

# Image Fusion Technique Based Upon Algebraic Multi Grid Using Improved Watershed Segmentation

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**Abstract-** This paper present a new hybrid multi-focus image fusion methodology based mostly upon the algebraically multi-grid (AMG) and improved watershed algorithm. The watershed algorithm is easy and intuitive and perpetually turn out an entire division of the image however some time it turn out over segmentation and become sensitive to noise. This limitation is removed by improved watershed algorithmic program. In improved watershed methodology k- mean clustering is combined with watershed algorithm. That divide image into region. At the moment feature like texture, edge is extracted then apply relevant fusion rule multi-focus pictures are fused. The visual qualitative effectiveness of the presented fusion methodology is evaluated by compare it with existing approach. Within which planned approach is best than 12.4%.

**Keywords-** Image Fusion, Watershed Segmentation, AMGW

## 1 INTRODUCTION

Image process may be a technique to convert a picture into digital kind and perform some operations on that, so as to induce associate degree increased image or to extract some helpful info from it. It's a kind of signal dispensation within which input is image, like video frame or photograph and output is also image or characteristics related to that image. Sometimes Image process system includes treating pictures as two dimensional signals whereas applying already set signal process ways to them. Image fusion is that the method of mixing relevant info from two or additional pictures into one image. Image fusion techniques area unit wide employed in varied applications like remote sensing, medical imaging, military and natural philosophy. Image fusion may be a method of mixing two or additional pictures to reinforce the data content. Image fusion techniques area unit vital because it improves the performance of visual perception systems by group action several sources of satellite, mobile and ground primarily based imaging systems with different connected information sets. Further, it additionally helps in sharpening the pictures, improve geometric corrections, enhance sure options that don't seem to be visible in either of the pictures, replace the defective information, and complement the information sets for higher cognitive process. It combines the many info from two or additional supply pictures into one resultant image that describes the scene higher and retains helpful info from the input pictures. A high resolution panchromatic image provides geometric details of a picture attributable to the presence of natural yet as manmade objects within the scene and an occasional resolution multispectral image provides the colour info of the supply image. The aim

of multi-sensor image fusion is to represent the visual info from multiple pictures having totally different geometric representations into one resultant image with none info loss. The benefits of image fusion embody image sharpening, feature improvement, improved classification, and creation of stereo information sets. Multi-sensor image fusion provides the advantages in terms of vary of operation, abstraction and temporal characteristics, system performance, reduced ambiguity and improved reliableness.

## 2 LEVELS OF IMAGE FUSION

### A. picture element Level

This is simplest technique in image fusion done at lowest level. During this mix the values and intensities of two input pictures supported its average, provides the only resultant image.

### B. Feature Level

It justifies with the options of image like if one image has its distorted eye different have distorted any feature like head, nose. During this level of technique simply extract the options of each similar pictures singly, then fusion rule provides the improved image once feature extraction.

### C. Block or Region primarily based

In region primarily based fusion happens per the picture element blocks of the image. Blocks level technique is highest level technique. Its period of time illustration and measurements are calculated per the regions.

## 3 TYPES OF IMAGE FUSION

### Single Sensor

Single sensing element captures the important world as a sequence of pictures. The set of pictures area unit coalesced along to come up with a brand new image with optimum info content. As an example in illumination variant and noise full surroundings, a personality's operators like slighter operator might not be able to detect objects of his interest which may be

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highlighted within the resultant coalesced image. The disadvantage of this sort of systems lies behind the restrictions of the imaging sensing element that area unit getting used in different sensing space. Underneath the conditions within which the system will operate, its dynamic vary, resolution, etc. area unit all restricted by the competence of the sensing element. as an example, a visible-band sensing element like the camera appropriate} for a brilliantly well-lighted surroundings like daylight scenes however isn't suitable for poorly well-lighted things found throughout evening time, or underneath not sensible conditions like in fog or rain.

#### Multi Sensor

A multi-sensor image fusion theme overcomes the restrictions of one sensing element image fusion by merging the pictures from many sensors to create a composite image. An infrared camera is related to the camera and their individual images area unit united to get a coalesced image. This approach overcomes the problems remarked before. The camera is appropriate for daylight scenes; the infrared camera is suitable in poorly well-lighted environments. It's utilized in military space, machine vision like in object detection, robotics, medical imaging. It's wont to solve the merge info of the many pictures.

#### Multi-view Fusion

During this pictures have multiple or totally different views at identical time. Multimodal Fusion: pictures from totally different models like panchromatic, multispectral, visible, infrared, remote sensing. Common ways of image fusion

- Weighted averaging pixel wise
- Fusion in rework domain
- Object level fusion

#### Multi-focus Fusion

Pictures from 3d views with its distance. The first image may be divided into regions specified each region is focused in a minimum of one channel of the image.

### 4 AMGW

AMGW is predicated on pure mathematics multi-grid (AMG) formula and watershed segmentation methodology. Within the implementation, the coarse grids of the supply pictures are initial extracted with the affinity matrix, and with a spatial interpolation operate the approximation of the supply image is reconstructed from the coarse grids. A substantial quantity of edge and textural info continues to be preserved in such approximation. The two supply pictures are compared with their corresponding approximation block by block severally by using the mean sq. error (MSE) as a sharpness criterion. The MSE values are then wont to establish the blocks of upper fidelity from the supply pictures. The watershed segmentation is applied to those unsure blocks in one supply image. The two supply pictures are compared once more with the MSEs

of the segmental regions. The consolidated image is obtained by reserving the blocks and regions with higher MSEs and applying a post-processing operation. Image fusion is that the method of mixing relevant info from two or additional pictures into one image. Strategies like AMG methodology is employed currently a days as a result of it opt for appropriate blocks from the supply pictures into the resultant image with the target of maximizing the sharpness of the consolidated image. Except for the variety and quality of the natural pictures, block primarily based or region-based image fusion cannot integrate the pictures okay. Discontinuities and blurred blocks are main issues of the standard algorithms. AMG primarily based image fusion methodology will keep the integrity of clear or unclear components, and a watershed formula will find the boundary between the clear and also the unclear half accurately. Therefore the combination of AMG methodology and watershed formula will retrieve fusion results. Many experiments were conducted to research the results of the AMG focus metric on the fusion performance. Simulation results show that the planned theme may be a vital improvement compared with existing schemes.

There are some following problems for future work.

- How to mix multiple metrics to create a comprehensive theme to eliminate the interference of abnormal analysis behavior.
- There is very little area for the development of the MFF methodology, for instance, AMGW methodology will increase QMI metric by 0.12% to 1.33%.

### 5 RELATED STUDY

Huang, Y; et al. [1] planned a replacement multi-focus image fusion technique named AMGW, and it's supported algebraic multi-grid (AMG) formula and watershed segmentation technique. Within the implementation, the coarse grids of the supply pictures are 1st extracted with the affinity matrix, and with an abstraction interpolation operate the approximation of the supply image are often reconstructed from the coarse grids. A substantial quantity of edge and textural info continues to be preserved in such approximation. The two supply pictures are compared with their corresponding approximation block by block severally by using the mean sq. error (MSE) as a sharpness criterion. Padmappriya S. et al. [2] reviewed numerous image process operations for example the essential ideas and to use them in numerous fields with minor changes within the methodology. This paper discusses regarding the essential technical aspects of digital image process with respect to be classified into 3 teams as: Image Rectification and Restoration, sweetening and knowledge Extraction. Importance of digital image process and its applications also are mentioned from the fields of laptop vision and different applications. Picture is outlined as Associate in nursing array, or a matrix, of sq. pixels organized

in rows and columns. Image process could be a procedure of changing a picture into digital kind and do some operation on that, so as to induce Associate in a Nursing improved image and to retrieve some necessary info from the image. Shouhong, C. et al. [3] preserved the wealthy detail info to satisfy the standard needs of spot fastening image fusion and has bound application worth. Seeable of the issues of uneven exposure within the image acquisition and also the serious loss of details within the ancient multi-exposure image fusion formula, a technique of image fusion with details preservation is planned. A weighted approach to multi-exposure image fusion is employed, taking into consideration the options like native distinction, exposure brightness, and color info to higher preserve detail. For the aim of eliminating the noise and interference, exploitation the algorithmic filter to filter. Galande, A; and Paril, R; [4] thought of the mixture of computed tomography (CT) and Magnetic Resonance Imaging (MRI) pictures. It's terribly exhausting to pick out one technique for all applications. However from visual perspective, united pictures obtained from fuzzy abstract thought system provide higher result. Medical image fusion is that the plan to boost the image content by fusing pictures taken from totally different imaging tools like CT, MRI, antielectron Emission pictorial representation (PET) and single gauge boson emission CT (SPECT). The target of image fusion is to mix additional helpful info and take away redundant info from supply registered pictures. during this survey paper, image fusion techniques are broadly speaking classified into 2 categories; picture element level image fusion and remodel primarily based image fusion. Numerous approaches in every class are mentioned well. Salem, Y.B.; et al. [5] conferred a general summary of the essential models and techniques utilized in image fusion. Info fusion consists in combining info so as to maximize the relevant info and scale back the redundancy. It's wide utilized in several fields, particularly in image process, for analyzing things. Since the primary use of the data fusion thought, several approaches are introduced to outline a process model to merge info. 3 basic approaches are utilized in info fusion: the JDL Model that is that the 1st one used, the Intelligence Cycle Model and also the Data - options - Decision (DFD) Model. In line with the sector of application and also the form of the data manipulated, the process model is totally different. In image process, numerous techniques and strategies ar accustomed perform image fusion. Several techniques ar most utilized in analysis studies: PCA (Principal part Analyses), wave remodel. Shandilya, V. K. and Ladhake, S. A.; [6] thought of multi-focal pictures as supply input pictures and 3 strategies of fusion, Weighted Average, PCA, and also the hybrid planned technique. The strategies ar evaluated exploitation numerous analysis metrics. Study shows North American country that planned fusion technique provides higher result compare to different strategies studied. An honest fusion is that the one that produces output fusion result with most spectral detail. Abstraction resolution is

equally necessary within the output united result than on the market with any single supply image. With the rise within the development of sensing technology and sensing devices, additional and additional knowledge are becoming on the market to the user therefore increasing the human employment to larger extent. It becomes tough for human operator to at the same time operate, analyze and interpret info from multiple pictures. It results in the necessity of image fusion techniques. Li, J; et al. [7] high-frequency and low-frequency pictures ar accustomed train 2 convolutional networks to cipher the high-frequency and low-frequency pictures of the supply and fusion pictures. The experimental results show that the tactic planned during this paper will acquire a satisfactory fusion image that is superior to it obtained by some advanced image fusion algorithms in terms of each visual and objective evaluations. Multi-focus image fusion is that the merging of pictures of constant scene and having multiple totally different focus into one all-focus image. Most existing fusion algorithms extract high-frequency info by planning native filters then adopt totally different fusion rules to get the united pictures. During this paper, a wave is employed for multi-scale decomposition of the supply and fusion pictures to get high-frequency and low-frequency pictures. To get clearer and complete fusion pictures, this paper uses a deep convolutional neural network to find out the direct mapping between the high-frequency and low-frequency pictures of the supply and fusion pictures. Rajini, K.C.; and Roopa S.; [8] presents the summary of image fusion technique and also the results from variety of wavelet-based image fusion schemes are compared. It integrates the required options of 2 or additional pictures into one image while not introducing artifacts. The standard image fusion strategies ar usually roaring at inserting abstraction detail into the multispectral mental imagery despite the color info within the mechanism is distorted. The numerous quantity of analysis has been conducted over the past decade associated with the appliance of wave transforms in image fusion. Wavelets have gained heaps of importance because of its energy compaction and multi-resolution properties. S.Ren et al. [9] defines a replacement image fusion technique exploitation the Curvelet remodel that represents the contour of image higher and is property. The tactic is outlined in 3 steps. Firstly, a bar chart is plot in accordance to the match of panchromatic image and multispectral pictures. Secondly, the Curvelet remodel of multi-spectral pictures and also the matched panchromatic image is taken. Thirdly, totally different fusion techniques ar used for estimating the coefficients of the Curvelet remodel, like weighted average for low frequency coefficients and region energy for high-frequency coefficients, which ends within the fusion image Curvelet coefficients. S. Rahmani et al. [10] describes Associate in a Nursing Intensity-Hue-Saturation (IHS) technique to extend the potency and high abstraction resolution of pan-sharpening technique. The pan-sharpening technique is employed to fuse a coffee abstraction resolution

multispectral image with a better resolution panchromatic image to get a high spectral and abstraction resolution image. During this technique two new modifications are introduced to boost the spectral quality of the image. 1st technique describe the estimation of image adjustive coefficients for IHS counting on the first multispectral and panchromatic pictures to attain additional correct spectral resolution. The second technique describes Associate in nursing edge-adaptive IHS technique to enforce spectral fidelity removed from the sides and preserves the high abstraction quality and will increase the spectral quality. M. V. Joshi et al. [11] developed a model-based approach to multi-resolution fusion of remotely perceived pictures to reinforce the abstraction resolution of the MS image to the resolution of the Pan pictures. The tactic is principally applied on a group of a coffee abstraction resolution multispectral (MS) image and high abstraction resolution panchromatic (Pan) image no inheritable on constant geographical region. The planned fusion technique utilizes Associate in nursing autoregressive (AR) model, whose parameters are learnt from the analysis of the Pan knowledge. M. Joshi et al. [12] conferred a model primarily based approach for multi-resolution fusion of satellite pictures. Within the model, every of the low abstraction resolution MS pictures are sculptural as clangorous versions of their corresponding high abstraction resolution pictures. A destruction matrix is calculable for every of the MS bands by exploitation the provision of Pan and also the MS image. The calculable high abstraction resolution MS pictures are sculptural as separate heterogenous mathematician Markov Random Fields (IGMRFs) and also the most A Posteriori (MAP) that is employed to get the united pictures. The tactic doesn't directly care for the Pan Picture element values. The advantage of the tactic is that it have higher performance in terms of each the spectral and also the abstraction fidelity than different approaches. J. Yonghong et al. [13] planned Associate in Nursing improved high FM fusion technique supported MTF (Modulation transfer functions). The experiment is finished in GeoEye – one satellite. It helps MS and PAN pictures with abstraction resolutions of two.0m and 0.5m severally. The planned technique uses 3 steps to get the ultimate united image. First, MTF are measured from GeoEye-1 pictures, then the degraded pictures are obtained supported MTF filters. Secondly, modulating parameter is obtained from the Minimum Mean sq. Error, and image fusion is performed that is measured within the degraded version. M. Choi et al. [14] First State fines a plan improvement First State la resolution spatial par injection de structures (ARSIS). The wavelet-based image fusion provides high-quality spectral content in united pictures however have less abstraction resolution. So as to resolve this downside ARSIS thought is developed exploitation the curvelet remodel as a result of it represents edges higher than the wavelets. Edgesar basic in image illustration and enhancing the sides is an efficient suggests that of enhancing abstraction resolution. L. Alparone

et.al [15] describes a unique image fusion technique, applicable for pan-sharpening of multispectral (MS) bands, supported multi-resolution analysis (MRA). During this technique the method is, the sharpening of low-resolution MS bands by adding high-pass directional details that is extracted from high-resolution Pan Image exploitation the curvelet remodel. S.Li et.al [16] uses a technique of compressed sensing (CS) theory that ensures the poorness regularization of the remote sensing image pan-sharpening downside. The pan sharpening is modified into signal restoration downside with poorness regularization. The idea pursuit (BP) formula is employed to resolve the restoration downside. V. Harikumar et.al [17] developed a technique supported compressive sensing (CS) and graph cuts. Within the opening move, assumes that each the MS and Pan pictures have constant scantiness. Associate in nursing estimation of the MS image is no inheritable from the Pan Image exploitation the idea of compressive sensing and l1 minimization. Second step is to get united image by regularization framework

## 6 PROPOSED SCHEME

In the implementation, the coarse grids of the supply images are first extracted with the affinity matrix, and with a spatial interpolation function the approximation of the supply image can be reconstructed from the coarse grids. A considerable amount of edge and textural information is quiet preserved in such approximation. The two supply images are compared with their corresponding approximation block by block respectively by employing the mean square error (MSE) as a sharpness criterion. The MSE values are then used to identify the blocks of higher fidelity from the source images.

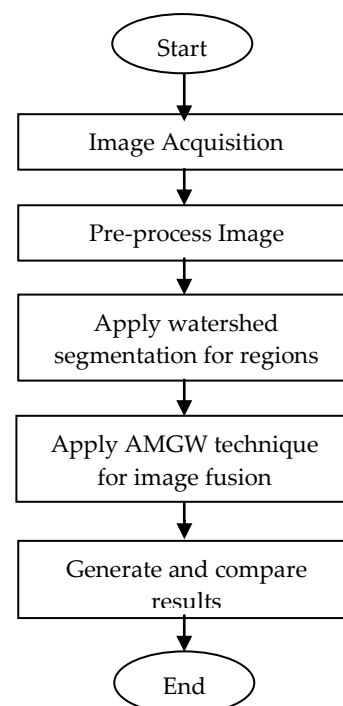


Fig 1: Flow Chart



As shown in the above flow of work images are acquired that are to be fused. After the preprocessing steps image is undergone the watershed segmentation. Watershed segmentation is required to find out the areas in image where sub banding i.e. generated after wavelets may not disturb that is reason to reduce the noise in the image and improve the image parameters for fusion of two images.

## 7 RESULTS AND DISCUSSION

In this section a performance analysis of the projected approach feature matching algorithmic program is given. Since the goal is to realize a trade-off between the increasing the quantity of correct matches associated minimizing the quantity of false matches for an object image try consisting of take a look at and model object pictures, the performance of the projected technique is evaluated. Two approach options F1i and F2j square measure matched once the projected approach descriptor of the feature F2j has the littlest distance to the descriptor of feature F1i among distances appreciate all different extracted options. If the quantitative relation between the geometrician distances to the closest neighbor and to the second nearest neighbor is below a threshold  $\tau$ , the match is labeled as positive, otherwise as negative. within the current analysis we've got enforced the changed projected Approach, by reducing the brink worth so we are able to refine the quantity of matches, during which time take and accuracy and potency is improved. In this section the results of the analysis to be gift. The experimental results are given in the Table 1

Table 1: Comparison of existing and proposed parameters

Technique Parameters	Existing	Proposed
MSE	23.4	18.3
Q <sub>Mi</sub>	0.134	0.231

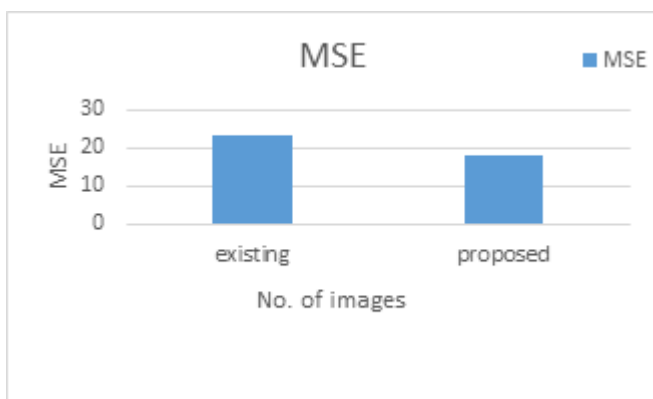


Fig 2: MSE comparison in Existing and Proposed approach.

As shown in fig 2 a comparative study of existing and proposed approach is done which in turns show that the MSE value in case of proposed approach is better than that of existing.

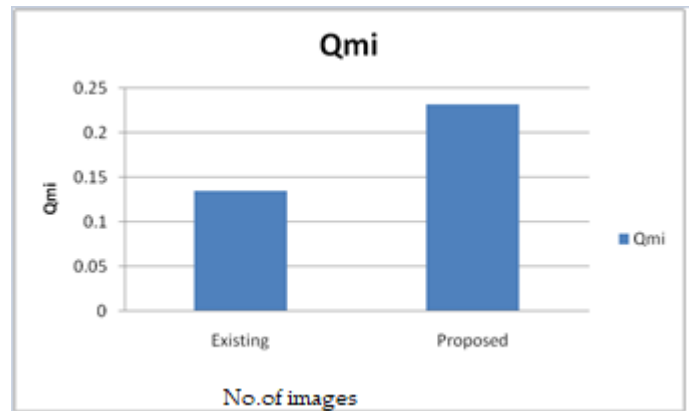


Fig 3: QMI comparison in Existing and Proposed approach.

As shown in fig 3 a comparative study of existing and proposed approach is done which in turns show that the MSE value in case of proposed approach is better than that of existing. This improvement matches to enhancement of feature matching robustness, so the number of exact proposed approach features matches is significantly increased while nearly all outliers are discarded. Also the matching time cost for the event of extracted features into subsets corresponding to dissimilar octaves. The new proposed tactic was tested using real images also. The presented experimental results show the effectiveness of the proposed tactic. This development corresponds to enhancement of feature matching robustness, so the amount of correct proposed tactic features matches is significantly improved while nearly all outliers are discarded. By reducing the no of outliers the precision of the system is improved.

## 8 CONCLUSION

By using a wavelet transform, a supply image and sharp image are decomposed to obtain high-frequency and low frequency info. This paper proposed a hybrid technique using improved watershed segmentation along with AMGW. In which high-frequency subband data is used to learn the mapping of high-frequency information of the supply image to the high-frequency info of the clear image. i.e. low-frequency subband data is used to study the mapping of low-frequency info of the supply image to the low-frequency info of the clear image. In this research a comparative study is shown between proposed technique and AMGW technique of image fusion. As shown in result the proposed technique show improvement of 12.4% from existing AMGW technique.

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