# A Novel Approach for Shadow Detection and Removal from Image

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***Abstract:*** Image processing has been one region of studies that draws the interest of extensive form of researchers. Surveillance structures are in big demand specially, for their packages in public areas, consisting of airports, stations, subways, front to buildings and mass events. Shadow occurs while objects consist of light from light source. Shadows offer wealthy information about the item shapes as well as light orientations. Shadow in picture reduces the reliability of many computer imaginative and prescient algorithms. Shadow regularly degrades the visual exceptional of an image. Shadow removal in an image is pre-processing step for computer imaginative and prescient algorithm and image enhancement. Shadow detection and removal in numerous actual lifestyles situations consisting of surveillance device and laptop vision machine remained a hard project. Shadow in visitors surveillance system might also misclassify the actual item, lowering the gadget overall performance

***Keywords****: Image processing, Object detection, Image Enhancement, Shadow detection, Shadow removal.*

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## 1. Introduction

An image is pictorial or graphical representation of something, which is stored in electronic form. Simply we can said that, image is collection of pixels which are arranged in particular matrix. Image processing is the processing of image using mathematical operation by using any form of signal processing for which the input is an image and output as an image. It is nothing but the analysis and manipulation of a digitized image, specially in ordered to improve its quality. Object detection is a computer technology related to computer vision and image processing that deals with detecting instances of semantic objects of a certain class in digital images and videos. Well-researched domains of object detection include face detection and pedestrian detection. Object detection has applications in many areas of computer vision, including image retrieval and video surveillance. A Shadow is an area where direct light from a light source cannot reach due to obstruction by an object. There have been few studies concerning shadow removal, and the existing approaches cannot perfectly restore the original background patterns after removing the shadows. Assumptions of Shadow: Here are our basic assumptions are as follows:

1. The illumination image is spatially smooth.
2. There is no change in the texture inside the shadow region.
3. In the shadow regions, the illumination image is close to being constant.

Pixels inside shadow regions have different colors because of the reflectance image. Shadow detection and removal is an important task in image processing when dealing with the outdoor images. Shadow occurs when objects occlude light from light source. Shadows provide rich information about the object shapes as well as light orientations. Some time we cannot recognize the original image of a particular object.

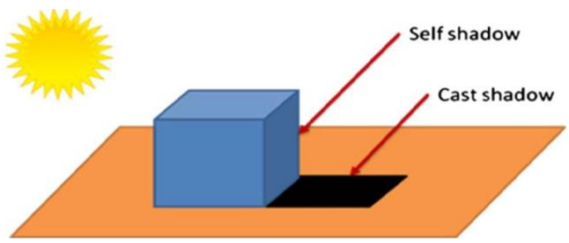


Figure. 1.1 Illustration of Cast and Self Shadow.

Shadow in image reduces the reliability of many computer vision algorithms. Shadow often degrades the visual quality of images. Shadow removal in an image is an important pre-processing step for computer vision algorithm and image enhancement.

## 2. Literature survey:

Several methods are available to remove the shadow that exists in the image. It is base on the shadow and no shadow region available within the image:

**I. Color Transformation:**

In this method RGB based color images are converted in to HSV color space. In HSV space the shadow regions have some special properties that can be used to identify and remove the shadow regions within the image.

**II. Shadow Segmentation:**

This process is base on the higher value of saturation component and lower value of value component available in the HSV color space. Based on these particular properties of shadows the normalized saturation values difference index is constructing to identify shadows.

**III. Shadow Compensation Surface texture:**

Shadow Compensation Surface texture does not significantly change when shadowed; neighboring non- shadowed segments are usually uses to compensate shadowed ones.

## 3. Working Mechanism:

The shadow has been in charge of diminishing the unwavering quality of numerous PC vision calculations, including division, protest discovery, scene investigation, stereo, following, and o on. In this way, shadow identification and evacuation is a critical pre-preparing for enhancing execution of such vision undertakings. is nothing but the analysis and manipulation of a digitized is nothing but the analysis and manipulation of a digitized

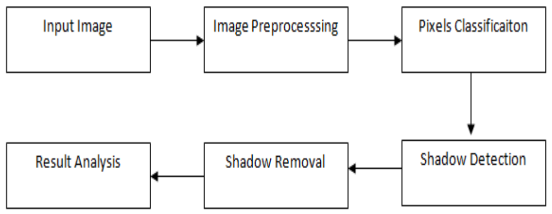


Figure 2: System architecture for shadow detection and removal

- **Input Image:**
  Take a one shadow image as input for removing shadow from image.
- **Image Preprocessing:**
  It converts color image into gray scale image.
- **Pixel Classification:**
- It makes shadow pixel as white and remaining portion of image as black.
- Shadow region get distinguish from non shadow if we get continue 10 pixels in a range from 0 to 50.
- Here we apply a masking technique that treating shadow pixel as foreground and non-shadow pixel as background.
- **Shadow Detection:**
  This Register shadow phase will locate the shadow position in image by taking input of image classification.
- **Shadow Removal:**
  Four frame decomposition levels are level 0, level 1, level 2 and level 3.For this, we use Haar wavelet method. The Haar wavelet transform may be consider into simply pair up input values, storing the difference and passing the sum.
- **Result Analysis**
- In this the technique which will replace the shadow region into non shadow region output.
- After an image matting for showing correct output as non shadow image need to reconstruct it.

## 4. Algorithm:

There are five types of algorithms used to convert shadow region into non-shadow region as follow:

**1. Preprocessing of Image**
**2. Classification of Image**
**3. Shadow Detection**
**4. Clustered Image**
**5. Shadow Removal**

**1. Preprocessing of Image**

**Step 1**: Start
**Step 2**: Input Image
**Step 3**: Convert Image into Gray Scale Image
**Step 4**: Apply Median Filter
**Step 5**: Convert into New Image
**Step 6**: Save Image
**Step 7**: Stop

**2. Classification of Image**

**Step 1**: Input preprocessing image
**Step 2:** Input threshold
**Step 3**: For i=0 to length W(Image)

```
        for j=0 to length H(Image)
                read P(i, j)
        if P(i, j)>0&&P(i, j)<50
                count++
                End
                if count==10
        Set all previous pixels to white
        from 0 to 10
                count=0
                End
            End
```

End
**Step 4**: Input preprocessing image
Input threshold
For i=0 to length H(Image)
for j=0 to length W(Image)
read P(i, j)
ifP(i,j)>0 && P(i, j)<50
count++
End
if count==10
Set all previous pixels to white from 0 to 10
count=0
End
End
End
**Step 5**: Save classified Image
**Step 6**: Stop

**3. Shadow Detection**
**Step 1:** Start
**Step 2:** Input Image(Ii) and Classified Image(Ci)
**Step 3**: for i=0 to H(Ci)
for j=0 to W(Ci)
if( Ci(H,W).colors="white")
Set
Ii(H,W).color=white
end
end
end
**Step 4:** Save Shadow Detection Image
**Step 5:** Stop

**4. Clustered Image**
**Step 1**: Start
**Step 2**: Read Image(I)
**Step 3**: for i=0 to H(I)
for j=0 to W(I)
Read P=I(H,W)
Avg=Pr+Pg+Pb/3
if Avg>=0 && Avg<=50
Set P.color=Red
End
if Avg>50 && Avg<=100
Set P.color=Green
End
if Avg>100 && Avg<=150
Set P.color=Blue
End
if Avg>150&& Avg<=200
Set P.color=Yellow
End
If Avg>200 && Avg<=255
Set P.color=Gold End
End
End
**Step 4**: Crop and Save Clusterd Region
**Step 5**: Stop

**5. Shadow Removal**
**Step 1**: Input Image Shadow detection & Clusterd Image
**Step 2**: Read Ci.color i.e. Selected cluster image pixel color
**Step 3**: for i=0 to H(Sdi)
for j=0 to W(Sdi)
read PSdi(H,W)
if PSdi.color=="white"
Set
PSdi.color==Ci.color
end
end
end
**Step 4**:Save Shadow Removal Image
**Step 5**: Stop

**5. Output Screenshots and Result Analysis:**

following figures shows the output of shadow free image. These figures demonstrated how project will be executed:

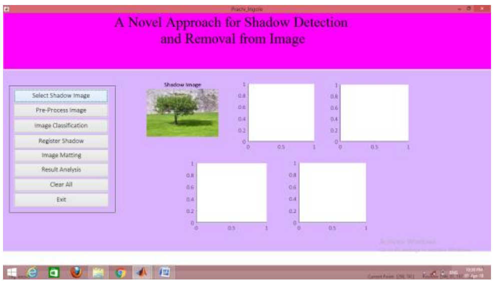


Figure 3: Select shadow image

Above figure 3, is selected from the picture library of the system to remove the shadow from an image.

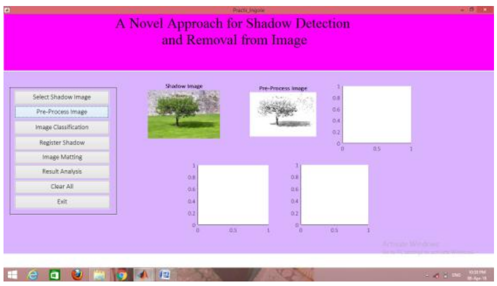


Figure 4: Preprocessing of selected shadow image.

Above figure 4, in these preprocessing of image, it will be converted color image into gray scale image.

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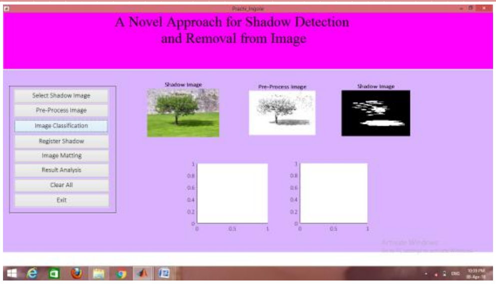


Figure 5: Classification of image.

Above figure 5, given image will be classified into two parts as follows:

1. Convert shadow part in an image into white color.
2. Convert non-shadow part in an image into black color.

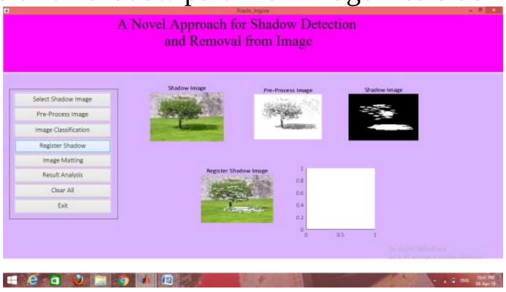


Figure 6: Register shadow

In above Figure 6, In the register shadow, shadow will be detected from an image and convert it into white color.

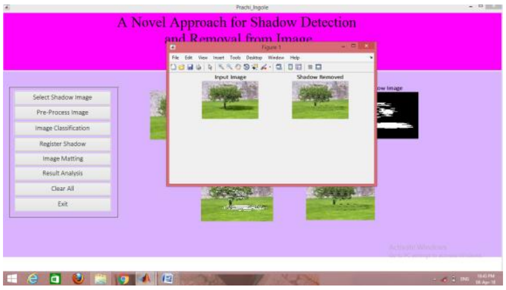


Figure 7: Image Matting

Above Image 7, It is the process to replace shadow part into their background pixels and make image shadow free.

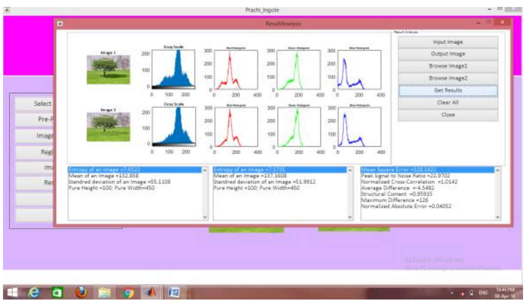

Figure 8: Result analysis

Above Image 8, its show the result analysis between two images. In result analysis presence of shadow image and after removing shadow from same image are compared. Following tables 1 show the comparison between shadow image and non shadow image and table 2 shows difference between two images as shadow image and non shadow image.

| **Comparison between shadow image and non shadow image** | | |
|---|---|---|
| Parameters | Shadow image | Non-Shadow image |
| Entropy of an Image | 7.6522 | 7.5735 |
| Mean of an Image | 132.858 | 137.1680 |
| Stander deviation of an Image | 55.1108 | 51.9912 |
| Pure Height | 100 | 100 |
| Pure Width | 450 | 450 |

Table 1: Comparison between shadow image and non shadow image

| **Difference between shadow image and non shadow image.** | |
|---|---|
| Parameters | Values |
| Mean Square Error | 328.1422 |
| Peak Signal to Noise Ratio | 22.9702 |
| Normalized Cross-Correlation | 1.0142 |
| Average Difference | 4.5482 |
| Structural Content | 0.95915 |
| Maximum Difference | 126 |
| Normalized Absolute Error | 0.04052 |

Table 2: shows difference between two images as shadow image and non shadow image.

## 6. Conclusion and Future scope:

### Conclusion

Shadow detection and removal in image is a complex and mutable subject. Here we proposed a novel approach to detect and remove shadows from an image. This shadow detection approach is better as compared with other existing appearance-based models. We summarizes that after all testing with all techniques, this implemented method of shadow detection and removal gives accurate 80% result.

### Future Scope

The proposed shadow detection and removal technique is applied to foreground figures rather than the entire image so as save significant processing time. This is important for real time applications such as vehicle classification, traffic measurement. However the current technique has to be improved to be able to entire images because in some applications images are used, no background images can be generated beforehand. The motion of the vehicle can be analyzed to detect the congestion, accident e.g. driving in a opposite lane, Similarly for a human object, a skin color features and length weight aspects ratio can be incorporated.

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