motion tracking from depth camera focus on energy-efficient lighting systems as a contribution in the smart cities energy field are few frontier information on smart city planning area.Xu, andDing [5] have proposedaGram Schmidt approach which generates a simulated lowerresolution pan image through weighted sum of Green, Blue and Red and near-infrared multispectral bands. Wang et al. [2] proposed a projected gradient approachbased on un-mixingbased non-negative matrix factorizationfound as hybrid component together with PCA [4].The existing approaches of tacitly describing greenspace, if continued, will ensure that the literature remains scattered and disparate.We found that most published research fails to provide a definitionof greenspace. We found that when a definition is provided, thereis variation in what is meant by the term ‘greenspace’. The current lack of consensus about what green space is not deterresearchers from using the term, but researchers should provide ameaningful definition that both qualifies and quantifies what theymeant by the term.

Future publications should employ clear operational definitions based on measurable criteria in order to progressgreenspace research.It is likely that the lexicalization of the oneword compound,greenspace, will continue. Our research shows thatgreenspace is used as well instead of the identified interpretations foundthat is asurban vegetation [13]. This will allow the literature tobe more distinct and meanings to be more widely understood.By using common terms and defining them well, an opportunity for meta-analyses presents itself. The term, greenspace canbe meaningfully used across disciplines, fostering multidisciplinaryand interdisciplinary research and syntheses. This will improve theotherwise disparate nature of research concerning greenspace thatspans multiple discipline areas. Mapping urban form at regional and local scales is being the most important task as identified by the case studies conducted [11]with the relevant government and department officials. Hence it is to be understood that the influence of urban expansion plays vital economical roles and many such industrial inputs being decided by the urban planning department. The researchers are still on long way to be deterministic on acceptable remote or satellite image for adaptable method for town and country planning department. Most smart cities are developing and changing rapidly due to the increases in the population and immigration. Rapid changing brings commitment to control the cities by planning. The satellite images and the aerial photographs enable us to track the urban development and provide the opportunity to get the current data about urban;Cities may have cross-examined dynamic structures with the help of these images.

4. Objective of the Work

The purpose of this research is to analyze the layout of satellite image including the parks using Matlabto provide design adaptation guidelines to increase the effectiveness of the planning based on green scapes present in urban surroundings. This research analyses the behavior of different land use patches like forests, cropland, grassland, water surfaces, built areas and greenhouse areas present in the given image. It studies their average night land surface temperature, imperviousness, patch size and patch shape index, and analyses through a multiple regression analysis the impact of each of these last four parameters in a fixed term of months or year.This study is composed of three steps. The images taken from satellite are viewed as the potential information in decision making in order to track urban developments by using the aerial photographs and the satellite images. In the second step, a 3D city model with database has been generated with the help of orthophoto images and the vector layouts[12] and up to date urban details acquired from 3D city model. This study shows that it is possible to detect the unlicensed buildings and the areas which are going to be nationalized and it also shows that it is easy to document the existing alterations in the cities with the help of current development plans and images. And since accessing updated data is very essential to control development and monitor the temporal alterations in urban areas, in this study it is proven that the orthophoto images generated by using aerial photos and satellite images are very reliable to use in obtaining topographical information, in change detection and in city planning. These images used with GIS, they provide quick decision control mechanisms and quick data collection. In addition, they help to find effective solutions in a short period in the planning applications.Urban improvement covers a wide range of subjects, from the movement of people, the planning of utilities to the distribution of resources. With the expansion of urban areas around the world growing at an exponential rate, we need new methods for helping with efficient planning.More than half of human beings (3.9bn) now live in urban areas[1], but whilst developed cities have challenges of their own. This research aims at solution providing the planning in urbanization of developing countries and emerging economies facing problems such as overcrowding, congestion, sanitation and environmental quality, with exact and complete information such as manageableurban plans as the decision maker have the chance to make fully informed decisions about a wide variety of urban growth and management projects.

5. Proposed Work

In this paper, for clustering a technique have presented which allows the partitioning of a given data set without having to depend on the initial identification of elements to represent clusters. Proposed technique is based on rearranging the clusters to better represent the partitions when new elements are added. For feature space selection the proposed method has adopted the standard RGB color map.

5.1 K-Means Clustering

Clustering is used to arrange data for efficient retrieval. One of the problems in clustering is the identification of clusters in given data .The K-means clustering algorithm uses iterative refinement to produce a final result. The algorithm inputs K number of clusters and the data set. The data set is a group of features for each data point. The algorithms starts with initial approximations for the K centroids, which may either be randomly generated or randomly selected from the data set. The algorithm then iterates between two steps:

i. Data assignment step: Each centroid defines one of the clusters. Based on the squared Euclidean distance each data point is assigned to its nearest centroid in this step. if c_i is the collection of centroids in set C, then each data point x is assigned to a cluster based on where $dist(\cdot)$ is the standard ($L2$) Euclidean distance. Let the set of data point assignments for each *ith* cluster centroid be S_i.

ii. ii. Centroid update step: The centroids are recomputed. This is done by taking the mean of all data points assigned to that centroid's cluster. The algorithm iterates between steps one and two until a stopping criteria is met (i.e., no data points change clusters, the sum of the distances is minimized, or some maximum number of iterations is reached).

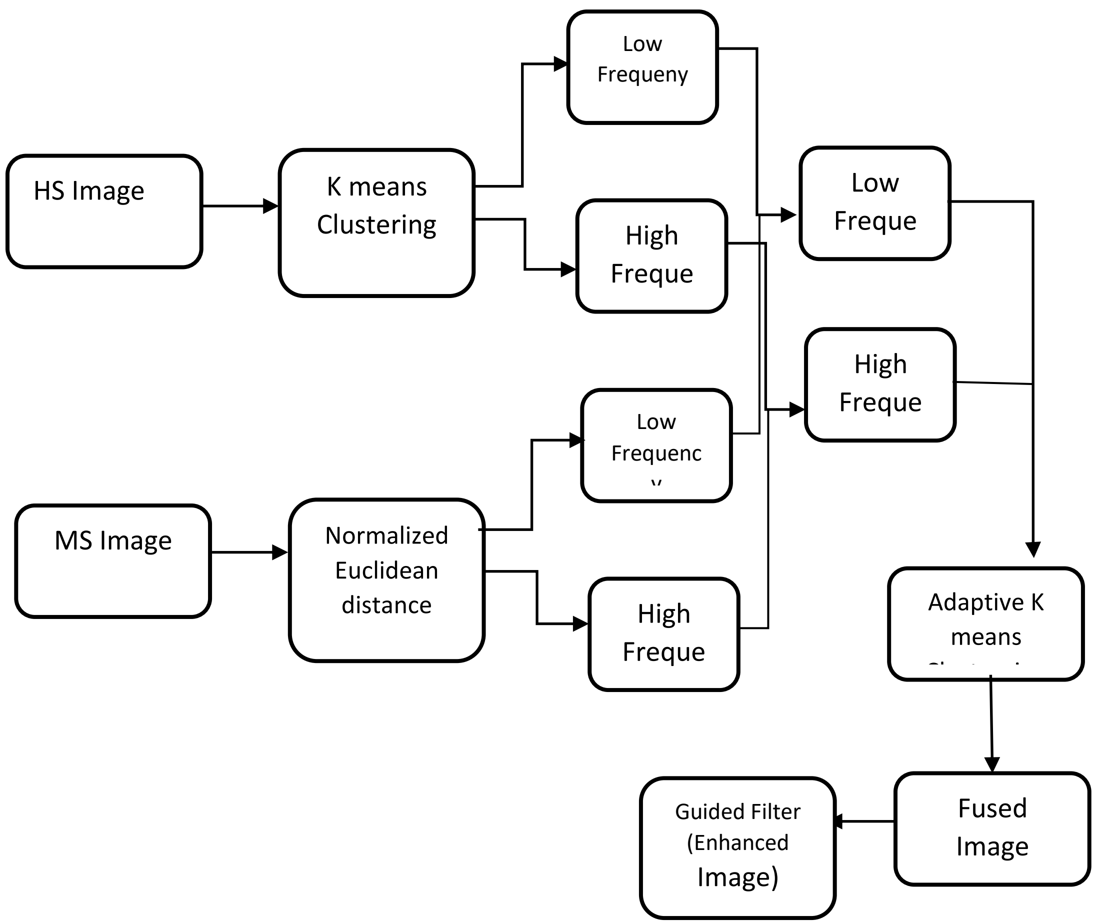

Figure 1. Block Diagram of proposed work

This algorithm is guaranteed to converge to a result. The result may be a local optimum (i.e. not necessarily the best possible outcome), meaning that evaluating more than one run of the algorithm with randomized starting centroids may provide a better outcome. The algorithm described above finds the clusters and data set labels for a specific pre-chosen K. To find the number of clusters within the data, the user must run the K-means clustering algorithm for a variety of *K* values and compare the results[6]. One of the metrics that is normally used to match results across different values of *K* is the mean distance between data points and their cluster centroid.

5.2Adaptive K-means clustering

The technique for clustering is based on K-means such that the data is partitioned into K clusters. In this, clustering is based on the identification of K elements in the data set that can be used to create an initial representation of clusters. These K-elements forming the cluster seeds. Left over elements of the data set is then assigned to one of these clusters. Even though the method seems to be simple, it has to bear from the fact that it may not be easy to clearly identify the initial K elements, or the seeds for the clusters. This shortcoming led the researchers to look into alternative methods that provide an improvement over K means. Some of these techniques include genetic algorithm based clustering and fuzzy clustering[8].

The adaptive K means clustering algorithm starts with the choice of K elements from the input data set. These K elements form the seeds of clusters and are randomly selected. The properties of each element also form the properties of the cluster that is constituted by the element. The algorithm is based on the ability to compute distance between a given elements and cluster. This function is additionally applied to compute distance between two elements. An important consideration for this function is that it should be able to account for the distance based on properties that have been normalized so that the distance is not dominated by one property or some property is not ignored while distance computation [14]. In most cases, the Euclidean distance may be sufficient. For example, in the case of spectral data given by ‘n’ dimensions, the distance between two data elements E1 and E2, is equal to

$$\sqrt{(E_{11} - E_{12})^2 + (E_{12} - E_{22})^2 + (E_{1n} - E_{2n})^2}$$

Where $E_1 = \{E_{11}, E_{12,\dots}, E_{1n}\}$ and $E_2 = \{E_{21}, E_{22,\dots}, E_{2n}\}$

5.3Color K-means method

Mostly, feature space selection is a key issue in K-means clustering segmentation. This work has included the standard RGB color map, which gradually maps gray-level values 0 to 255 into blue-to-green-to-red color. To retrieve important features to help the clustering process, the RGB color space is further converted to a CIELab color model (L*a*b*) [2]. The L*a*b* space consists of a luminosity layer L*, a chromaticity-layer a*, which indicates where color falls along the red-green axis, and a chromaticity-layer b*, which indicates axis. The translating formula calculatedfor the triple stimulus coefficients first as,

$$W = 0.4303R + 0.3416G + 0.1784B,$$
$$Y = 0.2219R + 0.7068G + 0.0713B,$$
$$Z = 0.0202R + 0.1296G + 0.9393B.$$

The CIELab color model is calculated as

$$L^* = 116(h(\frac{Y}{Y_s})) - 16,$$

$$a^* = 500(h(\frac{W}{W_s})) - h(\frac{Y}{Y_s}),$$

$$b^* = 200(h(\frac{Y}{Y_s}) - h(\frac{Z}{Z_s})),$$

$$h(q) = \begin{cases} \sqrt[3]{q} & q > 0.008856 \\ 7.787q + \frac{16}{116} & q \le 0.008856, \end{cases}$$

where YS, WS, and ZS are the standard stimulus coefficients. Both thea* and b* layers contain all required color information. Therefore, the proposed method then classifies the colors ina*b* space using K-means clustering. After the clustering process, the cluster containing an area of interest is selected as the primary segment. To eliminate the pixels which are not related to the interest in the selected cluster, histogram clustering is applied by luminosity feature L* to derive the final segmented result.

5.4Euclidean Distance Method

The Euclidean metric (and distance magnitude) is that which corresponds to everyday experience and perceptions. That is, the kind of 1, 2, and 3-Dimensional linear metric world where the distance between any two points in space corresponds to the length of a straight line drawn between them. Figure 1 shows the scores of three individuals on two variables. The straight line between each "Portion" is the Euclidean distance. There would this be three such distances to compute, one for each person-to-person distance. However, we could also calculate the Euclidean distance between the two variables, given the three person scores on each.The formula for calculating the distance between the two variables, given three persons scoring on each.

$$d = \sqrt{\sum_{i=1}^{p} (v_{1i} - v_{2i})^2}$$

where the difference between two variables' values is taken, and squared, and summed for p persons (in our example p=3). Only one distance would be computed – between v1 and v2. Let's do the calculations for finding the Euclidean distances between the three persons, given their scores on two variables.

5.5 Normalised Euclidean Distance

The problem with the raw distance coefficient is that it has no obvious bound value for the maximum distance, merely one that says 0 = absolute identity. The set of values differ from zero to maximum possible inconsistency value which remains unknown until exactly computed. This computed distance conveys less information about completevariation.

Figure 2.Satellite Image

Figure 3.Pre- processed image

Figure 4.Grey scale images

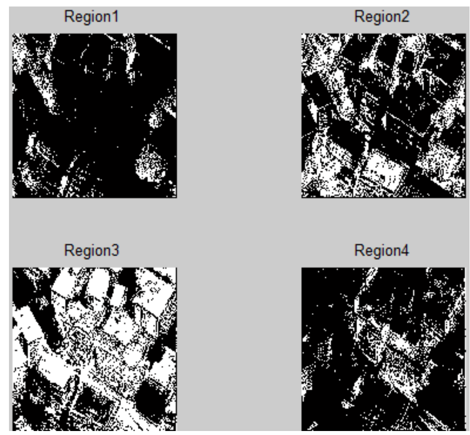

Figure 5. Segmented results of the scene

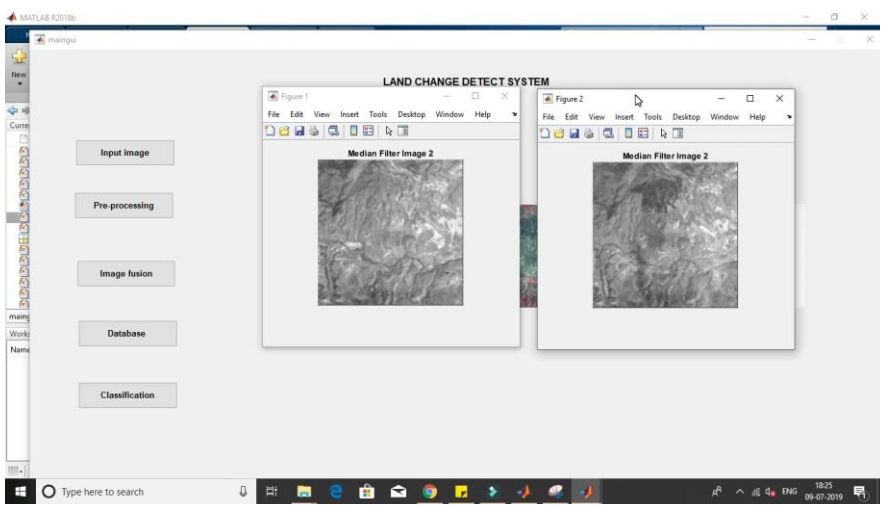

Figure 6. Final outcome by Segmentation

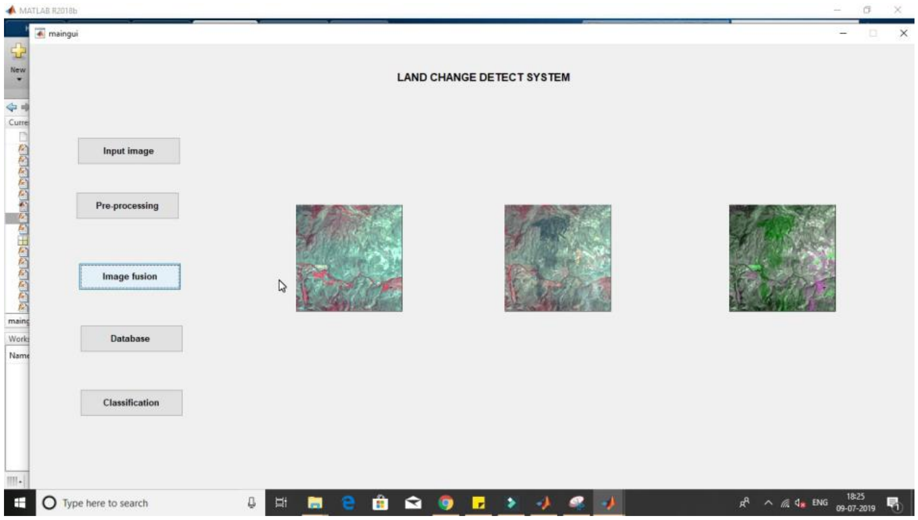

Figure 7.Classification clustering

Hence, Euclidean distance is acceptable only if relative ordering amongst a fixed set of profile attributes is required, unless we know the maximum possible values for a Euclidean distance, we can do little more than rank dissimilarities, without ever knowing whether any of them are actually similar or not to one another in any absolute sense. The challenge is raw Euclidean distance is sensitive to the scaling of each constituent variable, considering the development of matrix for Euclidean coefficients by comparing multiple variables to one another magnitude ranges are quite different.

6. Conclusion

This research proposes a novel method for satellite image fusion that fuses Multispectral and Hyper spectral image to obtain high information on spectral and spatial details of the satellite image. The research uses Adaptive K means clustering with Color k means and Normalized Euclidean method that gives a better decomposition of high and low frequency components for satellite image. Using these methods the high quality satellite images are processed and the resulted images is taken inverse and fused using max fusion rule and finalized fused image is resulted and the resulted single image contain have more information for town planner. And results show that our proposed method gives a better performance in satellite image fusion for identification of water sheds, green landscapes and households. This can be integrated with smart devices and gadgets for town and city planning to enrich city infrastructure using computer vision techniques.

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