IJCSE International Journal of Computer Sciences and Engineering Open Access

Review Paper Vol.-7, Issue-3, March 2019 E-ISSN: 2347-2693

A Review on Shadow Detection and Removal Method from Various Images

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DOI: https://doi.org/10.26438/ijcse/v7i3.344351 | Available online at: www.ijcseonline.org

Accepted: 20/Mar/2019, Published: 31/Mar/2019

Abstract— Now a day's capturing a live images with high quality plays an crucial role in all the fields. It is more important as far as security in military, commercial, household fields as well as to monitor the continuous changes in earth surfaces are concern. Most of the time to achieve clear images we have to differentiate between original object and shadow as detecting objects under the influence of shadow is a challenging task. In urban area the shadow produces artificial color features and shape deformation of objects which decays the quality of image. Shadow mainly occurs due to elevate objects and If light source has been blocked by some obstacles. However, a lot of shadowed areas in remote sensing images of urban areas have affected the tasks, such as image classification, object detection and recognition. Many times the shadow of image provides direct evidence for existing of large objects. The shadow is used for target recognition, building positioning, height estimation and slope calculation. The presence of shadow in very high resolution images can represent a serious obstacle for their full exploitation. Although shadow provide important visual clues for object shape perception, illumination position, object occlusion. Thus for the correct image interpretation it is important to detect shadow regions and restore their information. So it is very essential to detect the shadow regions and remove it effectively to get useful information with good quality. Significant researchers have been working on to develop the best shadow detection and removal algorithm which produces high accuracy results. Some researchers had implemented several methods and algorithm for detection and removal of shadow with experimental results. So this paper focuses on study of various methods of shadow detection and removal from images.

Keywords: Shadow detection method, Shadow removal method.

I. INTRODUCTION

SHADOWING is one of the main and inevitable acquisition artifacts in high-resolution, urban aerial, very high resolution satellite and optical images. In urban aerial images, shadows usually result in information loss or distortion of objects. In almost all cases, optical satellite images are contaminated with shadow. In order to perform a successful change detection using time series of images or to use a single image. In VHR optical images, particularly in urban areas, the presence of shadows may completely destroy the information contained in those images. The VHR satellite imageries are capable of providing a high level of detail, which make them a reliable and highly vital source of information. Therefore, the VHR satellite imageries support a range of services, especially in urban areas, for city planning and monitoring, urban change detection, estimation of human activities/population, and urban object/feature detection. If we consider the urban areas then we can easily get that, surfaces are quite complex, shadows formed by elevated objects like some tall buildings, bridges and trees Images are obtained in different areas of the Earth with different conditions of the atmosphere, intensity and the spectral characteristics of the images which have high variations. High-resolution images provided by latest missions such as QuickBird, Ikonos, or OrbView have opened a new range of applications in the remote sensing field because of the possibility of extracting detailed information from the images. The quality of data processing may be significantly degraded by the appearance of shadows in urban areas. A shadow indicates the shape of the object casting it, and in many ways it can indicate the texture of the surface receiving the shadow A shade can be defined as the side of an object which is opposite to the direction of illumination, which has less colour tone of the full blackness (the value intensity of darkness) compared to the objects' shadows that have very low values of brightness in VHR images. The line that locates and separates the light and shade areas on the object determines the shadow line on a receiving surface. Shadows cause difficulty in feature extraction, pattern recognition and image matching of shadow area images, especially for the high-resolution urban aerial images. In one consideration shadows themselves can be useful for the information in 3-D reconstruction, building position, height estimation. However, for color aerial images, the shadow detection accuracy can be improved by utilizing both the intensity and the color information Based on the three features, which are intensity values, geometrical properties, and light directions, several efficient algorithms have been presented to detect shadows for gray aerial images. The task of an automatic shadow detection becomes very complex. Prevention of errors caused by this kind of artifacts is still a current topic. So, The detection and removal of shadows play an important role in applications of urban high-resolution sensing images for object classification and recognition, change detection and image fusion and in area of computer image processing and analysis, and machine vision.

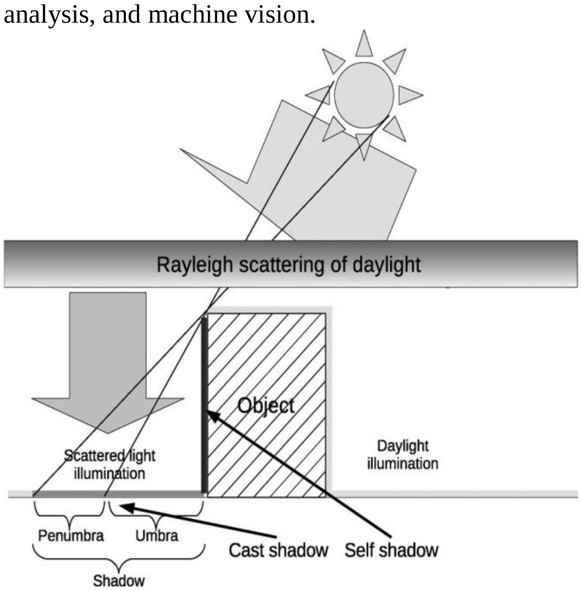

Figure 1. Shadow area formation.

A Shadow is created when an object lies in the path of a light source. Shadows are cast by the occluding object, or the object itself can be shaded; a phenomenon known as “self-shading”. Due to the difference between the light intensity reaching a shaded region and a directly lit region, shadows are often characterized by strong brightness gradients. While non-shadow regions are illuminated by both direct (e.g., sunlight, flashlight) and diffuse (e.g., skylight, fluorescent, incandescent) light sources, shadow regions are only illuminated by diffuse light. The change between shadow and non-shadow regions is thus not only a brightness difference, but a color one as well. The Illumination of an outdoor area is characterized by two main light components: direct sunlight and the atmospheric. The area under sunlight illumination is characterized by daylight sun illumination spectra, while the shadowed area is characterized primarily by the spectra of the scattered sunlight shown in figure1. The diffusion of sunlight in the atmosphere is caused by Rayleigh and aerosol scatterings. Obscuring objects from the direct sunlight causes the appearance of shadows, and the objects in this area are illuminated by the scattered light.

Normally, shadows appear when objects occlude the direct light from the illumination source, usually the sun. Also Shadows occur when objects totally or partially occlude direct light from a source of illumination. However, shadows are not all the same; they can be divided into two different classes: cast and self shadows (see Fig. 1). Cast shadow is caused by the projection of the light source in the direction of the object. Cast shadows in optical images result form the light source being blocked by objects and therefore, parts of the image are not illuminated by the direct light. These regions are usually among the darkest areas in an image and can be easily misclassified as other dark objects such as water. Self shadow is still a shadow but represents the part of the object that is not illuminated directly by the light source.

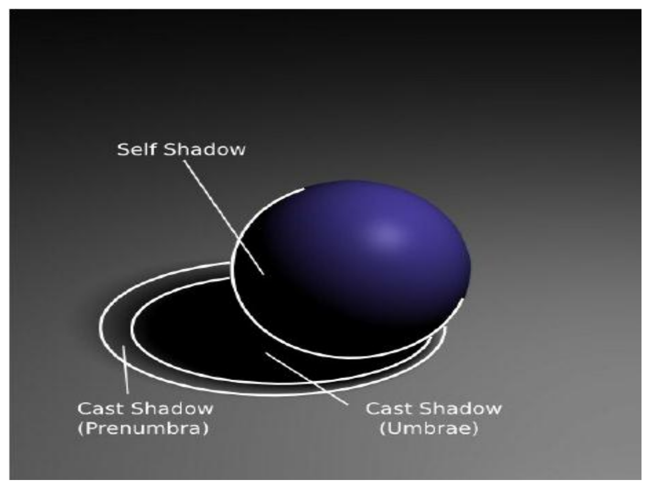

Figure 2. Different types of shadows

As shadows can be divided into two classes: cast and self . A cast shadow is projected by the object in the direction of the light source; a self shadow is the part of the object which is not illuminated by direct light. The part of a cast shadow where direct light is completely blocked by an object is called the umbra, while the part where direct light is partially blocked is called the penumbra as shown in figure 2. The shadow is divided into two classes of projected shadow and self-shadow. The shadow of image provides direct evidence for existing of large objects. The shadow is used to targets recognition such as building positioning, height estimation, slope calculation. So this paper focuses on review of various shadow detection and removal methods on which researchers had worked.

II. LITERATURE SURVEY

As shadow are natural phenomenon, which occur when the light is blocked by particular light sources. Although the shadow provide important visual cues for object shape perception, illumination position, objects occlusion. The shadow free images can help to improve the performance of the tasks such as object recognition, object tracking and information enhancement. For this the shadow detection and removal is a popular research direction in computer vision and image processing communities. Many researcher have been working to develop the efficient result oriented shadow detection and removal algorithm. This paper provides the comprehensive survey of various shadow detection and removal methods as given below:

A. Object-oriented shadow detection and removal from urban high -resolution remote sensing images

Hongya zhang, Kaimin sun, and Wenzhuo li [1] provides various steps such as segmentation, suspected shadow detection, elimination of false shadow, boundary extraction, inner –outer outline lines generation and shadow RRN or PF. The shadow features are taken into consideration in image segmentation and then suspected shadow is extracted to the statistical features of images. For shadow detection to consider the threshold limit bimodal histogram splitting method is used and in image segmentation task the convexity model is adopted. To rule out false objects which are misclassified as a suspected shadow, the geometrical characteristics and spatial relationship between objects are used. It also eliminated the false shadows from vegetation. In implementation of shadow removal two approaches are used first approach is relative radiometric correction and second approach is polynomial fitting. The relative radiometric correction approach calculates the radiation parameter according to the homogenous points of each and every object and then performs relative radiometric correction on each and every object. This assumes that a linear relationship exists between the gray scale value digital number the image to be corrected and DN of reference image is calculated as $DN_{ref} = a * DN_{rect} + b$. The polynomial approach retrieves all shadow directly with the obtained fitting parameter and also to recover the shadow areas in an image, we use a shadow removal method based on IOOPL matching. The inner and outer outline profile lines are generated along the inner and outer outline lines to determine the radiation features of the same type of object on both sides.

B. Efficient shadow detection of color aerial images based on successive thresholding scheme

Kuo-Liang Chung, Yi-Ru Lin, and Yong-Huai Huang[2] mainly focus on only shadow detection with highest accuracy from colour aerial images, The author proposed new successive thresholding scheme and comparing the result of this algorithm with the shadow detection by Tsai algorithm. This algorithm has a sequence of steps such as colour transformation of input image, calculation of ratio map, Otsu's thresholding method, calculation of shadow map and last step is shape preservation process. For colour transformation purpose several invariant color models are present like HIS, HSV, HCV, YIQ or YCbCr. Out of this all the Tsai's algorithm has best shadow detection performance for HIS color model. The ratio map values are scales between the range of 0 to 255 based on this threshold point is obtains with the use of Otsu's thresholding method. The shadow map is calculated depending on the value of threshold point. The proposed shadow detection algorithm is a successive thresholding algorithm with a sequence of steps such as construction of modified ratio map, anisotropic filtering, morphology operation, Calculation of global thresholding and fine shadow map. The global thresholding process is first performed to obtain the course shadow map. Local thresholding process is applied to each candidate shadow region in the coarse shadow map iteratively. Finally fine shadow determination process is applied to determine whether each pixel in the remaining candidate shadows is a true shadow pixel or not.

C. Adaptive shadow detection using a blackbody radiator model

Aliaksei Makarau, Rudolf Richter, Rupert Müller and Peter Reinartz [3] present an alternative method for shadow detection. This method is based on physics properties of a black body radiator model. The adaptive calculations are performed on the parameter for a particular scene and allow one to work with many different sensors and images obtained with different illumination conditions. The qualitative assessments are carried on the images of Landsat-7, IKONOS, world view-2 and German aerospace center and 3k camera air-bone system. The blackbody radiator model approach is fully motivated by the physical process of shadow formation. The formation performs in two sections image acquisition and illumination approximation by the blackbody radiator model. Robustness and high accuracy of shadow detection are reached by the adaptive nature of the method. The application of the method is not limited to remotely sensed date. The method can easily apply to other imagery from different sources and also in the areas of image recognition. This method is easy for deployment because the procedure for a system on remotely sensed image processing and interpretation. The complexity of overall method is mainly dependent on the algorithm for shadow border search and on the method for temperature calculation. This method has various application such as for reduction of errors in city digital elevation model updates change detection and for classification of optical data.

D. Novel approach for shadows detection and shadows removal from high resolution satellite images

P.S.Ramesh, S. Letitia [4] provides three important contributions such as Watershed, Bimodal histogram splitting and mean difference. The proposed system has to be divided into three parts like image pre-processing, shadow detection, shadow removal. The preprocessing step is carried out by following two steps segmentation and gray scale erosion for dividing entire image in smaller block with conversion of color image into black and white image. Bimodal histogram splitting method is able to provide the feasible way to find out the shadowed area. In false shadow elimination it may happen that dark object may be considered as a suspected shadow object. For this purpose the Rayleigh scattering results will provide a feasible way to eliminate the dark object. In shadow removal the elimination of mean value and standard deviation of shadow and non-shadow region is carried out. Boundary extraction is a vital step and it is carried out by dilation, erosion approaches. To finally get shadow free images the mean difference on RGB of non-shadow part of an image with normalization is carried out. The performance of the proposed algorithm is evaluated using four images with accuracy like producers, customers and overall accuracy.

E. Study on shadow detection method on high resolution remote sensing image based on his space transformation and NDVI index

Dong Cai , Manchun Li , Zhiliang Bao[5] has the shadow of image provides direct evidence for existing of large objects. The shadow is used for target recognition, building positioning, height estimation and slope calculation. So in this paper, the high resolution remote sensing image was transformed to HSI space and shadow of image could be detected with characteristics of the low brightness and high saturation in the area if shadow. The detected shadow is more efficaciously and accurately by applying the NDVI index of image because some of ground object such as dark green grass is eliminated. This method could achieve automatic recognition and extraction of the shadow without complicated calculation and any prior knowledge of the scene and light situation is not needed. In this shadow could be effectively separated out from the image by method based on HIS space transformation and NDVI index. If shadow extraction result includes green vegetation then the green vegetation should be separated from shadow. The normalized difference vegetation information expression and anti-interference in data extraction and processing is a main analysis tool of regional vegetation extraction. Accordingly, The research calculates NDVI index from remote sensing images and then extract green vegetation according to NDVI index.

F. Shadow detection and radiometric restoration in satellite high resolution images

P. Sarabandi ,F. Yamazaki , M. Matsuoka [6] describes the cast shadow in optical images result from the light source being blocked by objects and the parts of images are not illuminated by the direct light. These regions are usually darkest areas in an image and can be misclassified as other dark objects such as water. So this paper uses new transformation so that we can detect boundaries of cast shadows in high resolution satellite images. For this purpose a set of color invariant indices in order to apply a nonlinear transformation to our data and disaggregate the dark regions. Among many color spaces that are invariant to shadow such as hue-saturation-value or ration of red, green, blue bands are used. Three different algorithms are introduced in order to radiometrically restore the detected shadow areas. These algorithms are Gamma correction method, Linear correlation method and Histogram matching method. By applying texture fitter or edge detector filters the shadow boundaries in the image can be identified. The proposed method uses multiband rather than single band information because single band information often mis-represent shadow regions. From the application of the shadow restoration method presented the best results are obtained using linear correlation correction method.

G. A complete processing chain for shadow detection and reconstruction in VHR images

Luca Lorenzi, Farid Melgani, and Grégoire Mercier [7] explains the presence of shadow in very high resolution images can represent a serious obstacle for their full exploitation. In VHR optical images, particularly in urban areas the presence of shadows may completely destroy the information contained in those images. The proposed method undergoes successive steps like mask construction with binary classification and post-processing, Border creation is required for identification of transmission in between shadow and non-shadow areas can raise problems such as boundary ambiguity, color inconsistency and illumination variation, classification maps with multiclass classification, post classification, quality control, shadow reconstruction and border reconstruction. The proposed processing chain relies on different advanced image processing and pattern recognition technologies. Still further methodological improvements are required. The detection and classification tasks are implemented by means of the state of the art support vector machine approach. To reduce subsequent mis-reconstruction problems a quality check mechanism is integrated. The reconstruction is based on a linear regression method to compensate shadow regions by adjusting the intensities of the shaded pixels according to the statistical characteristics of corresponding non-shadow regions. Borders are explicitly handled by making use of adaptive morphological filters and linear interpolation for the prevention of possible border artifacts in the reconstructed image.

H. Shadow remover: image shadow removal based on illumination recovering optimization

Ling Zhang , Qing Zhang , Chunxia Xiao [8] present a novel shadow removal system for single natural image as well as color aerial images using an illumination recovering optimization method. This shadow removal system is simple and effective and it can process shadow images with rich texture types and non-uniform shadows. Although shadow provide important visual clues for object shape perception, illumination position, object occlusion. Shadow removal and editing can also improve the visual realism and physical realism in image processing. Shadow removal involves two basic stages shadow detection and shadow removal. Many researchers have been proposed shadow detection methods which includes automatic shadow detection and user assisted shadow detection method. To perform shadow removal, we first have to detect the shadows. The current shadow detection methods can be divided into two categories like automatic shadow detection and interactive shadow detection. An automatic shadow detection is an extremely difficult task. We incorporate user interaction and shadow alpha matting for shadow detection, Similar to interactive image matting we first specify some shadow samples, lit samples and construct a tri-map for the input image. According to the computed shadow matting alpha and the local reflectance constant assumption, for one patch in the shadow region, if we find a lit patching the nearby lit regions with similar material or texture, the shadow of this patch can be removed using our illumination recovering operator. There are various shadow removal methods such as gradient domain, illumination transfer, shadow matting. To remove the whole shadow of the input image, we can transform this problem into the following steps for each patch in the shadow region. We find a corresponding patch with similar texture in the lit regions. And then by using the illumination recovery method on each corresponding patch pair, the shadows in the image can be removed. It uses successive steps like image decomposition, fast nearest patch matching, coherence recovering optimization and shadow boundary processing. Our illumination recovering operator can be easily extended to image editing applications, such as shadow editing and color transfer.

I.cloud and cloud shadow removal of landsat 8 images using multi-temporal cloud removal method

Danang Surya Candra, Stuart Phinn, Peter Scarth [9] focus on removing cloud and cloud shadow from land satellite 8 images. This paper proposed a novel method of cloud and cloud shadow using multitemporal cloud removal. This method has 3 main steps like radiometric correction, cloud and cloud shadow detection and image reconstruction. In the first step the top of atmosphere radiometric correction converts digital number values to TOA reflectance for Landsat 8 OLI. In the second step multi temporal cloud masking was used to detect cloud and cloud shadow. This method uses a target image which has cloud and cloud shadow contaminated pixels and a reference image which is clear. The aim is to obtained the difference in reflectance values in visible, near infrared and short wave infrared band between target and reference image. In the last step we use multi-temporal images to reconstruct pixels which are contaminated by cloud and cloud shadow. The cloud and cloud shadow contaminated pixels on the target image are replaced by pixels from the reference image. The advantage of this approach is that original reflectance values can be retained as long as they are not contaminated by cloud and cloud shadow. This method is effective for removing cirrus cloud but it could not be used when the cloud is optically thick. The multi-temporal images are widely used to remove cloud contamination using methods such as maximum normalized difference vegetation index. The other advantage of this method is it can generate more clear images in time series dataset. So it is useful for remote sensing and GIS application that need more data such as land use change, urban planning, especially for time series analyses.

J. Shadow removal based on clustering correction of illumination field for urban aerial remote sensing images

Shuang Luo , Huifang Li , Huanfeng Shen [10] provides that the shadow is a natural phenomenon, existing in most aerial remote sensing images. In urban areas, the shadow effect is more obvious because the surface features are quite complex, with a great variety of objects such as high buildings, trees etc. The presence of shadows in urban aerial images can degrade the quality of the images and cause problems in image interpretation. In this paper, a novel shadow removal method based on the clustering correction of illumination field is proposed. We construct a spatially adaptive weighted total variation model to achieve the optimized illumination field. The clustering correction of illumination field approach combines the advantages of linear correlation correction and the regularized method without manual participation and solves the problems of shadows effectively. The proposed shadow removal method mainly composes of three parts. At first the spatially adaptive weighted total variation model is constructed to separate the illumination field from the reflectance field in a given image. In second part by considering land cover variation in the shadow regions, the image is clustered combining the clustering results of the non-shadow region in the original image and the shadow regions in the reflectance field. At last part the shadow information is correction the illumination field using the clustering moment matching method. The shadows cast on the ground are usually compound and the illumination information varies according to the different land surfaces. Therefore, the image should be clustered and the shadow information is corrected based on clustering moment matching method in the illumination field. For this purpose two steps are performed such as land surface clustering and clustering moment matching. The advantage of removing shadow shadows in the illumination field is that it could effectively recover the shadow regions and preserve non-shadow information.

K. Shadow removal for umbrageous information recovery in aerial images

Vertika Jain , Ajay Khunteta [11] provides the undesirable local change in the illumination intensity observed in a captured image often due to some opaque object hindering the light path is termed as shadow. This effect of shadow causes the partial or total occlusion of many important parts of the image. This poses a great problem in extracting a requisite piece of information or for further processing of image in computer vision. This problem of shadowing becomes more prominent in dense areas or areas which have tall buildings or skyscrapers. This paper proposes a method to recoup a shadow recovered image. The method involves the detection of shadow which also includes morphological filtering to rule out the ambiguities and then eliminating the detected shadow. This paper adopts gamma correction technique for shadow removal. The proposed method of shadow removal works in successive steps such as Image acquisition, Gray scale conversion, Obtaining histogram, Obtaining binarized image or hard mask, Morphological processing, Defining soft mask, Computing gamma correction, Creating Non shadow mask, Producing shadow free mask, Process of shadow recovered image, Image restoration, Reconstruction of the image, Concatenate the three outputs and Last step is restoration techniques. The accuracy and efficiency of the proposed method was found to be much better when the result of gamma correction method were compared with the results of the other two methods on the basis of visual inspection and the quality check parameter.

L. A novel shadow removal algorithm using niblack segmentation in satellite images

Geethu Vijayan , S. R. Reshma , F. E. Dhanya ; S. Anju , Gayathri R. Nair ; R. P. Aneesh [12] gives that the shadow is formed when an illuminating light source is obstructed by an object or by the interactions of light with object. Effect of shadow is very crucial in the case of satellite image processing. The interference of shadow makes mismatching of these objects. This paper presents a shadow detection technique based on Niblack segmentation. Niblack segmentation gives better shadow regions compared to Otsu's thresholding method and sauvola based thresholding. The reconstruction of the shadow region is done by the Baysian classifier. This paper uses a successive steps of preprocessing task, Niblack segmentation, morphological filterisng, detection of shadow and non-shadow region, classifier and shadow reconstruction. This paper compares the three types of segmentation methods like Sauvola based segmentation, Otsu's method and Niblack segmentation but implements only Niblack segmentation. To reconstruct the shadow pixel a shadow reconstruction algorithm is developed. This algorithm is based on Bayes classifier and using MRF which considers the associativity between the reconstructed shadow region and their corresponding non shadow region. The MRF will determines the information and Bayesian classifier will solve the uncertainty based on the observations using probabilistic theorem.

M. Shadow detection in remote sensing images based on weighted edge gradient ratio

Bin Pan, Junfeng Wu , Zhiguo Jiang . Xiaoyan Luo [13] describe that the shadow exist in nearly every remote sensing image owing to the obscure of the light. In many cases the shadows have negative effects on image analysis because of the loss of information. Specially, shadows in remote sensing images usually have similar spectral signature to water body which may result in misunderstanding of the scenes. On the other hand, shadows in high resolution remote sensing images are important bases for building recognition and atmospheric parameters estimation. This paper presents a novel shadow detection method in remote sensing images on edge feature description of candidate regions. Edge gradient ratio is defind and used to represent the inherent properties of shadow regions. To improve the detection result weighted edge gradient ratio is addressed, where the weight of a region is determined by the number of pixels belonging to shadow in the region, and the edge gradient ratio is proposed to describe the edge feature surrounding the region. The shadow detection based on edge gradient ratio works well in most cases but it may fail in dark regions that are non-shadow because of their similar properties. The WEGR based shadow detection is carried out in three steps such as extraction of ROIs, Calculation of weight based on texton and Calculation of edge gradient ratio. The experiments show that this method has better performance in accuracy and applicability when compared with other algorithms.

N. Shadow detection and removal for occluded object information recovery in urban high-resolution panchromatic satellite images

Nan Su , Ye Zhang , Shu Tian , Yiming Yan , Xinyuan Miao[14] provides that satellite imaging for the observation of earth has ability to obtain very high resolution data, ranged from 0.5 to 2 m in the panchromatix band. The existence of shadows in very high resolution panchromatic satellite images can occlude some objects to cause the reduction or loss of their information, particularly in urban scenes. The shadow removal is a significant processing procedure for the image interpretation and application to recover the occluded information of object, This paper proposed a novel framework of shadow detection and removal for panchromatic satellite images to restore the obscured object information. For shadow detection we present an automatic soft shadow detection method by the combined application of a bimodal histogram splitting method and image matting technique. Soft shadow detection results can exhibit both umbra and penumbra areas to describe the shadow distribution precisely. This paper mainly focus on the cast shadow areas, and distinguish the umbra and the penumbra in shadow detection. In shadow removal, we propose a spatial adaptive nonlocal sparse shadow removal method to operate at two levels. In the initial removal level, the line correction method is employed to enhance the shadow area. The aim of initial result is to make the same object across shadow and non-shadow areas belong roughly to the same category. In the refined process, we analyze the spatial relationship between objects and shadows and dig into their characteristics. The obscured information of objects in the shadow areas is recovered precisely by the unit of patches based on the group matrix. In shadow removal process, the second linear radiometric correction and nonlocal sparse model are used to simultaneously control the brightness and smoothness of the recovered areas by the corresponding non shadow areas with similar structures in the same group matrix. This shadow detection and removal method solves the main problems like The soft shadow detection is performed automatically, The proposed SANS shadow removal method can restore the obscured information of objects in the shadow areas effectively and based on group matrix of our SANS method, we present a twice line correction method to control the brightness of the recovered areas. Also uniform objects in the shadow areas can be restored automatically by this method.

O. DEM based shadow detection and removal for lunar craters

Hongmei Zhu , Jihao Yin , Ding Yuan , Xiang Liu , Guangyun Zhang [15] focuses on the shadow detection problem of the lunar surface, which hinders the implementation of visual tasks and visual processing for moon exploration projects. The random walker model is firstly applied to detect the shadowed pixels in lunar craters. Then the detected shadow are removed by rectifying the illumination coefficients and detail coefficients, which are obtained by using the multi-scale decomposition technique. The proposed algorithm is evaluated on three groups of CCD images and the corresponding DEM data. The framework of this algorithm includes four steps like a simple two dimension bilinear interpolation to resize the corresponding DEM to the size of CCD image, next step seeks for the shadow seed points of shadow areas, which are served as the initial labeled nodes for shadow detection via random walker model, finally the intensities of shadowed areas are restored through illumination rectification and details preservation. The shadow detection problem is transferred to calculate the probability that a random walker starting at non seed pixel first reaches each seed point. The label with maximum probability will be assigned to the non seed pixel and this method is carried out in two steps automatic localization of seed points, and detection based on random walker. In the shadow removal section the goal is to restore the intensities of shadowed areas detected. The edge preserving multi-scale decomposition technique is used to decompose the original CCD image into a illumination dependent base image and a sequence of illumination independent detail image, which are separately rectified for shadow removal. The shadow removal steps are also carried put in two steps like multi scale decomposition and boundary processing of shadowed areas.

P. Shadow Removal in Remote Sensing Images using Features Sample Matting

Lei Ma , Bitao Jiang , Xinwei Jiang , Ye Tian [16] discussed that shadowed areas in remote sensing images of urban areas have affected the tasks, such as image classification, object detection and recognition. It is very useful if the radiance of shadowed areas is corrected to the same radiance level of shadow free areas. The remote sensing images often suffer from shadow due to partially or totally occludes direct light from an illumination source. This paper proposed a novel shadow removal algorithm. In this the trimap could be generated automatically by morphological substraction method according to the result of shadow detection. Then the weighted color and texture sample selection image matting method is applied in order to obtain the accurate shadow coefficient. In the future we will explore more feature information to estimate more accurate the shadow coefficient and obtain the better result of shadow removal.

III. CONCLUSION

A Comprehensive survey of shadow detection and removal method is provided. Various methods with successive steps of shadow detection and removal are explained. The captured Images are converted into different invariant colour spaces to obtain shadows. The literature survey discussed the shadow detection and removal methods form various images such as Remote sensing images, Lunar craters images, urban aerial remote sensing images, aerial images, satellite images, Urban High -Resolution Remote Sensing Images, Color Aerial Images, High Resolution Satellite Images, VHR Images, Urban High-Resolution Panchromatic Satellite Images, Cloud and Cloud Shadow of Landsat 8 Images. Many researchers are comparing the proposed method results with other to defined accuracy levels of each algorithm. There is a possibility that noise and dark pixels be mistaken as shadows. In some shadow detection and removal method the spatial information is lost. In most shadow removal method the morphological filtering is useful.

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