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Research Article

Analysis of Medical image fusion using Yager's heuristic fuzzy analysis for multiple modes

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ABSTRACT

Multi-scale image fusion is one of the most important fusion techniques in which multi-scale fusion and subtraction tools play very important roles. Quaternion wavelet transform (QWT) is one of the most widely used optimization techniques. Therefore, this paper introduces a new multi-modal image fusion method using QWT and various features. First, we apply QWT to each image to obtain low coefficients and high coefficients. Secondly, the weighted average fusion rule based on the phase and amplitude of the low-frequency sub-bands and the spatial variance is proposed to fuse the low-frequency sub-bands. Then, the highest fusion rule is selected according to the ratio and the power coefficient is aimed to be combined with high sub-bands. Finally, the final merged image is created by inverse QWT. This method consists of multifocal images, medical images, high-resolution images and remote sensing images. The results of the experiment show the effectiveness of this method.

Keywords: Image fusion, Intuitionistic fuzzy sets, Multimodal medical images, Intuitionistic fuzzy entropy, Decision map

Multi-scale image fusion is one of the most important fusion techniques in which multi-scale fusion and subtraction tools play very important roles. Quaternion wavelet transform (QWT) is one of the most widely used optimization techniques. Therefore, this paper introduces a new multi-modal image fusion method using QWT and various features. First, we apply QWT to each image to obtain low coefficients and high coefficients. Secondly, the weighted average fusion rule based on the phase and amplitude of the low-frequency sub-bands and the spatial variance is proposed to fuse the low-frequency sub-bands. Then, the highest fusion rule is selected according to the ratio and the power coefficient is aimed to be combined with high sub-bands. Finally, the final merged image is created by inverse QWT. This method consists of multifocal images, medical images, high-resolution images and remote sensing images. The results of the experiment show the effectiveness of this method.
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INTRODUCTION

Image compositing is now divided into two groups. One of them is to directly combine space images from the spatial collection. However, this method is not good at creating edges. Another thing is to combine images in the transition area. This approach can eliminate relevant effects and obtain similar results. Image fusion method based on MSD has attracted the attention of researchers in recent years. For example, methods based on discrete transitions, methods based on stationary transitions, methods based on two-way transition trees, methods based on curvelet transform, methods based on contour transform, contour-based methods without subsampling, etc.

The performance of the sticker directly affects the performance of the sticker feature. In the traditional MSDbased fusion method, a feature is usually used to define the characteristics of the image, such as image contrast for fusion, phase coherence and direction contrast for fusion of low-frequency sub-bands and high-

frequency subbands. strength. etc. To overcome this shortcoming, in our work, various aspects of the image are extracted and combined to obtain a better representation of the image.

LITERATURE REVIEW

Mahendra PS Kuber1 and Manish Dixit2 2014. Discussed here is a set of optimization technique related to brightness-preserving dynamic histogram equalization that uses statistical data from digital images for representation and action. Representing and processing images in spatial domain allows the technology to better resolve the error of grayscale values, thus improving performance. This algorithm is useful in improving image contrast and brightness control. Since some images are bad these algorithms are used to enhance the image to improve the quality of the image. Digital image processing is a broad topic that often involves mathematical techniques, but the basic idea behind DIP is very simple. The purpose of image processing is to use the information contained in the image to enable the system to understand, interpret and recognize the information possible from the image structure. Image enhancement can be used in many fields of science and engineering. Image quality is affected by external noise, environmental effects such as ambient pressure, temperature changes, as well as illumination. The method is developed to enhance the non-contrast image by expanding the histogram with appropriate dynamic range and multi-scale adaptive histogram equation. Different authors have proposed different methods such as histogram equalization, multi-point histogram equalization, and pixel-dependent contrast preservation, but all of these methods are substandard. Here, a brief review of various methods proposed in the image enhancement process is presented. Many papers have proposed a basis for enhancing different images based on histogram equalization.

Sandeep Singh, Sandeep Sharma 2014 suggested to focus on different image enhancement techniques. Image enhancement is considered one of the most important aspects of visualization because it can increase the visibility of images. Increases the visibility of negative images. So far, specific techniques have been proposed to improve digital image quality. To improve image quality, image enhancement can enhance certain features and limit certain information contained in input images. It is a visualization that reduces image distortion, removes artifacts, and preserves text. The aim is to present some characteristic images for research, conclusion and further use. The main purpose of this article is to find out the limitations of existing image enhancement techniques. Image enhancement often allows observers to analyze information in images and provide enhancement ideas for other image processing methods. The main purpose of image enhancement is to change the characteristics of the image to suit a particular task and inspector. During this process, one or more energy sources change. The choice of attributes and the way they change are determined for a task. Additionally, observer-determining factors such as the human visual system and observer experience may introduce more non-objective factors into the selection of enhanced images. There are many ways to enhance digital images without damaging them. The previous method has some problems, such as distortion of image content after development. Therefore, in order to eliminate this problem, the brightness and contrast of the V component of the input image are explained. The form of the nonlinear transfer function used to improve brightness is the same for each pixel. But not all images are equally lit, some areas will be dark and others will be bright. Therefore, local images should be taken into account when developing color images. To achieve this goal, the value of the image component in the HSV image space is first divided into small overlaps, and negative changes in each pixel are found to improve the brightness of the image. During the contrast enhancement process, the amount of enhancement for each pixel is calculated based on the position of the pixel itself and the pixel value surrounding it. The dynamic histogram normalization algorithm based on the histogram normalization (HS) method is proposed to improve contrast without losing real histogram features. To maintain accurate histogram features, DHS extracts different information from the input histogram. On the other hand, it also uses

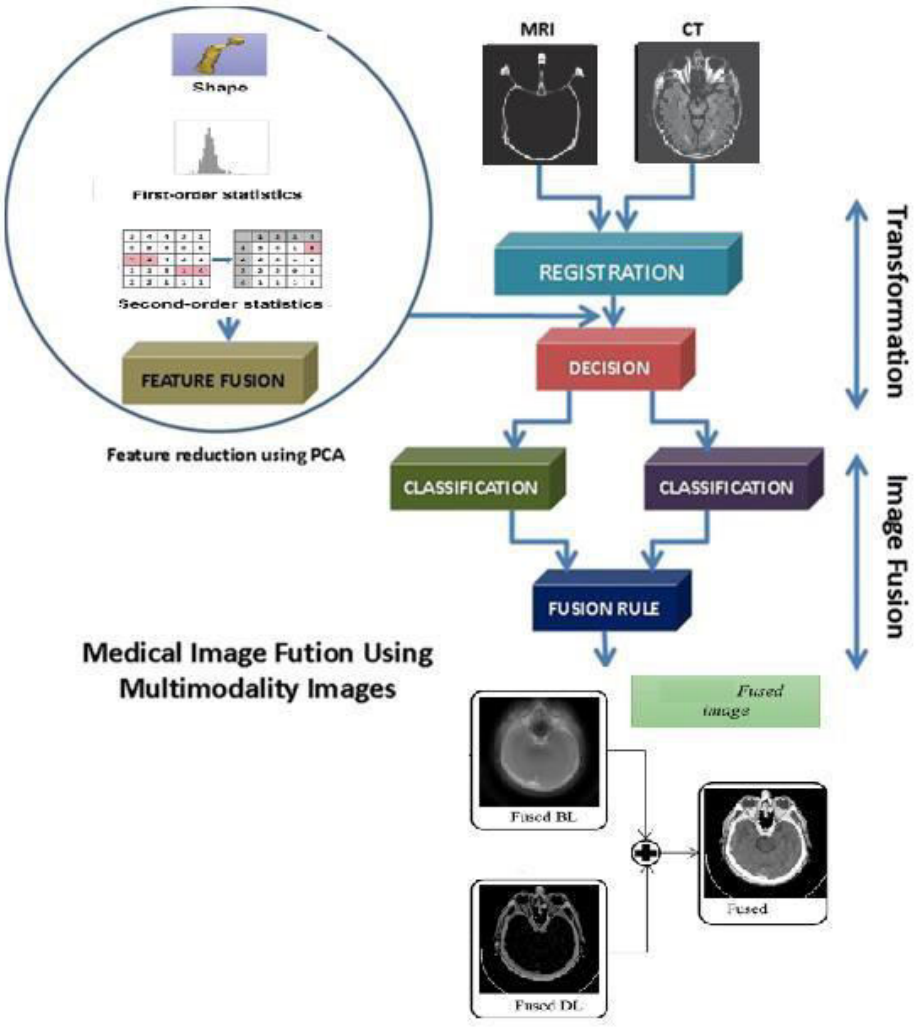
additional parameters to control the entire process and increase the control value, such as the DC frame. Flow chart:

METHODOLOGY

Collection of Data

The planning process improves detection accuracy: QWT is performed on each image to obtain low coefficients and high coefficients. Secondly, the weighted average fusion rule based on the phase and amplitude of the low frequency sub-bands and the spatial variance is proposed to fuse the low-frequency sub-bands. Secondly, the selection of maximum fusion rule based on comparison coefficient and power aims to fuse high-frequency subbands to achieve better analysis.

Block diagram:



Block diagram of Image fusion using hybrid methods in multimodality medical images

Take advantage of QWT's ability to capture phase and amplitude information from input images to efficiently combine additional information. Create new fusion rules and techniques to combine QWT coefficients between

input variables, preserving essential properties and details. Explore multi-scale, multi-channel QWT decomposition to improve fusion performance.

Advantages:

- High performance
- CNN increases accuracy by using tumor images.

Image Preprocessing:

Resizing and Cropping: Resize and crop images to standard or desired format. This can be done using techniques such as nearest neighbor, bilinear or bicubic interpolation. Custom colors are useful for applications or algorithms.

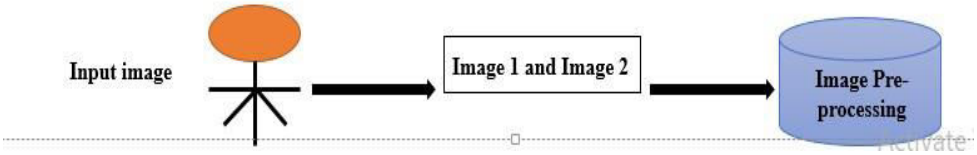
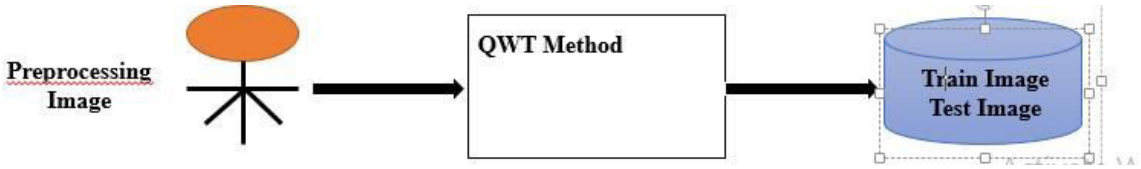


Image preprocessing

Quaternion representation of input images:

Input images from different modalities (e.g. visible and infrared) are first converted into quaternion representation. This representation places the image into a quadruple digital image and stores additional information from different models. Versatile display. QWT decomposition produces four sets of wavelet coefficients: one set of approximate coefficients and three sets of point coefficients (horizontal, vertical, and diagonal). Event creation:



RESULTS AND DISCUSSION

The final event will be created based on all classifications and predictions. The performance of this method is measured by some parameters such as

- PSNR
- SSIM
- MSE
- MAE
- Average Gradient
- Mutual Information
- Edge Intensity

6.1. Image selection:

A = imread(filename) reads the image from the specified file by filename and outputs the format according to the file content. If the filename consists of more than one image, imread reads the first image in the archive. imwrite(A, filename) writes image file A to the file specified by filename and extracts the file type from the file extension. imwrite creates a new file in the current folder. The bit depth of the output image A depends on the file type and file format. Upload or drag and drop images in various formats: JPG, PNG, JPEG, etc. Images are represented by dimensions (height and width) depending on the number of pixels. For example, if the image size is 500 x 400 (width x height), the total number of pixels in the image will be 200000. It is usually expressed in one of the following formats

Grayscale - A pixel is a number with a value between 0 and 255 (0 means completely black, 255 means completely white).

RGB: It consists of 3 numbers between 0 and 255 (these numbers represent the weight of red, green, and blue).

RGBA: Processing requires a series of operations on each pixel of the image. The image processor performs the first part of processing the image pixel by pixel. When it finishes, it starts the second task and so on. The output values of these functions can cover every pixel in the image. Success. Image preprocessing is a set of techniques used to improve the quality of digital images and extract relevant information from them before further analysis and processing by computer vision or machine learning algorithms. Image preprocessing prepares data for target workflows.

6. 2..1.Image processing:

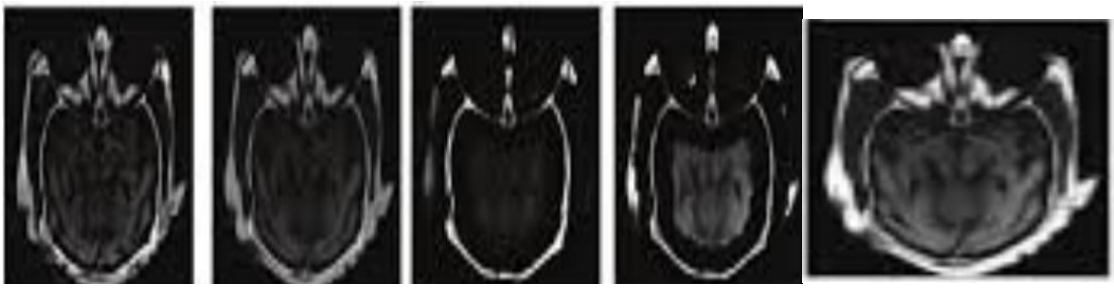
The main purpose of image processing is to reduce artifacts in the image and model the image in the database. Your prioritization needs depend on the methods and techniques used to obtain the data and your study objectives. Imaging is a layered technique used to process and analyze 2D images and 3D volumes. It is used in many sectors such as photography, medicine, robotics and remote sensing. Image processing tools allow you to enhance, filter, denoise, label and segment images and volumes. The main purpose of image processing is to reduce artifacts in the image and model the image in the database. Your prioritization needs depend on the methods and techniques used to obtain the data and your study objectives. Image processing is the process of converting images into digital form and doing some work to extract some important information from them. Most image processing methods treat all images as 2D markers while using some form of preprocessing problem.

6.3. Noise removal:

Wavelet based denoising is also a method to remove a lot of noise that is often present in images. Median filter is one of the most well-known products due to its performance for some noises such as Gaussian, Random and salt and pepper noise. Gaussian filter is a linear filter based on Gaussian function. However, average filter is a type of filter without a line. Eliminates noise while preserving edges. Deep convolutional neural networks (CNN) can remove Gaussian noise in some noises. Using Gaussian blur keeps the edges better but is slightly slower in the middle. Median filters are often used to reduce salt-and-pepper noise because average statistics are more robust and less sensitive to outliers than other statistical methods such as averages. Or the proce ss of combining multiple images into a composite image that combines the information contained in each image.

6.4. Image fusion QWT:

Benefits of image fusion include image sharpening, feature enhancement, improved classification, and creation of stereoscopic datasets. Multi-sensor image fusion has the advantages of multitasking, physical and physical properties, physical performance, reducing uncertainty and improving reliability. First, the spatial scale of the quaternion wavelet transforms in $L^2(R^2)$ and the orthonormal basis of the wavelet space are examined, and the quaternion wavelet and scale-based functions of the wavelet in the $L^2(R^2)$, spatial space are calculated. proven and ready to work.



Medical Image fusion based on QWT

Finally, quaternion wavelet transform was used to remove image noise within the framework of Bayes theory, the QWT coefficient-amplitude distribution was modeled using the generalized Gaussian distribution, and the purpose was achieved by recovering the original coefficients from the wavelet noise coefficients. represents noise. Experimental results show that our method not only outperforms many existing denoising methods in signal-tonoise ratio (PSNR) but also achieves better vision.

6.5. PSNR:

The term peak signal-to-noise ratio (PSNR) is an expression of the ratio of the maximum value (power) of the signal and the power of distortion noise that affects the quality of its representation. The PSNR module calculates the signal-to-noise ratio (in decibels) of two images. This ratio is used to measure the quality of original and compressed images. The higher the PSNR, the better the compressed or reconstructed image. PSNR calculates the PSNR ratio (in decibels) between two images. We often use this ratio to evaluate the quality of the original images and the resulting images. The higher the PSNR value, the better the output image. MSE is used to calculate PSNR. PSNR is used to calculate the ratio between maximum signal power and noise distortion that affects the quality of its representation. The ratio of two images is calculated in decibels. For most 8-bit images, the maximum value is 255 and the minimum value is 0.

The module then calculates the PSNR using the following formula:

6.6. SSIM:

A sign that has a significant impact on the PSNR value but a slight impact on the visual quality (such as a slight change in brightness, contrast, color and saturation). On the other hand, SSIM metric has better performance than PSNR. System Quality Benchmarking (SSIM) is a method for estimating the quality of television and video images, as well as other types of photos and videos. It is also used to measure the similarity between two images. The SSIM function calculates the similarity model for each pixel in the image based on its relationship to other pixels in the 11 × 11 space. This function returns this information as an image the same size as the image whose quality is to be measured.

6. 7.MSE:

MSE measures the mean square difference between actual and ideal pixel values. This metric is easy to calculate but will not be based on human perception of quality. Mean square error (MSE) and peak signal-to-noise ratio (PSNR) are used to compare image compression quality. MSE represents the squared error between the compressed image and the original image, while PSNR represents the measure of the error. MSE is a network operator. It measures the performance of the network in terms of mean squared error. The mean square error (MSE) or mean square deviation (MSD) of a forecaster (a technique for predicting the unobserved) measures the mean of the squared error, meaning the error between the forecast and the true value.

6.8. Image gradient:

Image gradient is the change in intensity or color in the image. The gradient of an image is one of the design elements of image processing. The average slope can be defined as what is called the ratio, which gives the average elevation drop per unit length of the river. It is calculated by dividing the difference between the elevation of the

source of the river and its end (junction or mouth) by the total length of the river or stream. Effectively use techniques such as deep learning-based CNN models to capture different images, data, and different points. Look for specific options and size reductions to identify the most common and discriminatory points. Develop powerful analysis algorithms including classification, anomaly detection and decision support. Image synthesis is an important area of decision-making research that aims to overcome the problems associated with obtaining multiple images that will be useful in treatment. This approach has proven useful in predicting the need for follow -up changes in the most common medical imaging modalities, such as computed tomography (CT), magnetic resonance imaging (MRI), and positron tomography (PET). However, problems occur in the conversion of the two measurement systems due to complexity and lack of record lines.

6.9. Mutual information:

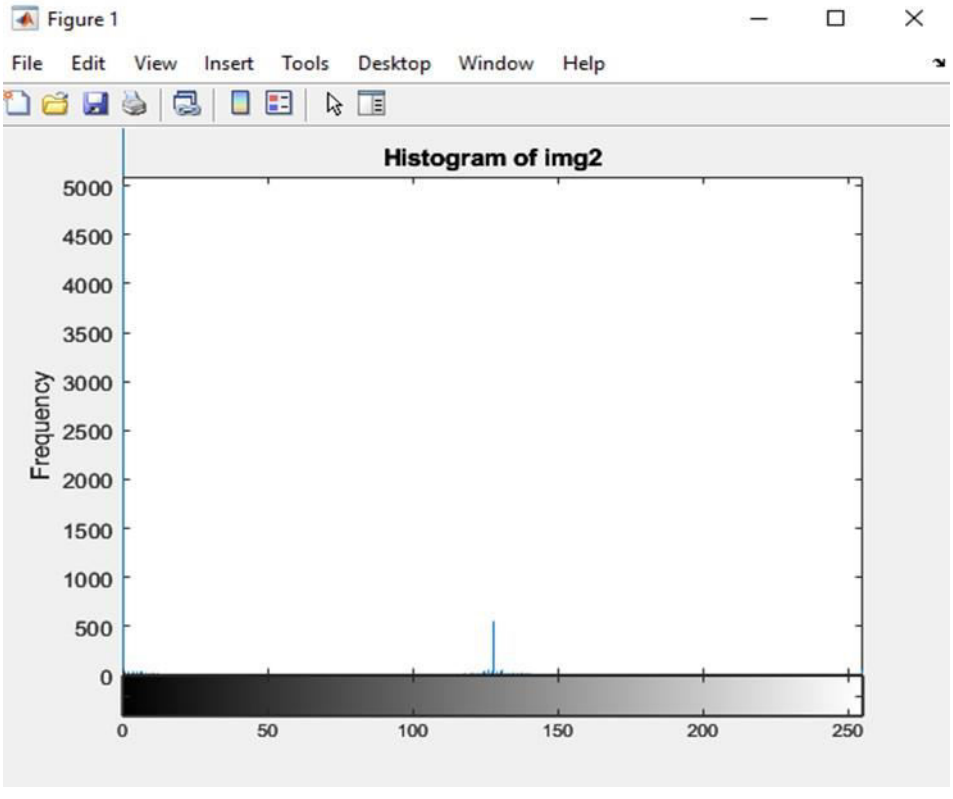
The symbols in both images are the same. It measures the ability to predict the signal in the second image, given the signal strength in the first image. Data integration processes images based on a single direction or distribution of a single point. Our RMI formulation first reframes the problem by treating each image as a distribution of multidimensional points, where each point represents a pixel and its neighbors, as shown in the Figure photograph. Mutual information is a measure of the relationship between two variables at the same time. Specifically, it measures how much information is transferred in one variable from another variable, namely the average.

6.10. Edge:

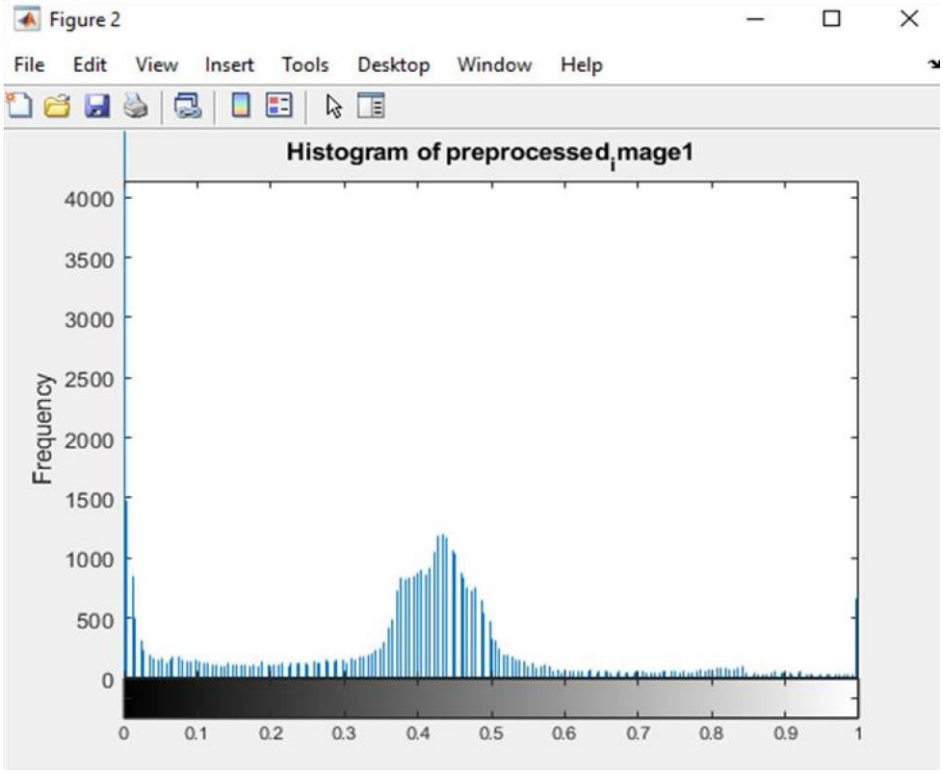
An edge usually occurs at the border of two regions.

6.10.1. Edge detection:

Edge detection is an imaging technique used to find the edges of objects in an image. It works by detecting irregularities in brightness. The edge intensity [%] of the line scan signal is determined by the illumination and imaging area w. Even in good lighting, the signal amplitude decreases towards the end of the line. A smooth and sharp focus was created by applying a negative mask to the bottom part of the image.



Analysis of cause within wireless network technology involves investigating the underlying reasons for performance issues or failures. It examines factors like signal interference, hardware malfunctions, and network congestion that can impact connectivity and efficiency. By delving into these causes, solutions can be developed to enhance reliability and optimize network performance.



CONCLUSION

A new image fusion method using QWT and various features is proposed. Compared with traditional MSD tools, QWT can provide rich information and phase information, willing to estimate translation parameters and limitations. Different from the traditional fusion method, which uses one feature as the phase measurement of low-frequency coefficients, we combine the amplitude, phase, and spatial variance of low-frequency coefficients into a single expansion based on the level measurement of low-frequency coefficients., the ratio and strength of the high frequency coefficients along with the frequency coefficients in another combination as a measure of the activity level for the High coefficients. Both of these features are reliable and powerful in terms of image compositing. Finally, experimental results show that the method is effective in various image fusion.

ETHICAL DECLARATION

Conflict of interest: No declaration required. **Financing:** No reporting required. **Peer review:** Double anonymous peer review.

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