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Image Fusion Algorithm Based on Multi-Focus Image Fusion Using a Guided-Filter-Based Images

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Abstract:- The image data are obtained by a variety of multimedia, information equipment, which include amount of information, extensive coverage, and redundancy in ubiquitous computing paradigm. In order to make use of these information reasonably and efficiently, it is necessary to fuse such massive data, therefore the multi-sensor image information fusion become a key technology to ubiquitous computing. In the new approach, fuzzy theories have advantages such as: easy to understand, incorporation of flexible and non-accurate data, as well as expert knowledge and natural language. Fuzzy neural network system developed by us has used multi-sensor image fusion, proved that the fusion is fast, effective, good, and can meet the real-time requirements of ubiquitous computing.

Keyword: Ubiquitous computing, neural network, Image data fusion, Fuzzy theory.

I. INTRODUCTION

In computer vision applications, one of the challenging problems is the combining of relevant information from various images of the same scene without introducing artifacts in the resultant image. Since images are captured by the use of different devices which may have different sensors. Because of the different types of sensors [1] used in image capturing devices and their principle of sensing and also, due to the limited depth of focus of optical lenses used in camera, it is possible to get several images of the same scene producing different information. Therefore, combining the different information from several images to get a new improved composite image becomes important area of research. Image fusion applications are found in diverse areas including medical imaging, remote sensing, forensic science, surveillance etc. Various spatial domain and frequency domain based image fusion methods have been proposed in literature. Some of the spatial domain methods are Arithmetic Averaging, Principal Component Analysis (PCA), and Sharpness criteria based fusion.

However, spatial domain based image fusion techniques often produce poor results because they usually produce spectral distortions in the fused image. With the improvement image fusion methods are regularly being proposed that address with the particular problems with the standard techniques.

BASIC METHODS OF IMAGE DATA FUSION

The images get in the environment of ubiquitous computing, because of the complexity and their stronger relationship of image information itself, incomplete and inaccuracy, unstructured as well as difficulties in modelling will occur at all layers of the process of image fusion. Artificial intelligence applies to image pervasive fusion, with the better results than traditional methods of calculation (that is, the use of precise, fixed and unchanging algorithm to express and solve the problem), can integrated with their respective advantages, compose intelligent fusion system, expand their original function. Therefore, it is a pervasive image fusion method with huge potential, the main intelligent methods as follows:-

NEURAL NETWORK

In recent years, neural network theory is a cutting-edge research field in artificial intelligence, suitable for non-linear modelling, with self-learning, self-organization, adaptive capacity, and higher accuracy, have good generality and flexibility for different object modelling, but the structure is complicated, not suitable as the steady-state model of optimization method for complex systems.

FUZZY THEORY

In recent years, fuzzy theory has begun to apply to the field of data fusion, because fuzzy theory provides an effective methods to express uncertainty and inaccuracy of in-formation, thus can establish the corresponding mathematical model to a lot of uncertainty data in data fusion issues; Meanwhile, fuzzy set theory can deal with knowledge digitally, with a way similar to the thinking of people to construct knowledge, therefore, it has a advantage of computing with clear and easy to understand.

ROUGH SET THEORY

Rough set theory has not only provided new scientific logic and research methods for the information science and cognitive science, but also provided an effective treatment technology to intelligent information processing. Rough set theory has abilities of analyzing, reasoning for incomplete data, and finding the intrinsic relationship between the

data extracting useful features and simplifying the information processing, so the using of rough set theory on the image fusion is a subject worth exploring.

IMAGE FUSION CATEGORIES

Image fusion methods can be grouped into three categories: Pixel or sensor level, feature level and decision level [10].

Pixel Level

Pixel-level pixels are followed by source picture information / feature extraction in pixel level fusion. To implement pixel level fusion, arithmetic operations are widely used in time domain and frequency changes are used in the frequency domain. The main goal of pixel level fusion is to increase raw input images and with more useful information than the input image.

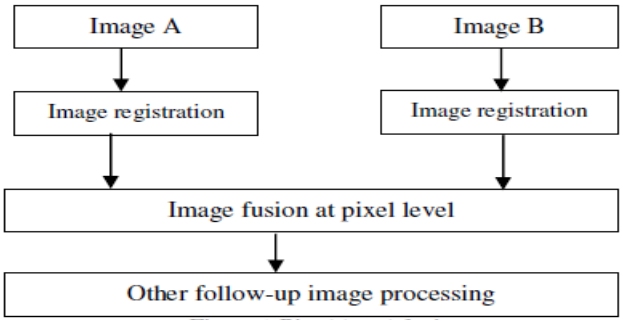

Figure 1: Pixel level fusion

Feature Level

In Feature Level Fusion, information is extracted individually from each image source, then fuse is done on the basis of the input image features. Generally, feature detection is achieved through the Edge Detection Algorithm, Artificial Neural Network and Knowledge Based Approach. Feature level fusion is effective for raw images with unbalanced quality levels. For this, both physical channels require effective algorithm extraction algorithms.

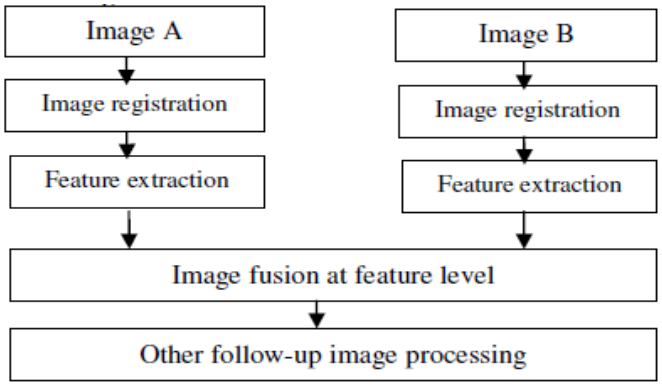

Figure 2: Feature level fusion

Decision Level

Fusion information in decision-level is removed separately from each source image and then decisions are made for each input or source channel. Finally, these decisions are made to produce the final decision or image. The decision-level fusion is effective for complex systems with many true or false decisions but is not suitable for normal applications.

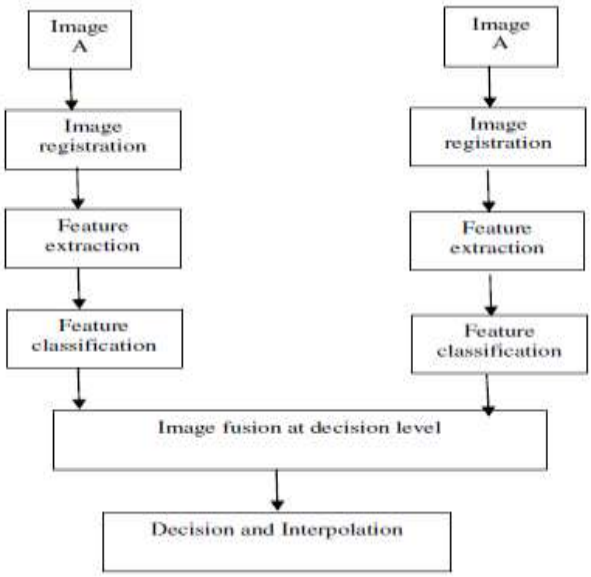

Figure 3: Decision level Fusion

Frequency domain methods

Methods of Frequency Domains initially disintegrate input images into multi-scale coefficients. Thereafter, different fusion rules are employed for selection or manipulation of these coefficients, which are later synthesized through inverted conversions that form a fused image. The required attribute of frequency domain methods is to avoid the blocking effect in images.

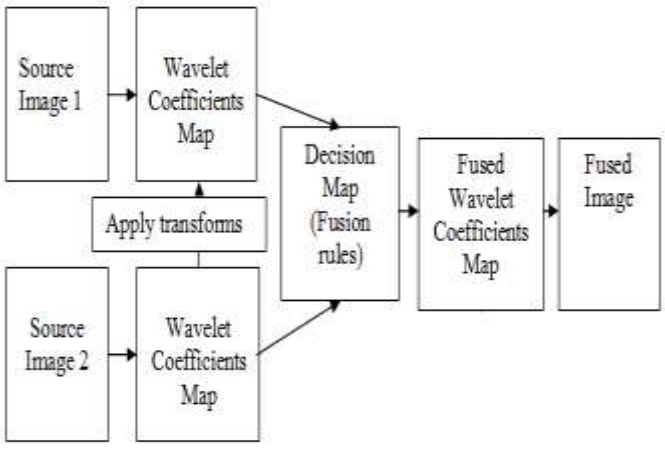

Fig.4. Frequency domain image fusion process

Spatial Domain Methods

The spatial domain fusion method works directly on the source images, weighted average is one of the simplest spatial domain methods, which do not require any changes or decomposition on the original images.

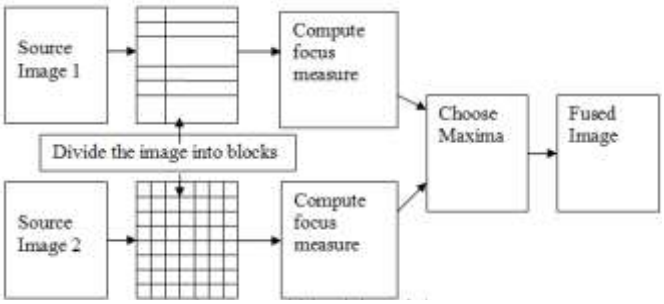

Fig.5. Spatial domain image fusion process

This method is beneficial because it is simple and fit for real-time processing. The spatial domain improves the block by calculating the degree of focus for each pixel and using various focus measures.

Note: Guided Image Filtering Theory Guided filters have been successfully employed in many image processing applications, especially in image fusion. Some image fusion methods with guided filters have obtained positive results. A guided filter is applied to optimize the fusion weight map in these existing methods.

II. LITERATURE SURVEY

Pixel-level image fusion scheme based on steerable pyramid wavelet transform using absolute maximum selection fusion rule

In this paper Author conclude that when images are free from any noise and other when they are corrupted with zero mean white Gaussian noise. From experiments, we observed that the proposed method performs better in all of the cases. The Performance is evaluated on the basis of qualitative and quantitative criteria. The main reasons to use steerable pyramid wavelet transform in image fusion are its shift invariance and rotation invariance nature.

Optimization of Image Fusion Using Genetic Algorithms and Discrete Wavelet Transform

In this paper Author conclude that a pair of "parent" solutions is selected for breeding from the previous selection pool. A new solution is created by producing a "child" solution using crossover and/or mutation. New candidate solutions are selected and the process continues until a new population of suitable size solutions is produced. The given technique is more accurate and improves the aspect of loss of information which is the fault of many other techniques. When DWT_IF incorporates efficiency from the feature extraction technique and PLGA_IF, the results improve the accuracy of the fused image, which can be beneficial for weather forecasting.

Focus Measure of Light Field image using Modified-Laplacian and Weighted Harmonic Variance

In this paper Author conclude that focus measure of light field image for different focal image fusion. We apply sum modified- Laplacian and weighted harmonic mean of variance algorithms. SML is a process to select the proper feature for region detection. While WHV algorithm decomposes in focused regions, then defocused and blurred parts will be omitted. Eventually, an all-focused image can be reconstructed. Based on the experiment results, we can analyze that the proposed method has more efficiently than other comparative methods.

Multi-focus Image Fusion Based on Image Decomposition and Quad Tree Decomposition

In this paper Author conclude that a novel multi-focus image fusion method is proposed to enhance the validity of focused regions extraction and blocking artifacts inhibition. The qualitative and quantitative evaluations have demonstrated that the proposed method can produce better fused image and significantly inhibit the blocking artifacts. But the proposed method is time-consuming for the computation of total EOG. In the future, we will consider optimizing the proposed method to reduce the computational cost and extending the developed method to the fusion of medical images.

Multi-Focus Image Fusion through Gradient-Based Decision Map Construction and Mathematical Morphology

In this letter the author concludes that a novel algorithm for multi-focus image fusion through gradient-based decision-making maps and mathematical morphology. The contributions of this letter are: (1) On the basis of the image gradient, a weighted kernel is proposed to measure the focus areas; (2) Limitations between Focus and Defocus areas allow for morphological operation and free boundary conditions.

III. PROBLEM IDENTIFICATION

Initially, image fusion can be defined as a combination of images from different sources (image sensors and cameras) aimed to obtain more informative or a more precise knowledge of the image. The main requirement of the fusion process is to identify the most important features in the input images and transfer them to the fuse image without loss in detail. Depending on the different areas of applications, we have different objectives and objectives for using image fusion: 1. Reducing noise, in the signal-to-noise ratio (SNR) by the average pixel values on many images to improve; 2. Improving spatial resolution

(super resolution); 3. Extension of local domains, such as mosaic algorithm.

IV. Conclusion

After reading number of research papers Authors conclude that, the object of image fusion is to obtain a better visual understanding of certain phenomena, and to introduce or enhance intelligence and system control functions. Many advantages of multi sensory data fusion such as improved system performance (improved detection, tracking and identification, improved situation assessment, and awareness), improved robustness (lessens or redundancy and graceful degradation), improved spatial and temporal coverage, shorter response time, and reduced communication and computing, can be achieved. The extent of the visual information contained in the input images that is preserved in the fused image is also a significant measurement of the image fusion performance.

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