International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878, Volume-8 Issue-3, September 2019

Statistical Testing of Different Fusion Techniques on MRI & CT Images

A Somasekhar, P Subbaiah

Abstract: ***Image fusion unites data from various modalities of identical prospect in to a single data retaining the significant and necessary features from each of the unique image. These days, with the hasty progress in high end technologies with contemporary instruments, has turn out to be a essential factor of a outsized numeral of applications, plus analysis, examine, and handling. Image fusion on medical field is the initiative progress of the picture substance by integrating data took from dissimilar picture tools like CT, MRI. MRI gives enhanced data on malleable hankie with lot of misrepresentation. But, one sort of picture might not be adequate to afford precise scientific necessities for the physicians. Therefore, the fusion of the different medicinal pictures is essential. In this work Static analysis of diverse fusion techniques are done with the help of parameters like Mean, Entropy, Correlation coefficient, Standard deviation, and covariance.***

Keywords **: *Fusion, MRI, CT, Mean, Entropy, Correlation Coefficient, Standard Deviation, Covariance.***

I. INTRODUCTION

Image fusion is needed for superior identification and apparent explanation of the received data from different multimodality sensors. Fusion technique is a well-liked method used for medicinal verdict and handling. Fusion has to be the progression of adding data from more pictures of a scene to a lone data. The incorporated data has additional instructive for rationalization and then study. It feasible with numerous pictures of identical scene offer diverse data on dissimilar motion and screening perspective, to unite the dissimilar data and getting a novel and enhanced picture with a fusion practice. Fused data can be produced by adding data from several modalities [2] such as MRI, CT. In medicinal CT scan and MRI from the brain of the alike patient. The CT pictures are worn extra to detect hankie compactness whereas MRI pictures were frequently worn to smudge brain tumors. Initially functional picture showing the brain movement whereas the subsequently gives anatomical data exclusive of functional activity, By adding CT picture and MRI picture the anatomical data showcase the brain action.

Manuscript published on 30 September 2019
* Correspondence Author
A Somasekhar*, Research Scholar, Rayalaseema University, Kurnool, A.P, India.
P Subbaiah, Professor, Nalla Narasimhareddy College of Engineering, Hyderabad, Telangana, India.

MRI: It is a medicinal picture practice worn in radiology to envision in depth inner structures of organs. MRI provides fine contrast among the various spongy organs of the corpse, which makes it mainly helpful in analyzing the brain, muscles, the heart, and cancers.

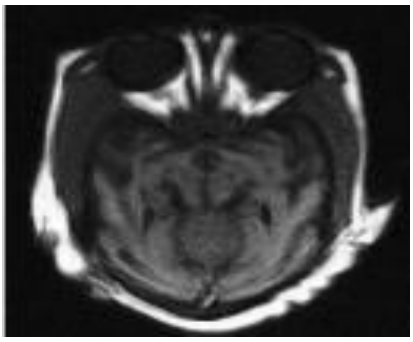

Fig.1 MRI Image

CT: Computed Tomography scans are a specific type of x-ray. It is very fine at imaging bone structures. It is limited in pulp contrast, looked-for differentiate tumors from blemish hankie or abnormalities of the central nervous system (CNS) that have meager hankie discrimination on CT pictures

Fig.2 CT image

Wavelets based image Fusion

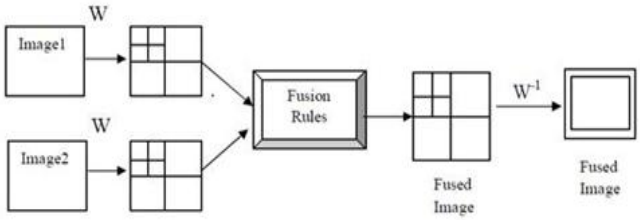

Fig.3 Wavelet based image fusion

II. TYPES OF WAVELETS

Haar: Decomposition is completed by preliminary a lone dimensional alteration on each row followed by a one dimensional alteration of each column. By averaging the coefficients of altered images image fusion is conceded out. Reverse transform is applied to get fused image at the end.
Advantage: Signals which are having sudden transitions are analyzed easily with the help of this transform.
Disadvantage: It is not differentiable because signal is not continuous.
Daubechies: The db2 can be decomposed to size of the image based on the n level. Daubechies wavelets are allied to the kind of ortho wavelets and they are Asymmetric in nature.
Advantage: Different image resolutions are able to manage with this transform.
Disadvantage: Wavelet coefficient values alone are considered.
Coiflets: Coiflet wavelets are getting by imposing varnishing moment form on both scaling and wavelet functions and in that way inducing more coefficients
Advantage: It is having maximum number of vanishing moments and are having closely symmetric graphs
Disadvantage: There is no any formula for arbitrary genus and there is no formal proof of their existence for arbitrary genus at this time.
Symlets: It is the short of Symmetric wavelet. Symlet Wavelets are very much similar to the Daubechies wavelets except the only difference being the vanishing moments of the wavelets function. Thus the wavelet coefficients differ than that of the Daubechies.
Advantage: it has the low asymmetry and having more of vanish moments for a given compact support.
Disadvantage: These are not perfectly symmetrical.
Dual Tree complex Wavelet Transform: A transform which attempts to a way of avoiding the Shortcomings of wavelet transforms are the DTCWT.
Advantage: flexibility of this method is more, visibility of image is better and time variant is reduced.
Disadvantage: Artifacts like Aliasing is introduced.

III. IMAGE EMINENCE METRICS & RESULT DISCUSSION

It is attributing of a picture that dealings the apparent picture deprivation. The fusion algorithm brings in a little value of misrepresentation or artifact in the gesture, so the feature assessment is a vital crisis.
Mean: mean is classified as spatial filtering and used for noise reduction

$$f(x,y) = \frac{1}{mn}\sum_{r,c\in W} g(r,c)$$

Where 'g' is noise of the picture, f(x,y) is the restored data, and 'r' and 'c' are the coordinates of the row and column correspondingly, within a size of window 'W'.
Entropy: It is one of the fundamental image eminence key to assess the data substance in an picture.

$$E = -\sum_{i=0}^{N} p(x_i)\log p(x_i)$$

Where x_i is the gray level value at i^{th} pixel with corresponding probability '*p*'. The entropy value is larger for images containing more the information.
Covariance: Covariance is a appraise of the extent to which analogous elements from two sets of ordered data move in the alike direction

$$COV(X,Y) = \frac{\sum_{i=1}^{n}(X_i-\bar{X})(Y_i-\bar{Y})}{(n-1)}$$

Correlation Coefficient (CC) : The correlation scale determines the amount of the connection between two variables and always the value of the correlation coefficient between -1 and +1.
Standard Deviation (SD): it is the square root of variance, reflects the stretch in the information. Thus, a soaring distinction picture had a better variance; low variance image had a low contrast

$$\sigma = \sqrt{\sum_{i=1}^{M}\sum_{j=1}^{N}(I(i,j)-M)^2}$$

Table.1 Statistical Parameter Analysis on Different Fusion Techniques

Parameter / Method	Mean	Entropy	Standard Deviation	Correlation Coefficient	Covariance
Haar	65.5	6.94	57.9	0.28	7.22
Daubechies	81.1	6.94	95.5	.10	9.96
Coiflets	75.2	7.0	64.6	0.81	8.96
Symlets	65.6	6.98	60.17	0.31	6.79
DTCWT	37.1	6.36	45.10	0.32	4.04

On By observing the table and graphical representation, fused image which is having large entropy value containing more the information, Images which are having large standard deviation, would have high contrast. if correlation coefficient value close to +1,indicates input image and output images are very similar that means the output image contains maximum of the input image data and if correlation coefficient value is -1 indicates high dissimilar.

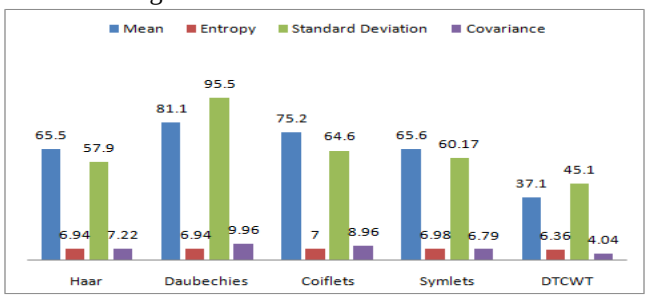

Fig.4 Graphical representation of statistical Analysis of Various methods

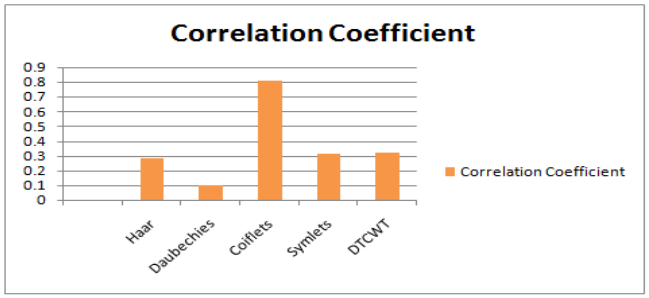

Fig.5 Graphical representation of statistical Analysis of Various methods

IV. CONCLUSION

In lots of vital applications, pictures having edges and discontinuities across curves. In organic metaphors, it is happens each time two organs or hankie structures congregate up. To attain the significant attributes of the images of frequent features, image fusion is usually used technology. Particularly in picture fusion the edging perpetuation is significant in getting the analogous particulars of the key in metaphors. Fusion on images has expansive series of applications in image processing. It boosts the eminence of pictures by fusing loads of metaphors of meager eminence.

REFERENCES

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing (2nd Edition). Prentice Hall, January 2002.
2. S. G. Mallat, "A theory for multiresolution signal decomposition: the wavelet representation," vol. 11, pp. 674–693, July 1989.
3. J. M. Shapiro, "Embedded image coding using zerotrees of wavelet coefficients," vol. 41, pp. 3445–3462, Dec. 1993.
4. A. Said and W. A. Pearlman, "A new, fast, and efficient image codec based on set partitioning in hierarchical trees," vol. 6, pp. 243–250, June 1996.
5. D. Taubman, "High performance scalable image compression with ebcot," in Proc. International Conference on Image Processing ICIP 99, vol. 3, pp. 344–348, Oct. 24–28, 1999.
6. Y.-S. Zhang, "Multiresolution analysis for image by generalized 2-d wavelets," Master's thesis, 2008.
7. I. Daubechies, Ten lectures on wavelets, vol. 61 of CBMS-NSF Regional Conference Series in Applied Mathematics. Philadelphia, PA: Society for Industrial and Applied Mathematics (SIAM), 1992.
8. S. Mallat, A Wavelet Tour of Signal Processing, 3rd ed., Third Edition: The Sparse Way. Academic Press, 3 ed., December 2008.
9. I. Daubechies, "Orthonormal bases of compactly supported wavelets," Communications on Pure and Applied Mathematics, vol. 41, no. 7, pp. 909–996, 1988.
10. P.-S. T. Tinku Acharya, JPEG2000 Standard for Image Compression, ch. Coding Algorithms in JPEG2000, pp. 163–196. 2005.