ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 9, September 2017

Adaptive Image Registration Based Nonuniformity Correction Algorithm for Image Filtration

Shweta Wanmali[1], Prof. R.U. Shekokar[2]

M. E Student, Department of Electronics and Telecommunication, RMD Sinhgad College of Engineering, Pune, India[1]

Professor, Department of Electronics and Telecommunication, RMD Sinhgad College of Engineering, Pune, India [2]

ABSTRACT: In infrared imaging the noise i.e. ghosting comes due to nonuniformity of detectors pixel to pixel response variation. This may lead to error of diagnosis and measurement. This paper shows the adaptive image registration non uniformity correction method with the function of eliminating ghost artifacts. With regard to real-time continuous image sequence, we first calculate the displacement vectors based on their row and column projections. Then, by bidirectional image registration, we can get the overlapped area matrices of two frames accurately. Meanwhile, a variance threshold is set to judge the scene classification, and then, displacement revising is selectively added to decrease noise.

KEYWORDS: Nonuniformity; Image registration; Nonuniformity correction; Ghost artifacts removal

I. INTRODUCTION

The focal plane array is an image sensing device. It consist an array of light sensing pixels at the focal plane of a lens [3]. FPAs are used most commonly for imaging purposes (e.g. taking images or video imagery), yet can likewise be utilized for non-imaging purposes, for example, spectrometry, lidar, and wave-front detecting.

In radio space science, the focal-plane array (FPA) is a cluster i.e. array at the concentration of a radio telescope. At optical and infrared wavelengths it can allude to an assortment of imaging gadget sorts, however in like manner use it alludes to two-dimensional gadgets that are touchy in the infrared range. Gadgets touchy in other spectra are normally alluded to by different terms, for example, CCD (charge-coupled gadget) and CMOS image sensor in the obvious range. FPAs work by identifying photons at specific wavelengths and after that creating an electrical charge, voltage, or resistance in connection to the quantity of photons recognized at every pixel. Then that charge, voltage and resistance get measured and then it digitized and after that it is used to construct an image which is emitted by the photons.

With the quick advancement of infrared focal plane arrays (IRFPAs), the infrared imaging framework is generally utilized as a part of the military, modern, therapeutic, and different fields. Not with standing, the nature of infrared image is genuinely influenced by the spatial settled example in IRFPAs, which is essentially brought on by the nonuniformity of the detectors' pixel-to-pixel response variation. To take care of this issue, two principle classifications of nonuniformity correction (NUC), i.e., calibration based (CB) [4], [5] and scene-based (SB) techniques [6], [7] have been developed. CB strategies have bring down computational intricacy however depend on adjusting the IRFPA at unmistakable temperatures which expend loads of extra infrared assets and intrude on ordinary imaging process; SB techniques are adjusted to the time-float of nonuniformity correction, yet their higher computational complexity make the continuous handling hard to accomplish, and over again issue, otherwise called ghosting antiquities, is conveyed to the infrared image.

Image registration is the way process of transforming different sets of data into one facilitate framework. Information might be numerous photos, information from various sensors, times, profundities, or perspectives. It is utilized as a part of PC vision, medicinal imaging, military programmed target acknowledgment, and accumulating and investigating pictures and information from satellites. Enlistment is fundamental with a specific end goal to have the capacity to think about or incorporate the information got from these distinctive estimations.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

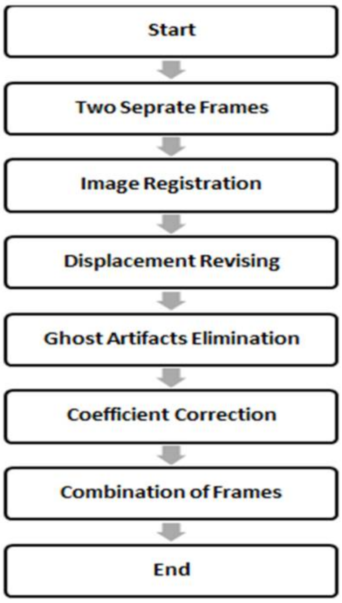
Website: www.ijircce.com

Vol. 5, Issue 9, September 2017

II. PROPOSED SYSTEM

At starting we take two different frames then we register them by using bidirectional image registration method. This method calculates row and column displacement vectors and then we got the overlapped area matrices of two frames and then the displacement calculated in in key points instead of intensity. Then the moving targets and backgrounds are extracted and separately the correction is done. Hence the ghosting is removed. After that we take coefficient correction. The gain and offset coefficients of the overlapped area can be updated in real-time with the image sequence adaptively

Flowchart



Algorithm

1. Image registration criterion

Image registration is the process of transforming different sets of data into one coordinate system. Registration is necessary in order to be able to compare or integrate the data obtained from these different measurements. We use here the bidirectional image registration mode. In this the two-point correction coefficients are presented. This image registration based NUC method assumes that in video sequence the gain and offset coefficients of detectors keep same in both frames but they may change in long term. By using this assumption we can utilize the unchangeable characteristic of those frames to design algorithm.

In real-time infrared video surveillance, the timing between the fames is fixed hence we can easily capture displacement in the successive images. In this algorithm, at first the global motion and displacement between two frames is calculated. We consider the infrared image is 2-D matrix. We take inversion of this 2-D image into row and column projections. The adverse effects occurred due to this factor is eliminated by using sinusoidal filter window as shown below, I is size of image and M × N [1]

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 9, September 2017

$$\begin{cases} p_i^y x \triangleq \sum_{y=1}^{N} a_y \cdot I_i(x,y) \\ p_i^x y \triangleq \sum_{x=1}^{M} a_x \cdot I_i(x,y) \end{cases} \quad \ldots 1$$

And ay and ax are weighting factor
The sinusoidal function reduces the weight of new information to the registration.

$$y_n(x,y) = g_n(x,y) \cdot X_n(x,y) + O_n(x,y) \quad \ldots a$$

Where X is the true response of detector; Y is the output value of readout circuit; g and o represent the gain and the offset coefficients of detector, respectively; (x,y) means pixel's coordinate; and subscript n is the frame number of the image sequence.

$$X_n(x,y) = w_n(x,y) \cdot Y_n(x,y) + b_n(x,y) \quad \ldots b$$

Where, $w_n = {}^{1}/_{gn}(x,y),\ b_n(x,y) = -(\frac{w_n(x,y)}{g_n(x,y)})$

As the image is discrete there may occur some bad pixels which decreases the accuracy of registration. Hence to overcome this problem we establish this operation in process of registration to make this process as same as normalization. Hence the projections of row and column is changed. After the row and column projection values of two adjacent frames are obtained we set the first image on the timeline as the reference frame and the second one as the current frame.

2. Displacement Revising

In image registration we calculate displacement vectors d_y and d_x. But there may occur stripe noise which affects the performance because of its strongly spatial interference. The strong spatial interference only occurs when fringe direction of stripe noise is in the same direction with global motion. The variances of the adjacent frames change in a small range. To change the row and column displacement vectors:

$$d_s' = \begin{cases} d_s + 1, & if\ |DX(n-1) - DX(n)| \le \delta \\ d_s, & otherwise \end{cases}$$

where ds represents dx or dy for short; and d's means the corrected displacement vector; DX(n-1) and DX(n) are the variances of frame n – 1 and n, respectively; and δ is the determination threshold, which is chosen from the real infrared image sequences [1].

3. Ghost Artifacts Eliminating

The current image registration based NUC method assumes that the motion in the infrared image sequences is a global rigid body transformation and ignore the moving targets in the global displacement. But, in infrared imaging system, the information of moving targets is very important so ignoring this moving targets information causes ghost artifacts. To distinguish the moving targets and relative slow moving background, we developed a method that based on the gray scale distribution is developed [1].

4. Coefficient Correction

Here we update gain and offset coefficients.The error function is defined by using frames (n-1) and n in the bidirectional way. We use here the steepest gradient descent to correct gain and offset coefficients adaptively. Also gain and offset matrices are updated separately [1].

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 9, September 2017

III. SIMULATION RESULTS

The process is done in MATLAB software. We take one reference image and one current image as a input images. In preprocessing we resize image to 50% and also reset the contrast of those images to visualize properly. Then we extract high intensity features. Then by setting some threshold we descript them. After features extraction we take image registration. Image registration is the process in which the coordinates to coordinate mapping is done. We register images to find out projections of the images. So we got matching inliers after image registration. Also we can see the displacement existed in the resultant image. Then we take displacement revising. Then at last by using geometric transformation we got corrected image.

Input Images

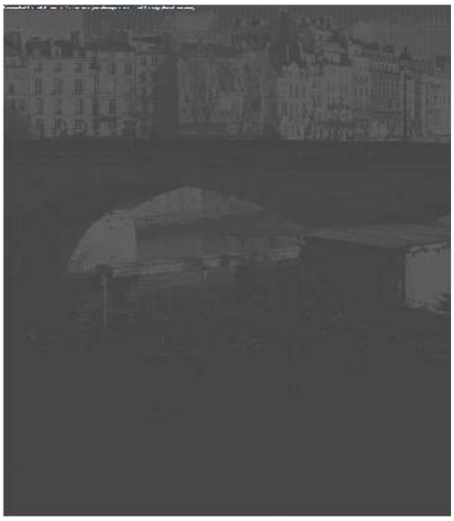


Image 1

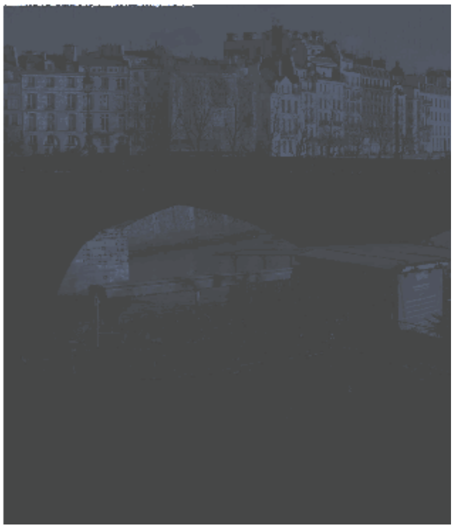


Image 2

Preprocessing

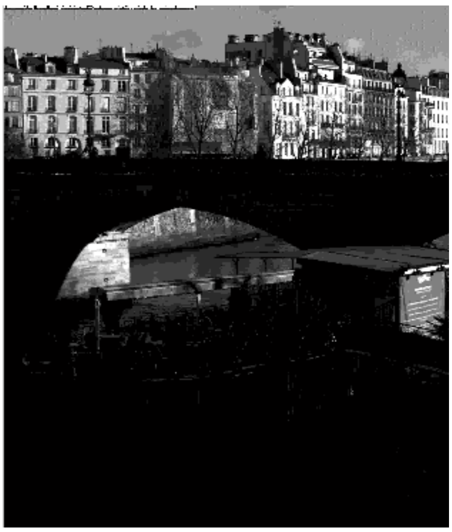


Image 1

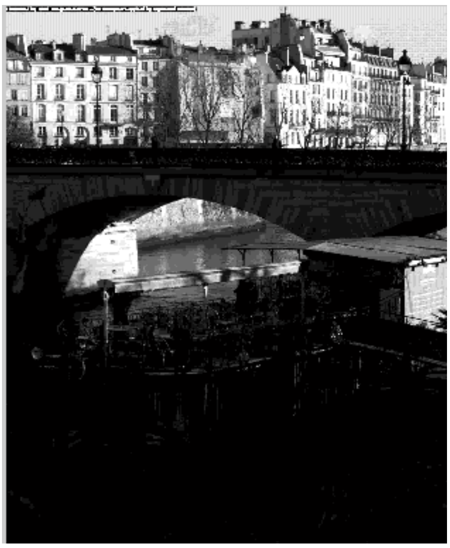


Image 2

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 9, September 2017

Features Extraction

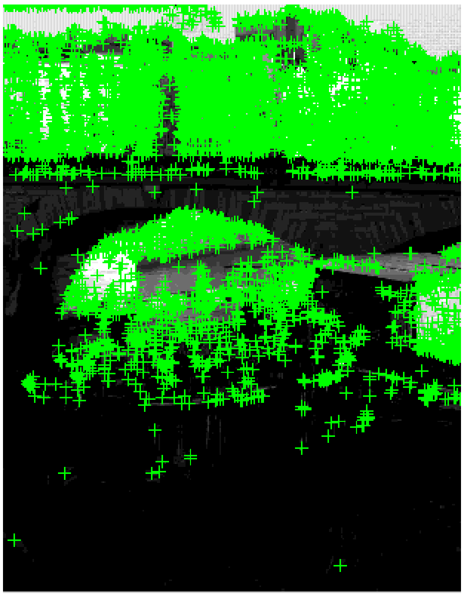


Image 1

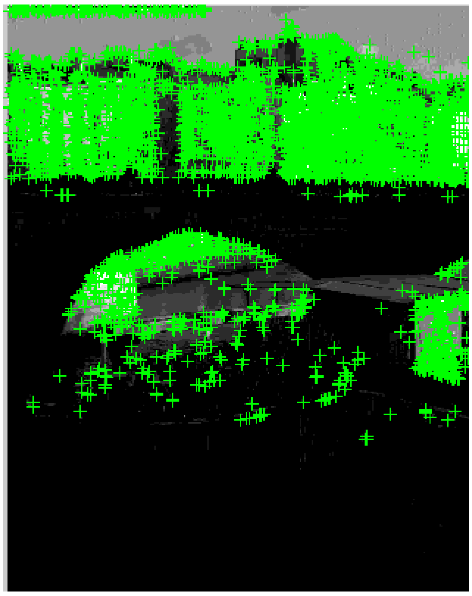


Image 2

Descripted Features in Image registration

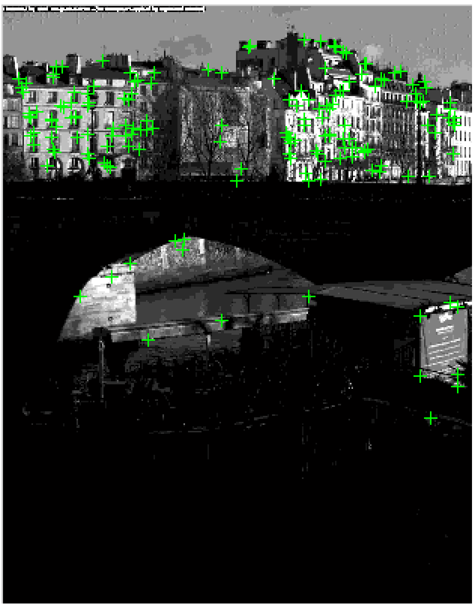


Image 1

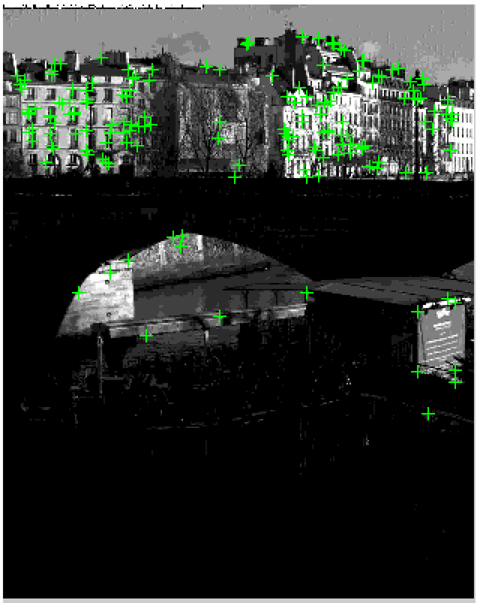


Image 2

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

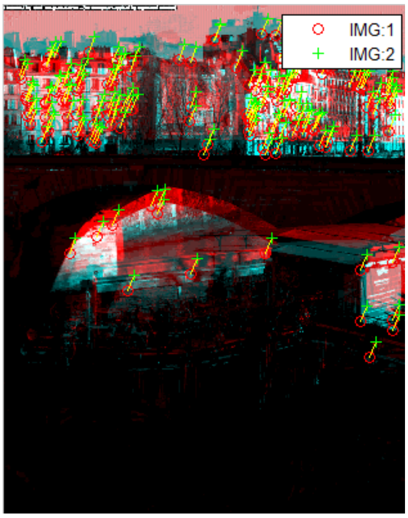
International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

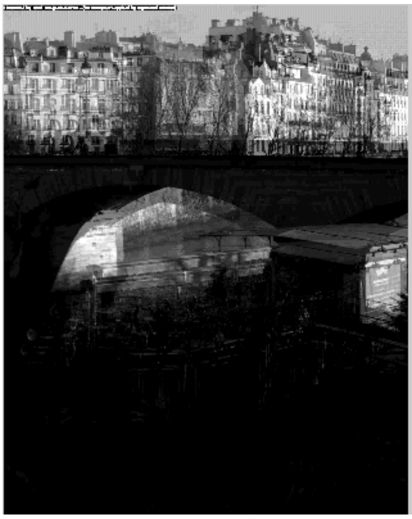
Website: www.ijircce.com

Vol. 5, Issue 9, September 2017

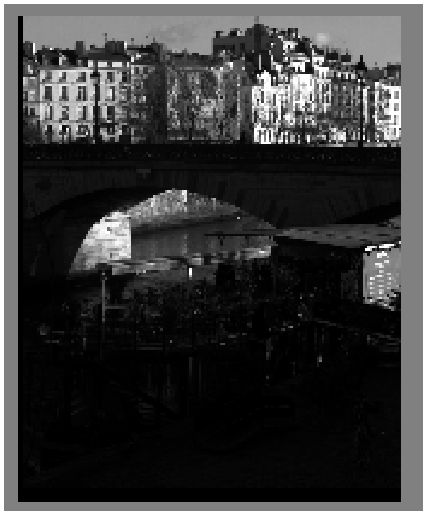
Matching Inliers



Displacement Revising



Corrected Image



IV. CONCLUSION

A new image registration NUC algorithm is proposed. It utilizes the row and column projections of two adjacent images to calculate the vertical and horizontal displacements and achieve the bidirectional image registration while calculating the variance variation and comparing the results with the threshold and doing the displacement revision. Then, the moving targets' effect is eliminated and then the ghosting artifacts have been almost completely removed.

REFERENCES

1. JunjieZeng, Xiubao Sui,Hang Gao, "Adaptive Image-Registration-BasedNonuniformity Correction AlgorithmWith Ghost Artifacts Eliminating forInfrared Focal Plane Arrays," in IEEE Photonics Society, vol. 7, Oct. 2015
2. D. A. Scribner, M. Kruer, and J. Killiany, "Infrared focal plane array technology," Proc. IEEE, vol. 79, no. 1, pp. 66–85, Jan. 1991.
3. Friedenberg and I. Goldblatt, "Nonuniformity two-point linear correction errors in infrared focal plane arrays," Opt. Eng., vol. 37, no. 4, pp. 1251–1253, 1998.
4. Scene-Based Nonuniformity Correction with Reduced Ghosting Using a Gated LMS Algorithm Russell C. Hardie1, Frank Baxley, Brandon Brys, and Patrick Hytla
5. Scene-based nonuniformity correction algorithm based on interframe registration Chao Zuo,* Qian Chen, Guohua Gu, and Xiubao Sui J. Opt. Soc. Am. A / Vol. 28, No. 6 / June 2011 pp 1164- 1176
6. ADMIRE: a locally adaptive single-image, non-uniformity correction and denoising algorithm: application to uncooled IR camera Y. Tendero a , J. Gillesb.
7. Jihong Wang , Zuofeng Zhou , Hanbing Leng , Qingquan Wu A Non-Uniformity Correction Algorithm Based on Single Infrared Image Journal of Information & Computational Science 12:1 (2015) 101–110 January 1, 2015 Available at http://www.joics.com
8. Minimizing the Ghosting" Artifact in Scene-Based Nonuniformity Correction John G. Harris and Yu-Ming Chiang Proc. SPIE Vol. 3377, p. 106-113, Infrared Imaging Systems: Design, Analysis, Modeling, and Testing IX,
9. Correction Lixiang Geng, Qian Chen, and Weixian Qian China An Adjacent Differential Statistics Method for IRFPA Nonuniformity DOI: 10.1109/JPHOT.2013.2293614 1943-0655 2013 IEEE

BIOGRAPHY

Ms. Shweta D. Wanmaliis M.E. Student, studying VLSI and Embedded system in RMD Sinhgad college of Engineering, Pune. Author has her personal interest in the domain of Image Processing.

Prof. Rajesh U. Shekokaris working as a Assistant Professor in Department of E&TC. His area of interest in the domain of VLSI and Embedded System.