# Survey on Image Integration of Misaligned Images

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**Abstract -** *Under low lighting conditions the amount of light captured by a camera sensor is often inadequate for recording an image with a clear contrast. Taking satisfactory photos under low lighting conditions using a hand-held camera is a challenging task. Often the photos taken are blurred or noisy. Blurring and imperfection of image due to noise is a common artifact that produces disappointing distorted images with inevitable information loss. There are different methods available for image integration. Most of the previous methods uses well aligned images for integration. In case of misaligned images, the image integration and color transfer yield an unnatural image with low contrast.*

***Key Words***: Image Registration, Image Alignment, Correspondence Algorithm, Image Integration, Color Transfer.

## 1. INTRODUCTION

A blurred or a very noisy image can be reconstructed into a high quality image using Image integration technique. Capturing photos under low light using hand-held cameras will be often unsatisfactory. Such photos might be blurred or noisy.

The brightness of the image can be increased in three ways. First method is by reducing the shutter speed. But with a shutter speed below a safe range, images may get blurred due to camera shake. Second, is by using a large aperture. A large aperture will however reduce the depth of field. Moreover, the range of apertures in many cameras is very limited. Third is by setting a high ISO. But, as the camera gain is amplified, the noise also may get increased. The largest aperture, safe shutter speed, and the highest ISO are the best settings to take a sharp image in a low light. Even with this combination, the captured image may still be dark and very noisy.

Typically, two kinds of degraded image can be taken in the low light. One is a blurred image which is taken with a slow shutter speed and a low ISO setting. Inspite of enough light, correct color, intensity and a high Signal-Noise Ratio (SNR), the image is blurry due to camera shake. The other is an underexposed and noisy image with has a fast shutter speed and also has a high ISO setting. Due to insufficient exposure and high camera gain the image is sharp but very noisy. Due to low contrast the colors of the image are also partially lost. Recovering a high quality image from a very noisy image is no easy task as fine image details and textures are concealed in noise.

Image restoration from a very noisy or blurred image remains a challenging problem. One simple but efficient approach is to use multiple images. Many papers discuss significant improvement in image quality by using flash images. In some previous methods, they combine the features of the images to integrate the colorfulness of a no-flash image with the vivid contrast of flash image. Some of these methods have sufficient deblurring or denoising capabilities especially under dim lighting conditions, but they does not handles misaligned images, it require perfectly aligned images. This is a severe restriction in practical use, since a camera needs to be fixed on a tripod, and a scene must be stationary.

## 2. LITERATURE SURVEY

In [1] Sunghyun Cho and Seungyong Lee proposed a fast deblurring from a single image within a few seconds. The high speed of this method is enabled by accelerating both kernel estimation and latent image estimation steps in the iterative process. Introduce a novel prediction step into the iterative deblurring process where the strong edges are predicted. Image derivatives are used to optimize the function for kernel estimation thus it improves the numerical process by decreasing the number of fourier transforms. A motion blur is a common artifact that produces disappointing blurry images with unavoidable information loss. It is caused by the nature of imaging sensors. During exposure, if the camera sensor moves, a motion blurred image will be obtained. Reconstructing a high quality image from a single image is a challenging task.

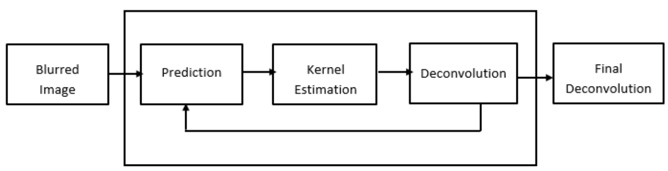


**Fig -1: Overview of deblurring process [1].**

In [2] Rob Fergus, Barun Singh, Aaron Hertzmann, Sam T. Roweis proposed a conventional blind deconvolution technique to remove the effects of camera shake from blurred images. In a coarse-to-fine fashion the blur kernel is estimated from the input image. Using this kernel, the image is then reconstructed with the help of a standard deconvolution algorithm. The system is mainly focused on kernel estimation and these estimated kernel seem to match the image camera motion. The results of method often contain artifacts occur near saturated regions and regions of significant object motion. These artifacts can be blamed primarily on the non-blind deconvolution step. But it is difficult to completely avoid blur and ringing artifacts from a single image.

In [3] G. Petschnigg, R. Szeliski, M. Agrawala, proposed a variety of applications that analyze and combine the strengths of such flash/no-flash image pairs. Digital photography makes it fast, easy, and economical to take a pair of images of low-light environments: one with flash having the details of the image and other is no flash to capture ambient illumination. This system maintaining the natural lighting of the ambient image, and it includes detail transfer from flash to ambient image with the help of bilateral filter, white-balancing, continuous flash intensity adjustment and red-eye removal. When these applications are demonstrated it produces new images that are of higher quality than originals. Joint bilateral filter speed up the denoising process and helps to improve the appearance of the ambient image but it does not handle a misaligned images.

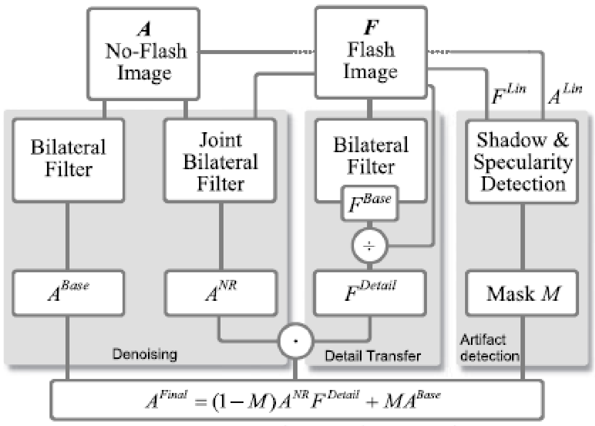


**Fig -2: Overview of denoising, detail transfer, and flash artifact detection [3].**

In [4] Y. HaCohen, E. Shechtman, D.B Goldman and D. Lischinski proposed a correspondence algorithm for recovering reliable set of dense correspondences between two images. This method is designed for pairs of images share some common content, acquired by different cameras and lenses, under non-rigid transformations, under different lighting, and over different backgrounds. Then, extend the Generalized PatchMatch algorithm by making it robust to significant tonal differences between the images, and embed it in a new coarse-to-fine scheme, where the nearest-neighbor field computations are interleaved with color transformation model fitting. This method is widely applicable for color transfer in real-world images, as well as additional transfer challenges such as deblurring and mask transfer. This method may also prove useful for a variety of computer graphics and vision applications that currently rely on previous correspondence methods. It is difficulty to finding reliable correspondences in very large smooth regions.

In [5] Jie Feng, Wangyu Xiao and Bingfeng Zhou proposed an image based material modeling based on a pair of input images. One under diffuse light which is texture image, and other under point light named highlighted image. First, the texture and highlighted image of the material are decomposed respectively into a reflectance image and an illumination image. Then obtained the reflection component of the texture image, orientation field, height field information of the material and BRDF parameters. With the help of this information render a new image under new viewing conditions with the geometry and reflection information.

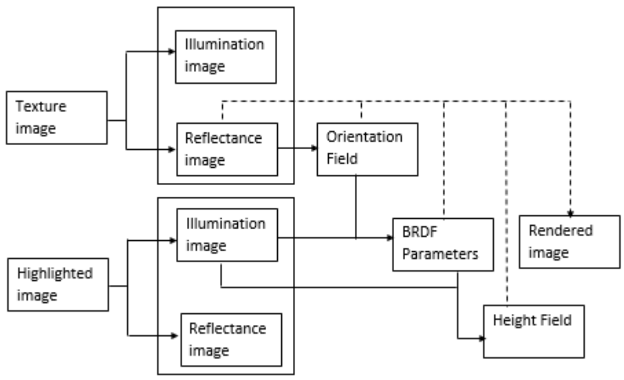


**Fig -3: Framework of Anisotropic material modeling [5].**

In [6] G. Petschnigg, R. Szeliski, M. Agrawala, M. Cohen and K. Toyama proposed a work focusing on improving the lighting and ambiance of flash photography by combining a picture taken with the flash and one using the available lighting. Using a feature preserving filter, estimate what can be seen as intrinsic layers of the image and use them to transfer the available illumination to the flash picture. The detection of shadows cast by the ash and correct their color balance and noise level. Even when the no-flash picture is extremely noisy, the method successfully transfers lighting due to the use of the flash image to perform edge-preserving filtering. This is however challenging because it requires different sensors and these wavelengths provide limited resolution and color information. The difference of the ash and no-ash images contains much information about the 3D scene.

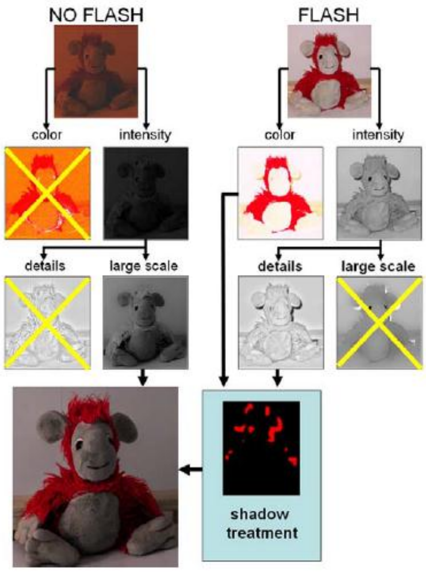


**Fig -4: Basic reconstruction and shadow correction [6]**

In [7] Liu, Wan, Qu, Wong, Lin, Leung, Heng proposed a novel method to colorize a grayscale image by extracting intrinsic reflectance colors from multiple references. These references are all obtained directly from web search. With previous example-based methods, consistent colorization results are difficult to obtain when illumination conditions between the target grayscale image and its references are different. By reducing the influence of illumination with intrinsic image decomposition, reliable colorization results can be generated. The current method assumes that a sufficient number of registerable reference images of the target scene can be acquired from the Internet. In cases when no exact match is available, color information from similar scenes may potentially be used in computing intrinsic reflectance images. Relevant scenes may be identified through texture analysis. Alternatively, single-image methods for intrinsic image decomposition may also be employed to determine reflectance colors of the target scene, when reference images are very scarce.

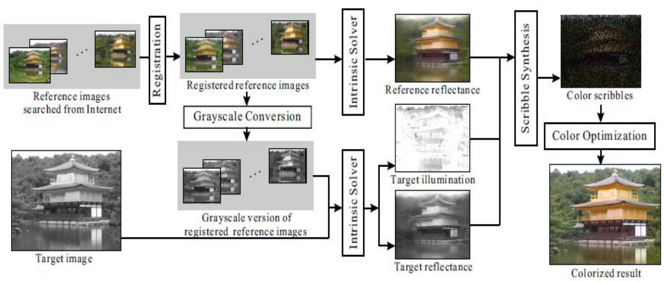


**Fig -5: An overview of intrinsic colorization [7]**

In [8] L. Yuan, J. Sun, L. Quan, and H.-Y. Shum proposed an image deblurring approach using a pair of blurred/noisy images. The approach takes an advantage of both images to produce a high quality reconstructed image. By formulating the image deblurring problem using two images, developed an iterative deconvolution algorithm which can estimate the initial kernel and significantly reduce deconvolution artifacts. There is no special hardware is required. The proposed approach uses off-the-shelf, hand-held cameras. The approach shares the common limitation of most image deblurring techniques: assuming a single, spatial-invariant blur kernel. For spatial-variant kernel, locally estimate kernels for different parts of the image and blend deconvolution results. The limitation of this work is quality of the estimation may be degraded when the kernel is time-varying.

In [9] Tatsuya Baba, Ryo Matsuoka, Keiichiro Shirai and Masahiro Okuda proposed a new image integration approach for a misaligned image pair. In this framework, two kinds of images are used to restore an image with natural colors and a high contrast under dim lighting conditions. One is a long-exposure image other image is a flash image. An image integration method that maintains the detail of a flash image for a misalignment image pair was presented in this work. The previous methods for color transfer results an unnatural image and incur low contrast. In this work the local linear model into the image integration method is introduced to transfer the color while maintaining the natural color and high-contrast of the flash image. This method restores more natural images without experiencing contrast deterioration.

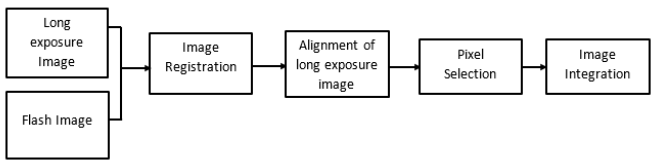


**Fig -6: Block diagram of image integration**

## 3. CONCLUSIONS

Misaligned Image Integration has been a broad prospect within the study of recent years. Many works has been kept focusing on this. Each work handles different kinds of input image pairs such as flash image, no flash image, long-exposure image, ambient image etc. Many of these works have efficient color transferring and image integration capabilities especially under dim lighting conditions, but they require perfectly aligned images. So handling misaligned images is a very difficult task. Some of these works contains deconvolution process. It is difficult to completely avoid blur and ringing artifacts. Blurring and imperfection of image due to noise is a common artifact that produces disappointing distorted images with inevitable information loss. A detailed study has been performed regarding this subject in the survey.

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