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A Simple Method for Removing Reflection and Distortion from a Single Image

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Abstract: ***This paper deals with a problem of removing reflection and distortion from un-natural images. This will effected in the quality of images. Reflection happens when there is the variation in direction of a wave front at an interface between two different media so that the wave front returns into the medium from which it originated. The law of reflection describes for specular reflection the angle at which wave is reflected equals the angle at which it is incident on the surface. Mirrors exhibit specular reflection. In photograph Distortion will happens when either the properties of the lens or the position of the camera relative to the subject. Here the input contains multiple polarized images with different polarizer angles. The output consists of high quality distortion and reflection separation from images. In this paper proposed a Quality Assessment method Scheme (QAMS) for removing both reflection and distortion from images. Using this QAMS method, the quality of the image can be improved by measuring PSNR and Error Rate.***

Keywords: **Image Enhancement, Distortion Separation, Reflection Separation.**

I. INTRODUCTION

This paper deals with a problem of reflection and distortion separation in photography. The issue of this reflection and distortion separation arises naturally in our everyday life when a desired scene contains another scene reflected off a transparent or semi reflective medium. One of the common examples for this is when we took photographs through windows or taking the images of an object which are placed inside a glass. When we took such kind of images there will be reflection occurs. Sometimes the camera may be shake when we take photographs so the image will be distorted or blurred. Distortion will happens when either the properties of the lens or the position of the camera relative to the subject. One type of distortion is caused when the camera is keen at an extreme angle to the subject. The figure 1 below shows an example or perspective distortion and also known as leaning of the subject. In the Fig 1 church appears to be leaning away from the camera.

Fig 1 Perspective Distortion

Another type of distortion is called as barrel Distortion. Inside a lens there is a round glass element, with the side effect of this type of glasses occurs barrel distortion. Due to the effect of bending light more near the edges of the lens then we happenstance near the center of the lens. When the lens diameter is smaller it will get more extreme effect of barrel Distortion becomes. The fig .2 (a) and (b) shows an example of barrel distortion

Fig .2 (A) (B)Shows Barrel Distortion

Depending on the nature of the interface, reflection of light is either specular or mirror like or diffuse (retaining the energy, but losing the image). Furthermore, the phase of the reflected wave is retained if the interface is placed between a dielectric and a conductor, otherwise if the interface is between two. The most common model for specular light reflection is provided by the mirror, and typically consists of a glass sheet with a metallic coating where the reflection actually occurs. With the help of suppression of wave propagation beyond their skin depths Reflection can be enhanced in metals. Reflection also happens at the surface of transparent media, such as glass or water. A polarization glasses is used by the polarized 3D system to create the illusion of three-dimensional images by restricting the light that reaches each eye, This is an example of stereoscopy.

The image with reflection can be described by a linear superposition of two layers: the background layer from the scene beyond the glass and the reflection layer from the scene reflected by the glass. Decomposing the degraded input image into two layers is an ill-posed problem since there are an infinite number of ways to decompose an image. Fortunately, the reflection layer is a polarized image [2]. One of the common examples to reduce the effect of reflection is to place a polarizer in front of the camera lens to filter out the polarized light coming from reflection. However, the amount of polarization depends on the angle of incident light. In most cases, the reflected light is only partially polarized. Previous work of the polarization-based approaches are solved by simply collecting polarized pixel values to explored the reflection separation problem. In Ohnishi et

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al. [3], proposed the reflection layer by computing the image difference between the maximum intensity image and the minimum intensity image and he background layer as minimum intensity image over different polarizer angles. However with partial polarization, a polarizer cannot fully separate reflection and in there recovered background weak reflection may still remain. It is also common that reflection is reduced in certain parts of the image but remains in other parts, when we change the rotation angle of the polarizer.

By analyzing the polarized images, the remaining reflection can be further reduced. While improving the accuracy and efficiency based on sparsity of large image gradients, Bronstein et al. [5] proposed the ICA approach to allow multiple polarized images, Farid and Andelson [7] generalized a method, which can separate reflection from two polarized images without using such prior knowledge based on independent component analysis (ICA).In Schechner et al. [4], [6] based on physical analysis of polarization, reflection are separated. Their method assumed some prior knowledge about the scene, such as an angle of incidence and a pair of polarizer angles that maximize and minimize reflection, which are hard to be measured directly in general.. Using [1]it can only completely remove the reflection from an image. By combining this reflection separation algorithm [1] and the use of a distortion separation algorithm, we can remove both reflection and distortion from a single image. Here it uses a QAM scheme for removing the reflection and distortion from an image. The fig 3(a) 3(b) shows an image containing both reflection and distortion. We begin our study of reflection and distortion separation by utilizing the effect of reflection under different rotation angles of a polarizer. Our approach uses two algorithm to separate both reflection and distortion. Here we use two algorithm for removing the reflection and distortion from a single image.

Fig. 3 (A) and (B) Shows the Reflection and Distortion on the Surface of Building

II.PROPOSED SYSTEM

In this approach we are removing the reflection and distortion from a single image using the two algorithms. The algorithms used for this purpose are reflection separation algorithm [1] and distortion Separation Algorithm. Here first we check whether there is any reflection in our input image. If there is any reflection in the image removes it using our reflection separation algorithm otherwise leaves it. Then we check whether any distortion in the image. if any distortion in the image remove it using the distortion separation algorithm and otherwise we get the same output what we give as our input or a reflection separated image, if there is any reflection finally we get the desired output. .The algorithm for distortion tries to calculate two main parameters of the distortion K1 and K2.This is based on an extremely simple search loop finding one parameter(k) at a time is either k1 or k2.Fig.3 shows the flow chart of proposed system.

Algorithm 1: Procedures for reflection separation [1]
Input: $I_1, \ldots, I_N$
Output: $\alpha_1, \ldots, \alpha_N$,R,B
Construct the Gaussian image pyramid.
For each level, from coarse to fine, in the multi-scale pyramid, do:
Compute the mask image and the reflection guide map.
If the current scale is the coarsest scale,
Initialize α_i
else:
Up-sample the results of α_i, R and B.
Evaluate the regularization weights $\lambda_{\alpha i}$, λ_R and λ_B.
end if
For a fixed number of iterations do:
Estimate (R,B) with i fixed.
Estimate α_i with (R,B) fixed.
end for
end for

Algorithm 2: procedure for Distortion Separation
Input:I
Output:B
Construct the Gaussian image Pyramid
While(step>minstep)
{
Calculate_error_at (K-step)
Calculate_error_at (K+step)
Calculate_error_at (K)
If(K is smallest)
{
Step:=step/4;
}
else
{
If(K-step was better)
k:=K-step
else
K:=K+step
}}

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III.FLOW CHART

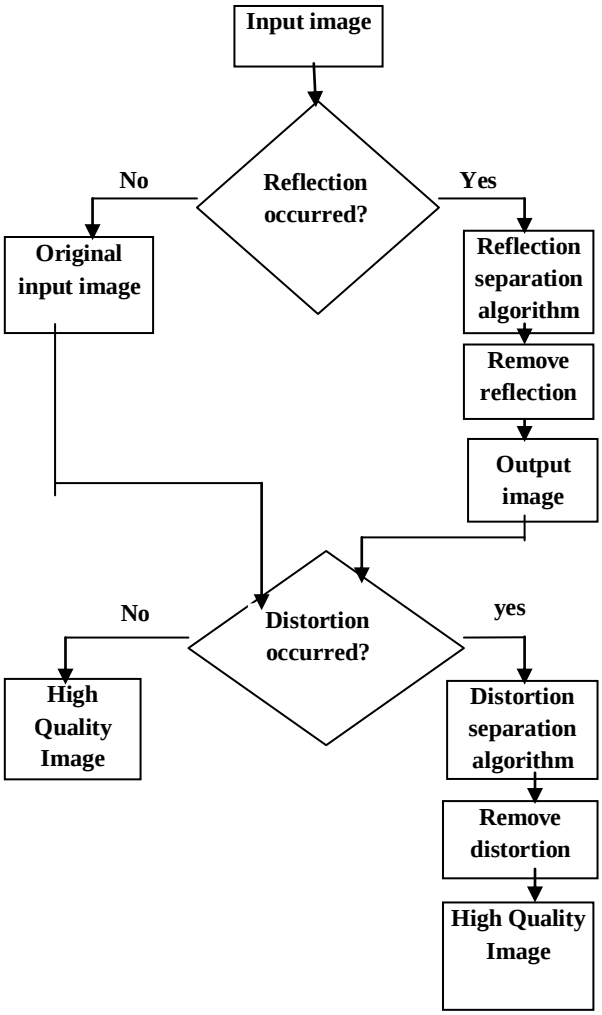


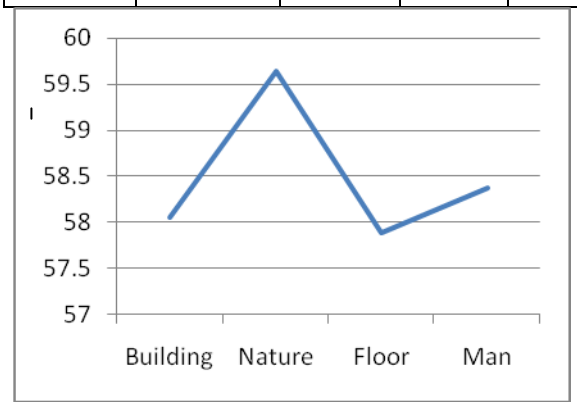
Fig.3 Flow Chart of Proposed System

IV. EXPERIMENTS AND RESULT

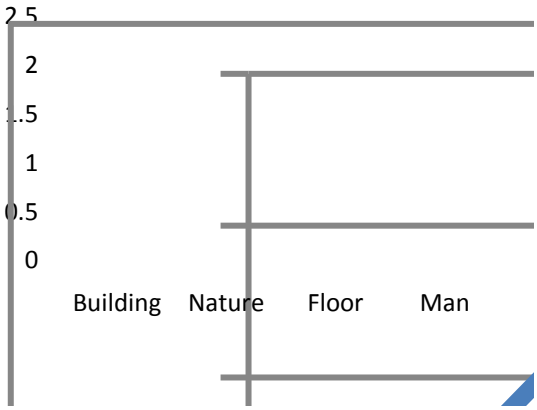
The proposed approach can be used to remove reflection and distortion from a single image. This helps to increase the quality of image. This method is applied to four different images. It shows a better PSNR value when compared to other. The fig 4(a) shows an image containing both reflection and distortion. Using this QAMS method it can simply remove. Fig 4(a) shows the output of 5(e) after removing the reflection and distortion. Similarly Fig 4(b) 4(c) 4(d) is the input and 5(f) 5(g) 5(h) is the output after using the QAMS method. The below table shows the PSNR value and error rate of four various images containing both reflection and distortion.

Table 1: The accuracy of Images

Input image	Size of image before processing	Size of image after processing	PSNR	Error rate
Building	155KB	202 KB	58.06	1.09
Nature	1263KB	2529 KB	59.64	2.23
Floor	48.8KB	91.2K B	57.89	1.58
Man	223KB	256 KB	58.37	1.87



The Graph shows the PSNR value of various images



The Graph shows the Error Rate value of various images

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

Fig.4 (A), (B), (C), and (D) Shows Image Containing Both Reflection and Distortion

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(e) (f) (g) (h)

Fig. 5 (E) ,(F), (G) and (H) Shows The Result After Removing Reflection and Distortion Using Algorithms

V. CONCLUSION

The contribution of this paper is removing reflection and distortion from a single image. Here a reliable method is used for removing the reflection and distortion from single images. For this we use two algorithms for removing both the contents from the images. The image can be either real images or synthetic images. The input image consists both of this. The output is high quality reflection and distortion separated images. Here we propose a method called QAMS.Using this method the quality image can be measured by PSNR value and by calculating the error rate.

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