A Comparison of Shadow Detection Removal and Reconstruction Methods

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Abstract

Nowadays image processing is a developing area. In this area there are variety of sub areas like remote sensing, biomedical image processing etc. Even now many problems are faced during its processing. The atmosphere, land, and water of the Earth are remarkably complex and do not provide themselves well to being recorded by remote sensing devices. They have constraints like spectral, spatial and radiometric resolution. It creates a range of errors like geometric, atmospheric and topographic in the sensor data. Such errors ease the quality of recorded data and in turn affect the accuracy. Hence, employing image pre-processing operation is necessary in order to construct corrected image or at least to reduce impacts of errors. One of the most common type of error seen is shadow. This is the main cause of misclassification and uncertainty in extracting land cover information. In this paper a comparison of two methods based on IOOPL and K-MEANS CLUSTERING for shadow detection, removal and reconstruction is done. Experiment shows that using K-MEANS method the shadow detection and removal is more perfect and data can be perfectly reconstructed.

Keywords: IOOPL, Kmeans clustering, Shadow detection, Shadow removal, Reconstruction

I. INTRODUCTION

A shadow is caused by the interaction of light with objects. Shadows leads to the failure of images. Shadows are classified as- self shadows and cast shadows. A self-shadow is the shadow on a subject on the side that is not directly facing the light source. A cast shadow is the shadow of a subject falling on the surface of another subject because the former subject has blocked the light source .Cast shadows are of two types- umbra and penumbra. Due to multiple lighting, these regions are created. The umbra is created because the direct light has been completely blocked while the penumbra is created by something partially blocking the direct light. There are several methods for shadow detection based on intensity, pixel values, Region growing, Dual-pass Otsu, Gradient based, Pixel Intensity based, Support Vector Machine Method etc. All the methods have advantages and disadvantages. Using all these algorithms shadow can be detected and removed and using some methods image can be reconstructed. But here presenting two different methods for shadow detection, removal and reconstruction using IOOPL and KMEANS clustering and results are compared. The remaining paper is as follows section ii related works section iii system overview section iv experimental results section v conclusion.

II. RELATED WORKS

Shadow regions and non-shadow regions are separated by using segmentation process [2] [3] and using SVM approach [4] Hong-GyooSohn et.al [5] Proposed scheme includes data co-registration, detection of shadowed regions, segmentation of shadowed regions, correction of shadow effects, and potential application to asphalt road extraction. Supriya A. Hadke et.al [6] consider a VHR image I of dimensions m × n, composed of N bands and characterized by the presence of shadow areas. The resulting image will allow performing first a binary classification in order to distinguish between shadow and non-shadow regions. Using hsv color model [7] presents an efficient and simple approach for shadow detection and removal in complex urban color remote sensing images for solving problems caused by shadows.. P.Srinivasulu et.al [8] ex-tracting shadows from a single outdoor image is presented. Based on image formation theory relationship between shadow and its nonshadow background is derived based on image formation theory. Yan li et.al [9] presents methodology to automatically detect and remove the shadows in high-resolution urban aerial images for urban GIS applications. The system includes cast shadow computation, image shadow tracing a detection, and shadow removal. The method based on a region growing process [10] presents a simple and effective procedure to segment shadow regions on high-resolution colour satellite images on a specific

band (namely, the c3 component of the c1c2c3 colour space). A novel processing chain for shadow detection and reconstruction in VHR images [11] main aim of this chain process is not only detect shadow region form image but also remove shadow region and reconstruct shadow less image. Using an (ICA) algorithm, gray scale histogram, RGB channels, HIS space transformation and multi-threshold retinex [12] to achieve the shadow detection and compensation method. Tapas Kanungo et.al[13] present a simple and efficient implementation of Lloyd's K-MEANS clustering algorithm, which call the filtering algorithm. This algorithm is easy to implement, requiring a kd-tree as the only major data structure. Qiang He1et.al[14] shadow removal method based on intrinsic image decomposition on a single color image using the Fisher Linear Discriminant (FLD).

III. PROPOSED APPROACH

This paper compares the result of two methods for shadow detection, removal and reconstruction The first method is using IOOPL (Inner outer outline profile line) and another using K-MEANS clustering. In both methods the removal is done by same approach but the shadow detection is done by different approach.

A. IOOPL (Inner Outer Outline Profile Line):

In this method, shadow features are taken into consideration during image segmentation and then, according to the statistical features of the images, suspected shadows are extracted. Furthermore, some dark objects which could be mistaken for shadows are ruled out according to object properties and spatial relationship between objects. For shadow removal, inner–outer outline profile line (IOOPL) matching is used. First, the IOOPLs are obtained with respect to the boundary lines of shadows. Shadow removal is then perfor med according to the homogeneous sections attained through IOOPL similarity matching.

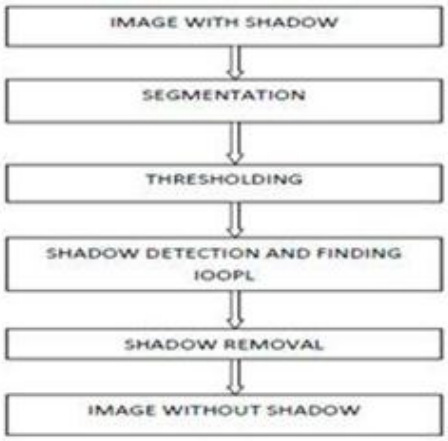


Fig. l: Block Diagram of IOOPL Method

Here the first step is the segmentation where watershed algorithm is used. The watershed transform is used to search for regions of high intensity gradients (watersheds) that divide neighbouring local minima (basins Watershed Segmentation). The key behind watershed transform for segmentation is to change the image into another image whose catchment basins are the objects which we want to identify. After segmentation thresholding is done to differentiate shadow and nonshadow region on basis of threshold value. Thresholding is done by Otsu's method. Otsu's method selects the threshold by minimizing the within-class variance of the two groups of pixels separated by the thresholding operator. It assumes a bimodal distribution of gray-level values. In Otsu's method we exhaustively search for the threshold that minimizes the intra-class variance (the variance within the class), defined as a weighted sum of variances. After finding its threshold, it is converted into binary maps. Now the shadow is detected and perfect boundary is identified. After identifying the boundary of shadow portions, a looping is applied (IOOPL) ie. Inner Outer Outline Profile Lines. The inner and outer outlines are obtained by contracting the shadow boundary inward and expanding it outward, respectively. The radiation features of the same type of object on both sides are obtained using inner and outer profile lines . Comparing the inner and outer loop, the colour is refilled and shadow is removed and the output is shadowless image.

B. K-MEANS Clustering:

There are many methods to create mask. Here mask is created by using an adaptation method. One of the drawbacks of this mask is that it cannot identify the accurate edges and shadow areas. So an improved method for shadow detection is used called kmeans clustering. Clustering is the process of partitioning a group of data points into a small number of clusters. Here cluster number is decided on the basis of data points and clustering is done. In K-MEANS clustering the main parameter for classifying data points into cluster is distance measurement. Each point is included in the cluster on the basis of minimum distance. After clustering the cluster which is showing the shadow portion and the mask is compared and perfect shadow area is identified. After

that for each and every point in the mask image and in the original image, the pixel values are identified and the difference in the intensity or pixel variation is found. Using this difference value the colour in the shadow portion is refilled.

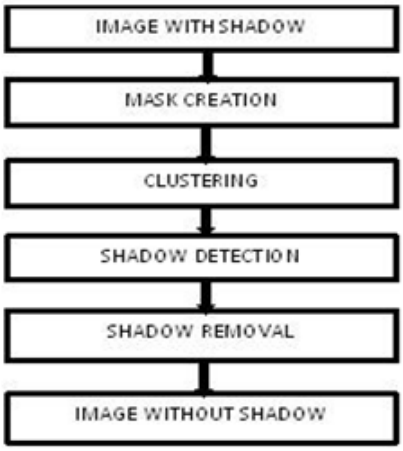


Fig. 2: Block Diagram of K-MEANS method

IV. EXPERIMENTAL RESULTS

The experiment is conducted by using different images. The experiment shows that using both methods the shadows can be detected and removed, but the output is more accurate using clustering method. Using IOOPL technique sometimes there occurs some colour variations in nonshadow region which reduces the quality of image and also, the data in the shadow area are not perfectly reconstructed. So Compared to IOOPL method, clustering using K-MEANS method is better. The result for two images using these techniques is given below.

A. IMAGE 1:

1)*IOOPL:*

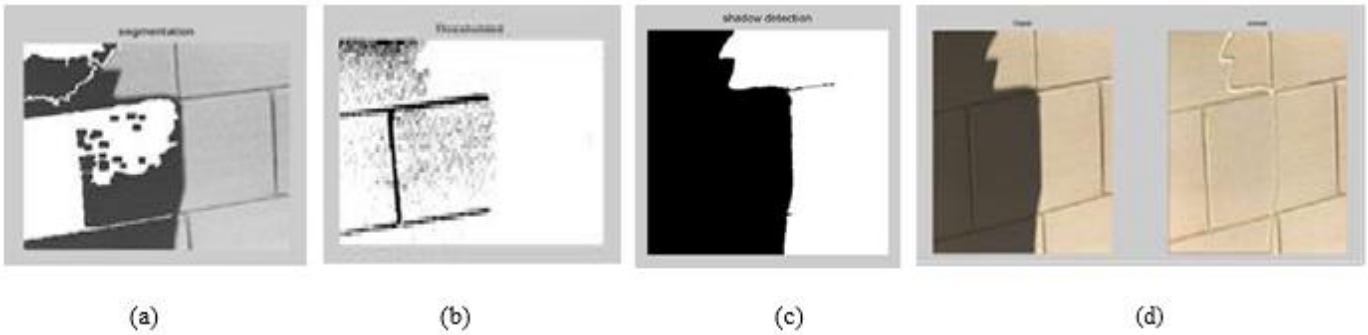


Fig. 3: Experimental result for Ioopl of image 1 (a) Segmented image (b) Thresholded image (c) Shadow detected image (d) Original and removed image

2) *K-MEANS:*

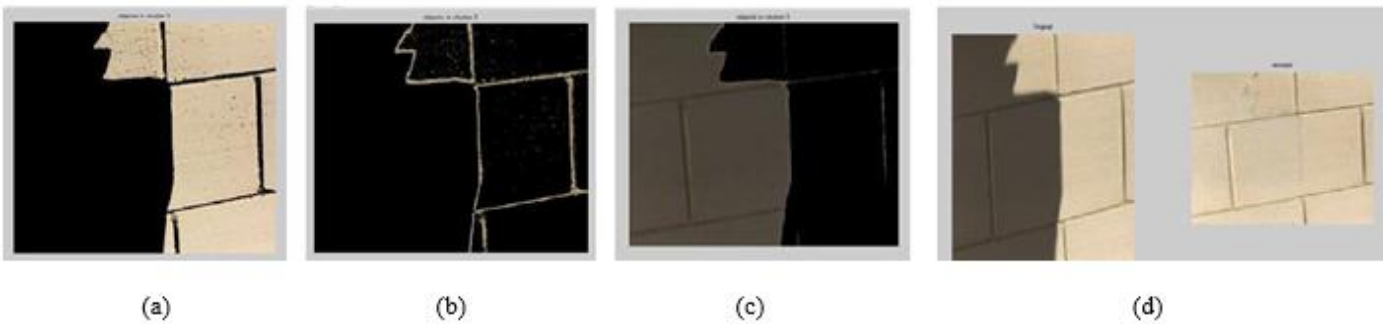
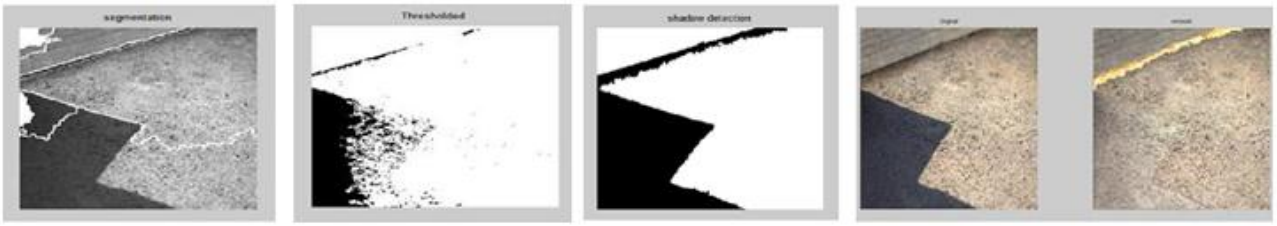


Fig. 4: Experimental result of Kmeans clustering of Image 1(a) Object in cluster 1 (b) Object in cluster 2 (c) Object in cluster 3 (d) original and removed image

B. IMAGE 2:

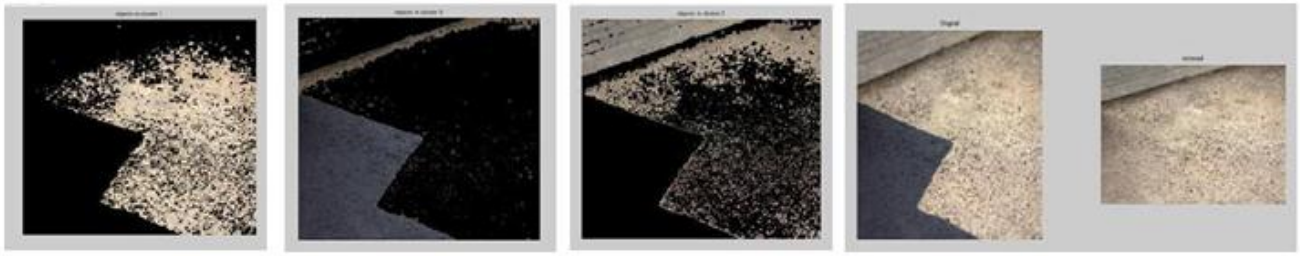
1) *IOOPL:*



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

Fig. 5: Experimental result for Ioopl of image 2 (a) Segmented image (b) Thresholded image (c) Shadow detected image (d) Original and removed image

2) *K-MEANS:*



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

Fig. 6: Experimental result of Kmeans clustering of Image 2(a) Object in cluster 1 (b) Object in cluster 2 (c) Object in cluster 3 (d) original and removed image

V. CONCLUSION

In this paper we have put forward a systematic comparison of two different methods for shadow detection, removal and reconstruction of images. It is evident from the experimental results that kmeans provide better and accurate shadow detection by precisely detecting the edges of shadow. Also by using pixel comparison precise reconstruction of image becomes possible. Thus this method proves better than IOOPL.

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