

## The Application of Image Restoration in Aviation Image

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**Abstract.** It has great significance for the quality of aviation image in military image processing system. But it cannot avoid image degradation encountered in the process acquired. In order to get the high-quality aviation image, in this paper, we firstly analyze the main factors of image degradation, and then the wiener filter is proposed for aviation degradation image to recover image. The results show the effectiveness of method.

### Introduction

We will use satellites to get geographic information data in the production scene database, but this image always exist the problem of quality decreased. In order to improve image quality and the focus landmark sharpness, in this paper, we adopt the image restoration algorithm to image restoration.

In recent years, the image restoration technology has got great development. For example, indirect methods [1-4] were developed primarily over the past two decades. Parametric models are applied to the image, the blur, and the noise statistics. The models' parameters are estimated from the degraded image according to a certain mathematical criterion or constraint about the solution. The image can be assumed to be a realization of a two-dimensional homogenous Gauss–Markov random field that is characterized by a two-dimensional autoregressive model. The blur function can be modeled as a finite impulse response linear space-invariant system. When motion blur is considered, a simple model that uses a few parameters is per-formed. The simple model that is usually used [4] is the uniform velocity motion model that considers two parameters: the motion direction in the image and the blur extent. The iterative methods are computationally more expensive and require a parametric form of the blur. However, when this is available, a wide variety of blur types can be considered.

### Image degradation factors

The main of image degradation is the imaging system focusing improperly or the relative movement of between camera and target. It is called image moved. The image moved can form image resolution drops, caused image blur. It is shown in Fig.1.



Fig.1 The blur image

The main reasons of generating image moved:

1. The forward movement of the camera;
2. The change in attitude angle camera movement and angular rate;
3. The relative vibration of between the camera and the aircraft;
4. Environmental random noise and other reasons.

Many reasons can form the image moved which is primary factor affecting the quality of image and unavoidable factors. So it is important to eliminate it effectively..

### Image degradation model

The key of image restoration is to establish the model of image degradation. The model of image degradation is shown in Fig.2.

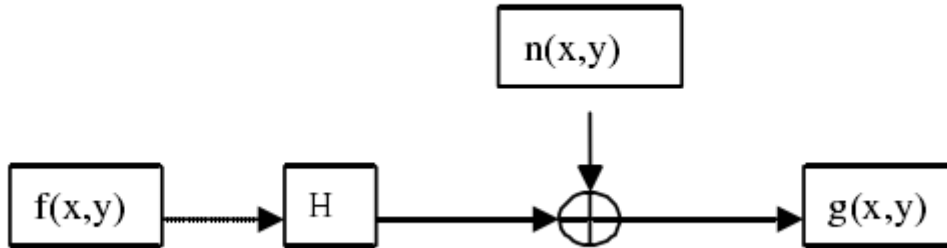


Fig.2 The model of image degradation

In Fig.2  $f(x,y)$  is the input image.  $h(x,y)$  is degenerate system and is  $g(x,y)$  degradation image.

### Image evaluation standard

Image quality refers to the people evaluation of image visual perception. With the rapid development of image restoration technology, whether checking the quality of restored image is objective has become the focus of attention.

Image quality assessment is divided into subjective and objective evaluation. Image subjective evaluation is to determine the image quality by people. Image Objective evaluation is to determine the image quality by some statistical characteristics and physical parameters. These are some common objective evaluation standards such as minimum mean square error and peak signal noise ratio which are defined as follows.

$$MSE = \frac{1}{M \times N} \sum_{x=0}^{M-1} \sum_{y=0}^{N-1} [f(x,y) - \bar{f}(x,y)]^2 \quad (1)$$

$$PSNR = 10 \log_{10} \frac{255^2}{MSE}$$

In Formula 1,  $M \times N$  is the size of image,  $f(x,y)$  is the original image and  $\bar{f}(x,y)$  is the evaluation image. By Formula 3 we can know that the MMSE is smaller and the peak signal noise ratio is larger, the evaluation image closer to the original image. In this paper the minimum mean square error and peak signal noise ratio are used for image quality evaluation standard.

### Image restoration algorithm

Wiener filter can be attributed to a class of de-convolution algorithm. Since the Wiener filter is good at recovery efficiency, lower amounts of computing, and excellent noise immunity, thus it has been widely used in restoring the image areas and continuously improved development.

Wiener filter combines the degradation function and noise statistical characteristics. It is looking for a filter, so that the minimum mean square error between the restored image  $f(x,y)$  and the original image  $\hat{f}(x,y)$ . It is shown in Equation 2.

$$E \left[ \left( f(x,y) - \hat{f}(x,y) \right)^2 \right] = \min \quad (2)$$

In Equation 2, E is mathematical expectation.

## Test results

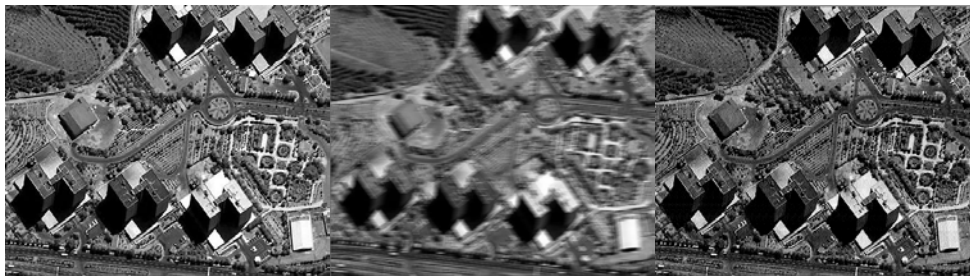
The experiments divided into two part, these are we use wiener filtering algorithm to recover the images with motion blur and noise.



(a) The original image      (b) The degradation image      (c) The restoration image

Fig.3. image remove blur experimental results

For degradation image in Fig.3, the value of MSE and PSNR are 1203.47 and 15.22 before recovery and after that the value of MSE and PSNR change to 231.64 and 26.24.



(a) The original image      (b) The degradation image      (c) The restoration image

Fig.4. image remove blur experimental results

For another degradation image in Fig.4, the value of MSE and PSNR are 2251.22 and 16.23 before recovery and after that the value of MSE and PSNR change to 1125.28 and 22.95. From the results in Fig.3 and Fig.4, the wiener filtering can effectively remove motion blur in the image.

## Conclusion

Motion blurring formed image moved is primary factor affecting image quality and unavoidable factors. The aviation images always with enormous texture information, so the degradation of aviation images will give us a great deal trouble. In order to improve the quality of image, we must have the image post-processing. In this paper the wiener filtering algorithm is used to restoration image. This algorithm can eliminate motion blur effectively, and the experimental results prove the effectiveness of the algorithm.

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