Shadow Detection and Reconstruction in VHR Images

Amol .D. Dharmadhikari
TSSM's Bhivarabai Sawant College
of Engg & Research, Narhe
Pune, India.

M. S. Deshpande
TSSM's Bhivarabai Sawant College
of Engg & Research, Narhe
Pune, India.

Abstract- **The shadows are mainly observed due to tall buildings, towers etc in urban areas. To mitigate the shadow effects in very high resolution images (VHR) for their further applications, shadow detection and reconstruction is necessary. In this paper we have addressed the issue of shadow detection &reconstruction in VHR images. The, shadow detection and classification is implemented by support vector machine (SVM). Noise and wrong shadow regions are handled by using morphological filtering method and Borders are explicitly handled by making use of adaptive morphological filter.**

Index terms-**Image enhancement, image restoration, shadow detection, shadow reconstruction, support vector machine (svms), very high resolutions (VHR) images.**

I INTRODUCTION

Very high resolution (VHR) images creates a new era in satellite image processing and remote sensing field. Due to VHR image it is very easy to compare between each and every object of image. We can easily identify full detail of each object from (VHR) image. Such as vehicles, road, different shape of buildings, trees, seas etc. as well as shadow of buildings,. For such kind image we required to find new change of shadow detection, analysis and classification techniques. When any object lies in the way of light emerging source then shadow is created. for e.g. when sun light falls on the person his shadow must be created. This shadow brightness level is not same it is varied. The difference between shadow vs. non shadow is shadows are having different color tone than non shadow part of the image. Basically Shadows are generally used to find out position, height and other parameter of building, bridges etc. Frequency of the shadow kind of application is very less compare to non shadow images. Generally shadows are define as undesired information of an image .Shadow can causes loose of an object, destroy shape of an object, merge of an object . Shadow which is present in image gives bad result for the Classification, mapping, interpretation and image processing method. To avoid above drawbacks & to increase image quality shadow detection and shadow reconstruction is necessary in VHR images. Tsunami in 2004,is the best application for getting shadow free images. Also shadow free image is useful in less timing rescue operations [3].

Shadow detection generally can uses model based approach .This is not easy approach because it needs information before scenario and sensor information before processing the data. Because of such kind of problems it uses shadow property based approach. Shadow property based approach uses hue, saturation, intensity properties of shadow. Also invariant color model and hue constant for RGB color model used for shadow detection purpose. In these techniques which is based on threshold estimator and space color transformation. In complete chain scheme, different processes are analyzed to detect shadow.

When any image contains shadow, surface texture of that image does not change texture analysis between a segment of shadow and its neighbors, on the basis kind of surface under shadow.

There are many methods for shadow detection of an image in which histogram matching method is used [7]. In this method adjust the Hue intensity and saturation (HIS) values of shadow pixel with local surrounding of each shadow images.

In this paper another method is used for the shadow detection. Hierarchical supervised classification scheme [6] is used for the shadow detection. The processing chain includes morphological filtering to eliminate the noise and morphological operators for handling borders.

The remainder of this paper is organized as follows. In Section II, background and notations. Section III Proposed method. Section IV gives experimental results, Section V Presents the conclusions.

II .BACKGROUND AND NOTATIONS

A. Background cast and self shadow

Many metro cities in VHR satellite images because of shadow in buildings, towers information may be lost . Missing information in image gives effect on common analysis and mainly in the processing chain also it affects on classification process. Shadows are created when any object lies in the way of source like Sun. Generally shadows are of two types 1) cast shadow 2) self shadow as shown in Fig.1.The shadow which is caused by projection of light on the object and shadow in which diffuse light present in it is called self shadow. Self shadow is the part of object. Our paper does not distinguish

between cast and self shadow. In most of the images cast shadow is used so we concentrate on cast shadow. Cast shadow shows property for homogenous dark areas. which shows the loss of information in an image. This paper works to recover the loss of information in an image.

In this paper shadow detection is implemented by using supervised hierarchical classification scheme because of following reasons : 1) It separates shadow and non shadow areas in the given image 2)Also it identifies non shadow part of image as well as its shadow counter part of that image. Accordingly, ground truth information is needed for both categories of classes. In training phase for region of interest (ROI) creation human help is needed. By doing features extraction feature comparison is done by using SVM. Then filtering is used to removes unwanted noise in that image. Boundary between shadow and non shadow areas are created to distinguish between them.

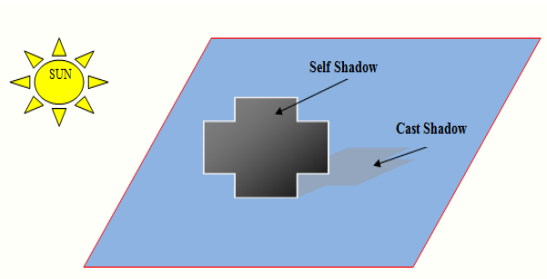

Fig.1 illustration of cast and self shadow

III. PROPOSED METHOD

Below fig .2 shows the proposed methodology. It contains image of *I* dimensions and N composed bands. The resulting image will perform first binary classification to distinguish between shadow and non shadow areas. To handle the noise generally two mathematical morphological operators are used i.e. opening and closing by reconstruction [1] and [2] after morphological filtering another need is the boundary creation so boundary between shadow and non shadow areas will be created. Above classification allows localization of shadow and non shadow to the same object. And after this to provide spectral relationship between them shadow reconstruction is processed. Following some detail steps of shadow detection is provided.

In Training phase Region of interest (ROI) creation select shadow and non shadow blocks manually. By performing wavelet decomposition on that block extract LL features of shadow and non shadow block .In that 8*3 image 4 images are shadow and 4 are non shadow images.

B. Binary classification:-

The first step binary classification is done by supervised way by using support vector machine approach (SVM).Which proves their effectiveness in remote sensing applications [4]-[5]. The features of the original image band extracted by means of the wavelet transform. In particular a one level stationary wavelet transform is applied on each spectral band thus obtaining each band four space frequency features. The Haar wavelet is adopted to maximize the sparseness of the transformation (most of the coefficients are near 0.While enforcing texture area. Compare the features of input image with training phase by using (SVM). For shadow 1 and non shadow 0 will be selected.

C. Post processing:-

Post processing is used for the removal of noise in the image. It is also known as morphological filtering. It removes isolated shadow pixel in non shadow areas and isolated non shadow pixel in shadow area. To attenuate this problem right choice of filer is necessary. Opening and closing is referred as opening by reconstruction and closing by reconstruction i.e. dilated and eroded. Both morphological operators are needed in order to remove isolated shadow pixels in non shadow and isolated non shadow pixel shadow area.

D. Border creation

The conversion between shadow and non shadow areas creates problems like boundary ambiguity, illumination in variation. Morphological operators are used to construct borders. Presence of Penumbra produces mixed pixel which are difficult to classify. The penumbra is a region where light source partially obscured. So that border between the shadow and non shadow class is defined in order appropriately handle the border pixel. The border region is constructed by means of morphological operators.

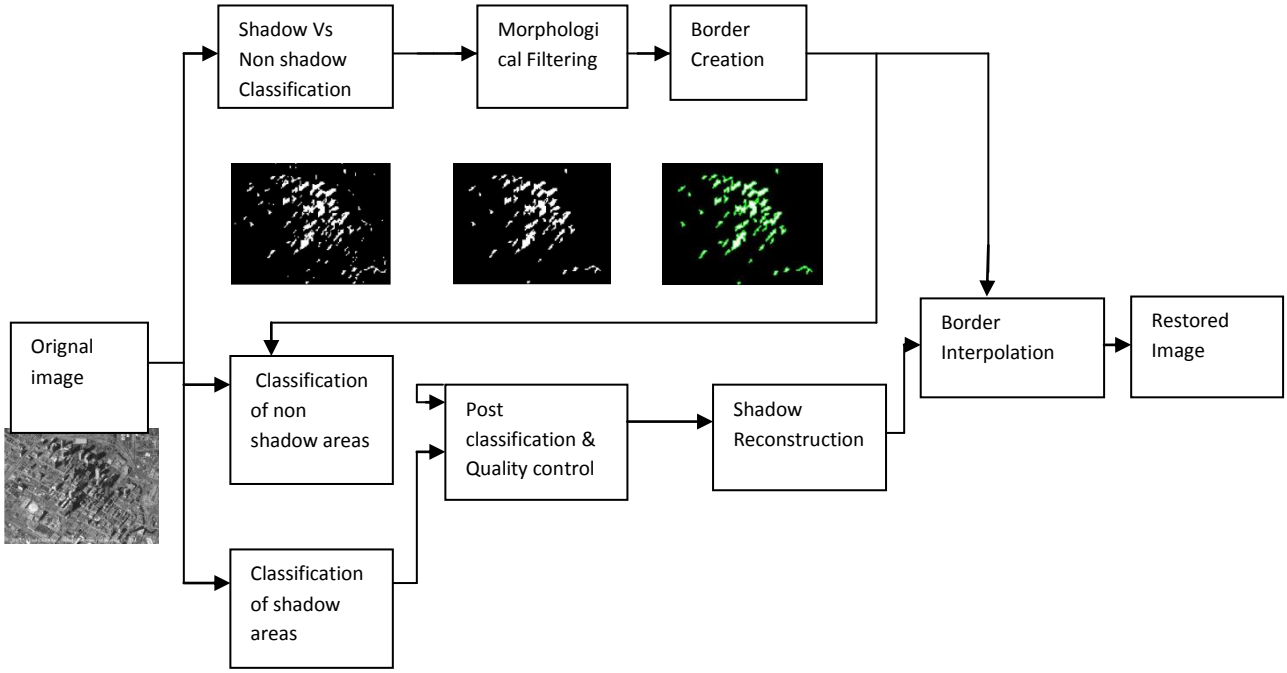

Fig. 2 Flow chart of proposed method

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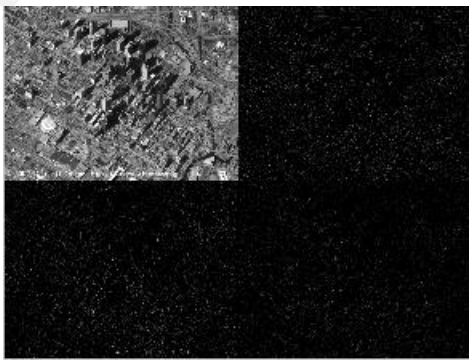
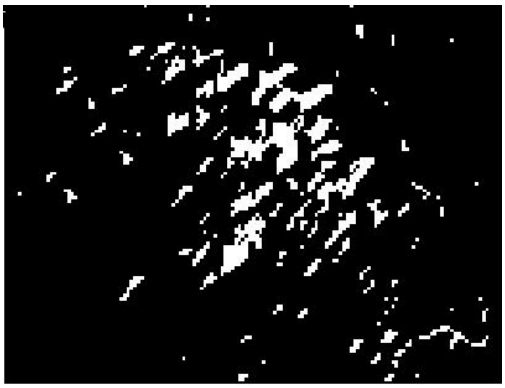
IV. EXPERIMENTAL RESULT

(a)

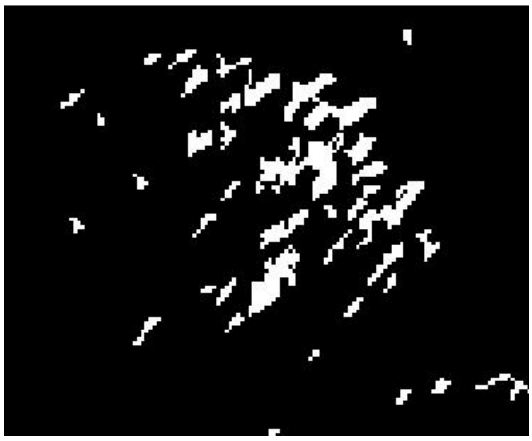
(b)



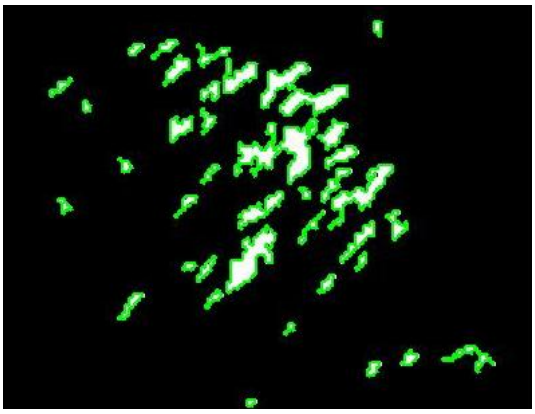
(c)



(d)



(e)



(f)

Fig.3.(a) original image (b) Gray image (c)Wavelet decomposed image (d) Post processing (e) Boundary creation

Fig3. (a) shows that the original VHR image. Fig 3.(b) presents original image is converted into gray image .Fig3. (c) presents first level using Haar wavelet decomposed image .In this LL features of that image are extracted for the further level. Fig3. (d) presents that the classification of shadow vs. non shadow by using SVM. Fig3.(e) presents post processed image. It is used for the removal of noise in that image. Fig 3.(f) presents border constructed image. Morphological operators are used to construct border.

V. CONCLUSION

This paper deal with the detection of shadows in VHR image . The classification tasks implemented are implemented by using support vector machine(SVM).The presented methodology can yield realistic shadow free images with promising preservation of textural properties of the obscured objects. SVM improves classification accuracy compare to other classifiers.

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