

Survey on Multifocus Image Fusion using Fuzzy logic

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Abstract- *The information extraction process of image, for example image taken from precise camera, is full of complexities and noises. As a result, cost spends on such processing like time and assets is high, particularly for large and complex amount of information.[1] The fusion of images is the process of merging two or more images into a single image preserving significant features from each. The result of fused image is a single image which is highly appropriate for person and machine observation or further image-processing missions. In this paper, we are going to extract image from two or more images. The proposed fusion technique are based on Fuzzy logic that allows the problems to be solved in linguistic terms. This method is different from traditional image fusion methods and eventuate the best results by using intelligent algorithms. It can provide number of possible result.[2]*

Keywords- Image Fusion, pixel level, fuzzy logic, multifocus

I. INTRODUCTION

Image fusion combines registered image to make a high quality fused image with spatial and spectral information. Multi-focus image fusion is a sub-field of image processing techniques in which the images of the same scene, taken by the same sensor, are combined to create a fully sharp and in-focus image. Image fusion has many important applications such as digital auto-focusing, microscopic imaging, remote sensing, and medical imaging, Weather forecasting and biometric images.[3]

Image fusion methods are classified under two groups:

1.Spatial domain fusion method 2.Transform domain fusion.

Spatial domain straight-forward works with the pixel values. To get the appropriate result, pixel values are manipulated. It is modifying or changing an image representing an object in space to further improve the image for a given application. Pixel level algorithms that fall under Spatial domain are Simple maximum, Simple minimum, Averaging, Intensity-hue-saturation(IHS) transform, Principal component analysis (PCA). In frequency domain methods, image is initially transferred into frequency domain in order to calculate Fourier transform followed by applying inverse

fourier transform to produce resultant image. For identifying salient features, the transformed coefficients, each matches to a transform basis of image that are recognized. As a result, as stated in the information specified by transformed coefficients, it can decide the appropriate data provided from the source images to develop the final fused image. Types of Transform domain methods include Wavelet transform, Curvelet transform, Contourlet Transform, Nonsubsampled Contourlet Transform. Fuzzy logic is widely applied techniques as it allows the problems to be solved in linguistic term. The fuzzy sets and fuzzy membership functions are required for system implementation was carried out considering that the input image and the output image obtained after defuzzification are both 8-bit quantized; this way, their gray levels are always between 0 and 255. The original image in the gray level plane is subjected to fuzzification and the modification of membership functions is carried out in the membership plane. The result is the output image obtained after the defuzzification process.[2]

II. PIXEL BASED IMAGE FUSION

Image fusion is generally performed at three different levels of information representation, including pixel-level, feature-level and decision-level. This paper aims to suggest some ways to improve the pixel-level image fusion methods. In the pixel-level image fusion, the fusion takes place directly at the pixel level. In this method, the mean of the corresponding pixel values of the two registered images is calculated and taken as the corresponding pixel value of the fused image. Advantages of pixel level are that the original measured quantities are directly involved in image fusion process. Feature level fusion image fusions require the extraction of different features from the source data before features are merged together. Decision level image fusion involves sensor fusion and these fusions combine the clarification of the source images generated after image understanding.[3]

Fusion process at pixel-level performed by correlation of pixel and fusion straight on the situation that images are precisely recorded first. Pixel-level fusion is handle in the duration of image pre-processing and therefore the signal to noise ratio (SNR) and signal's sensitivity is much

better in this method. Intention is to generate a simple image with greater information. Pixel-level is also called as a low level fusion. Registration of original images is necessary before fusing the images. Check whether images resolution is dissimilar, then the process of image mapping is necessary.

III. IMAGE FUSION BASED ON FUZZY LOGIC

Fuzzy image processing is not a unique theory. It is a collection different fuzzy approaches that understand, represent and process the images, their segments and features as fuzzy sets. The representation and processing depend on the selected fuzzy technique and on the problem to be solved. Fuzzy logic derives from the fact that most modes of human reasoning and especially commonsense reasoning are approximate in nature. It allows computerized devices to reason more like humans. The fuzzy inference process can formulate the mapping from the inputs to the output using the

membership functions, fuzzy logic operation and fuzzy control rules.[4]

Fuzzy set is a class of object grade of membership function. Fuzzy set represents spatial information in images along with its imprecision. Membership function that represents a graphical method. Participation of each input in the input space. Input space refer to universe discourse (or) set universal. MF's assign to each object a grade of membership ranging between [0,1]. Fuzzy logic operations are performed in Boolean operation (AND, OR, NOT). Fuzzy control rules are used to IF-then rules. Fuzzy inference process uses two main methods, which are Mamdani and Sugeno. Mamdani fuzzy inference systems require the output membership functions are fuzzy sets and this requires defuzzification. The Sugeno inference system uses the output Membership function's that is either constant or linear and this avoids the need for Defuzzification.[3]

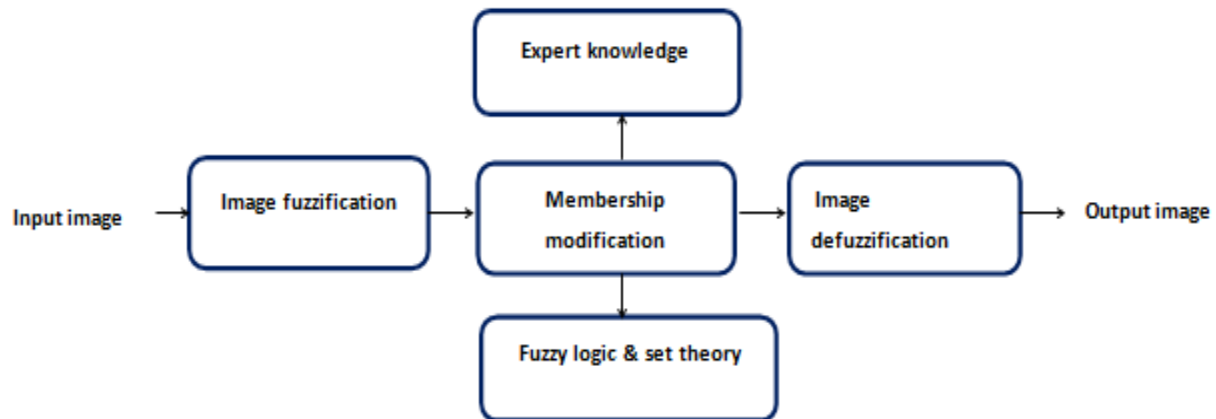


Fig: The general structure of the fuzzy image processing[2]

Fuzzy process involves 3 main steps: Fuzzification, rules based on inference system and Defuzzification.

Fuzzification: The procedure that converts crisp numerical input values into linguistic variables is referred to as Fuzzification.

Rules: if -then rules

Defuzzification: This process of producing a crisp output from the fuzzy response, the Defuzzifier is the aggregate output fuzzy set that covers a set of output values. [2]

IV. CONCLUSION

There are a large number of applications in remote sensing that require images with both spatial and spectral resolution. In this paper, the potentials of pixel level image fusion using fuzzy logic approach has been explored. Fused images are primarily used to human observers for viewing or

interpretation and to be further processed by a computer using different image processing techniques. The proposed fuzzy approach performs better than the other simulated pixel-level methods. This fuzzy method can further be improved and optimized by using other computational intelligence-based and soft computing algorithms such as neuro-fuzzy systems to decrease the possibility of errors. So, the use of such methods for multifocus image fusion will be examined in the future activities of this research.

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