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SHADOW DETECTION OF AERIAL IMAGES USING SUCCESSIVE THRESHOLDING AND REMOVAL BY ADAPTIVE HISTOGRAM EQUALIZATION

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ABSTRACT:

In this paper, the successive thresholding scheme is focus of discussion. In this scheme the modified ratio map obtained by applying the exponential function to the ratio map, is presented to stretch the distance between the ratio values of shadow and non shadow pixels. In order to stumble on the real shadow pixels from the candidate shadow pixels, the connected element system is first implemented to the candidate shadow pixels for grouping the candidate shadow regions. For every candidate shadow area, the local thresholding technique is carried out iteratively to extract the real shadow pixels from the candidate shadow area. Finally, for the remaining candidate shadow regions, a fine-shadow determination process is applied to identify whether each remaining candidate shadow pixel is the true shadow pixel or not.

KEYWORDS: Coarse-to-fine strategy, color aerial image, shadow detection, successive thresholding scheme (STS), Shadow Removal, adaptive histogram equalization.

INTRODUCTION:

The presence of shadows has been accountable for decreasing the reliability of many computer vision algorithms together with segmentation, objectdetection, scene evaluation, monitoring and many others. Consequently shadow detection and elimination is a crucial preprocessing for enhancing overall performance of such vision tasks. the availability of spatial resolution satellites which include quick-bird, Geo-Eye and resource 3 for the observation of earth and the speedy improvement of a few aerial systems which includes airships and unmanned aerial automobiles applications of urban excessive-resolution remote sensing pictures along with object classification, item recognition, there has been an growing need to investigate excessive resolution pictures for distinctive applications. Shadows themselves can be regarded as a kind of beneficial information in 3-D reconstruction, recognition of position of building and estimation of height; they can also intervene with the processing and application of excessive-resolution remote sensing pictures. As an example shadows may cause wrong outcomes for the duration of change detection. Consequently, the detection and elimination of shadows play a crucial role in a change detection and picture fusion. The shadow areas are insufficient illumined than the surrounding regions. Shadows are created because the light source has been blocked by something. There are kinds of shadows-self shadow and cast shadow. Self Shadow is a shadow on a subject on the facet that is not directly facing the light source.

Present shadow detection method can be kind of classified into two groups. Model based approach & Shadow-feature based approach. Model based approach makes use of prior statistics together with scene, moving objectives and camera altitude to construct shadow models. This approach is frequently utilized in some particular scene conditions inclusive of aerial image analysis and video tracking. Shadow feature based approach identifies shadow areas with statistics including grey scale, brightness, saturation, and texture. An advanced set of rules exists that cascades with the 2 strategies. First, the Shadow regions are estimated consistent with the distance coordinates of buildings calculated from digital surface models and the altitude and azimuth of the sun. Then, to correctly identify a shadow, the threshold value is acquired from the estimated grayscale value of the shadow regions. but statistics which include scene and camera altitude is not generally readily available. The 3 features, which are intensity values, geometrical characteristics, and light directions, numerous efficient algorithms have been presented to detect shadows for grey aerial pictures. since grey aerial images only offer the intensity statistics, some nonshadow regions may be identified as shadows even if the aforementioned 3 features have been taken into consideration. However, for color aerial images, the shadow detection accuracy may be advanced by making use of both the depth and the color statistics.

To detect shadows of color aerial pictures, two properties of shadows, which are the low luminance and the highly saturated blue/violet wavelength, to detect shadows according to the 2 shadow characteristics, the red, green, and blue (RGB) color aerial image is first transformed into the hue, saturation, and intensity (HSI) color model, and then, a segmentation system is implemented to the saturation element and the intensity element to identify shadows. Later the pixels in shadow vicinity generally have huge hue value, little blue color value, and small variation between green and blue color values. The input picture can be first converted into the HSI; hue, saturation, and value (HSV); luma, blue-distinction chroma, and red-difference chroma (Y CbCr); hue, chroma, and value (HCV); or luminance, hue, and saturation (YIQ) color models. Below the transformed invariant color model, the ratio of the hue to the intensity for every pixel to built the ratio map, and then, a global threshold of the build ratio map is determined to identify shadows.

LITERATURE SURVEY:

In June 2015 shadow affected region are taken for segmentation, and in line with the statistical features the suspected shadows are extracted. After that, the dark objects which could be flawed for shadows are taken off in line with object properties and spatial relationship between objects. Then apply color picture transformation and global Thresholding, morphological erosion convolution filtering. Experimental result shows that the accuracy of the approach is greater. For shadow elimination avalanche histogram equalization is used. [1]

In February 2015 the Shadow regions are calculated in line with the distance coordinates of buildings calculated from digital surface models and the altitude and azimuth of the sun. Then, to correctly identify a shadow, the threshold value is acquired from the calculated grayscale value of the shadow regions. However statistics inclusive of scene and camera altitude is not generally easily to be had. Pictures are transformed into distinct invariant colour spaces to acquire shadows with Otsu's set of rules. This can successfully dispose of the fake shadows created by vegetation in certain invariant spaces. Based on that work, a successive thresholding scheme was proposed to detect shadows. [2]

In 2009 shadow detection and compensation are treated as picture enhancement tasks. The principal components analysis (PCA) and luminance based multi-scale Retinex (LMSR) set of rules are explored to detect and compensate shadow in excessive resolution satellite picture. PCA gives orthogonally channels, therefore permit the color to stay stable regardless of the modification of luminance. firstly, the PCA transform is used to acquire the luminance channel, which enables us to detect shadow areas the use of histogram threshold approach. After detection, the LMSR approach is used to enhance the picture only in luminance channel to compensate for shadows. Then the improved picture is acquired by inverse transform of PCA. The final shadow compensation picture is acquired by evaluation of the original picture, the improved picture and the shadow detection picture. [3]

In June 2006 an automatic property-based totally de-shadowing method for solving the issues caused by cast shadows in colour aerial pictures of complicated urban environment was introduced. The method exploits the properties of shadows in luminance and chromaticity and is carried out in several invariant colour spaces, which includes HIS, HSV, HCV, YIQ and YCbCr models. The outcomes from applying the method in de-shadowing color aerial pictures of a complicated building and a highway segment in these colour models are evaluated in terms of visual comparisons and shadow detection accuracy assessment. The outcomes exhibit the effectiveness of the method in revealing details below shadows and the suitability of these colour models in de-shadowing colour aerial pictures. [4]

In 2003 to detect shadows in the colour aerial picture, Tsai transforms the input picture I into an invariant colour models. For every pixel, the ratio of the hue over the intensity is used to determine whether the pixel is a shadow pixel or not. For easy exposition, the HSI colour model is used as the representative. Note that, some of the five invariant colour models, Tsai's set of rules has the excellent shadow detection overall performance for the HSI model. In the HSI colour model, I and H additives are known as the intensity- and hue-equivalent additives, respectively. By scaling I and H additives to the range in [0, 1] acquire the intensity-equivalent picture Ie and hue-equivalent picture He, respectively. The ratio map R is described by R(x, y) = He(x, y) + 1 / Ie(x, y) + 1 where R(x, y), He(x, y), and Ie(x, y) denote the pixel at position (x, y) of R, the picture He, and the picture Ie, respectively. In Tsai's set of rules, the value of R(x, y) is scaled to the range [0, 255] for shadow detection. From the ratio map R, Otsu's thresholding approach is carried out to determine the threshold T which can be used for keeping apart all the pixels of R. [5]

In 2015, shadow removal method which uses an illumination recovering optimization method. According to the shadow distribution the input image is decomposed into overlapped patches. An optimized illumination recovering operator is constructed by building the correlation between the shadow patch and the lit patch according to the texture similarity. Shadows are effectively removed and the texture details under shadow patches are recovered. High quality shadow free results with constant illumination can be produced based on reasonable optimization processing among the adjacent patches. This methodcan process shadows with rich texture types. [10]

In 2001 the method that uses invariant color models to identify and classify shadows. Here invariance properties of some color transformations are exploited for shadow detection. These transformations describe the color configuration of each image point disregarding shadings, shadows and highlights. The luminance values of shadow regions are smaller than those in the surrounding lit regions. Like this shadow regions are extracted. The classification is done as cast shadows, if they belong to the scene background or as self-shadow if they are part of an object. [6]

RELATED THEORY:

SHADOW DETECTION-

Given an input RGB colour aerial picture I, we first transform I to the HSI color model by, and then ratio map R_ can be acquired. Moreover, the anisotropic filter is implemented to R_ to relieve the noise effect with out blurring the boundaries between candidate shadow areas and nonshadow areas. In order to refer greater shadow statistics, the morphology dilation operator with 3 × 3 square structuring elements is implemented to R_ to expand the candidate shadow regions. below the acquired ratio map R_, Otsu's approach is used to determine a threshold T for constructing the coarse-shadow map. In STS-based set of rules, only the candidate shadow pixels are required to perform the neighborhood thresholding procedure to identify real shadow pixels. For the candidate shadow pixels in the coarse-shadow map, we construct candidate shadow areas by applying the connected component analysis to these pixels. Next, for each candidate shadow location, the neighborhood thresholding procedure is implemented to differentiate real shadow pixels from candidate shadow pixels.

Ratio map acquired via the usage of: shadow ratio = ((4/pi).*atan(((b-g))./(b+g)));

Successive Thresholding based set of rules is used to detect shadows for aerial pictures. Input picture is transformed into ratio map by color transformation approach. Ratio map is then modified by applying exponential function so that gap between shadow & non-shadow pixels stretches.

A coarse shadow map is acquired by applying the global thresholding method. This separates input picture into candidate shadow pixels & non shadow pixels.

The candidate shadow pixels are grouped to form candidate shadow area by the usage of connected component analysis & then local thresholding method is carried out to every area iteratively to detect real shadow pixels from candidate shadow pixels. To check whether the remaining candidate shadow pixel is real shadow pixel or not, a fine shadow determination method is carried out.

The flow Chart for Shadow detection is shown in figure.1

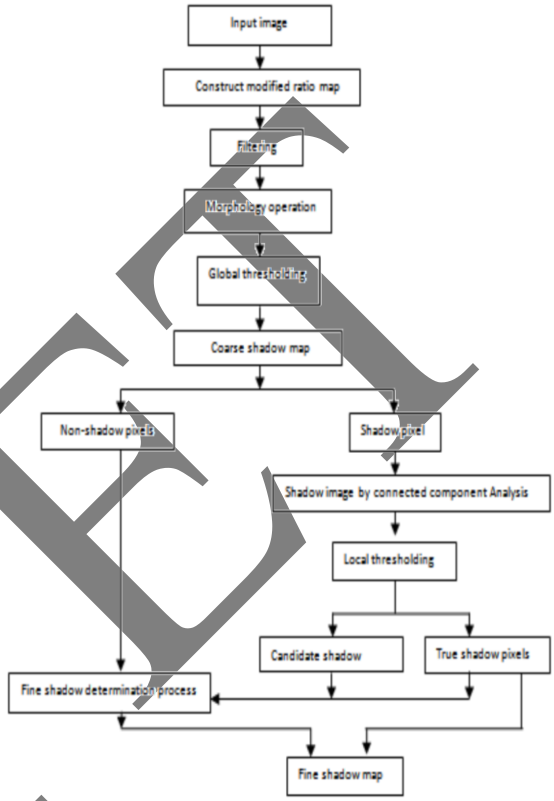

Figure 1 Flow Chart of shadow detection

BLOCK DIAGRAM OF SHADOW DETECTION AND REMOVAL:

Block diagram of shadow detection the usage of successive thresholding and elimination the usage of adaptive histogram equalization is as shown in figure.2

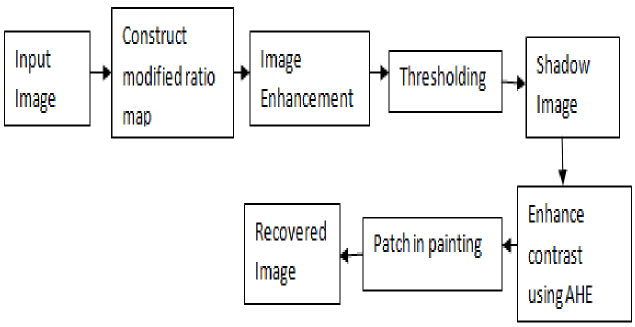

Figure 2 block diagram of shadow detection & removal

Detection method uses invariant colour models to identify and classify shadows. Shadow candidate areas are extracted first and then the candidate pixels are categorized as self-shadow points or as cast shadow points by the usage of the invariant colour functions. Even if there is a change in the imaging conditions like viewing direction, illumination condition and object's surface orientation the modifications are invariant. The luminance properties of shadows are exploited on the edge map acquired by applying the Sobel operator on input picture. The luminance values of shadow areas are smaller than those in the surrounding lit areas. Like this shadow areas are extracted. The classification is done as cast shadows, if they belong to the scene background or as self-shadow if they are part of an object.

SHADOW REMOVAL:

For pictures which contain the local areas of low contrast bright or dark areas, global histogram equalization won to work efficiently. A amendment of histogram equalization is known as the Adaptive Histogram Equalization is used in such pictures for better outcomes. Adaptive histogram equalization is work by considering only small areas and based totally on their local cdf, performing some contrast enhancement of those areas .Adaptive histogram equalization can be carried out by some strategies and each of those strategies have multiple variation. Patch Inpainting means reconstructing lost or deteriorated statistics.

Flow chart for shadow elimination is shown in figure 3

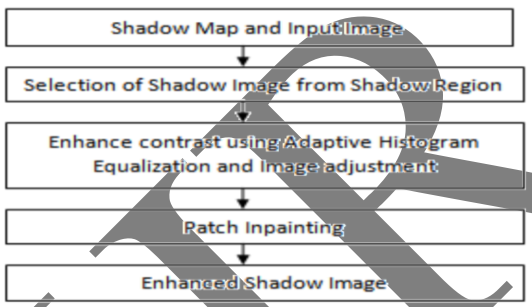

Figure 3 flow chart of shadow removal

CONCLUSION:

In our project i.e. Shadow Detection of Aerial pictures the use of Successive thresholding(STS) and elimination by Adaptive histogram equalization(AHE), we come to understand that STS based set of rules for shadow detection & AHE based set of rules for shadow elimination show better performance than other algorithms.

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