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WAVELET TRANSFORM-BASED MEDICAL IMAGE INTEGRATION

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The term "image fusion" is used to describe the method of integrating the data from many pictures into a single composite one. The combined picture is richer in detail than any of the originals. In this work, we use PCA fusion approaches based on the Wavelet Transform (WT) to combine two medical pictures. When two imaging modalities, such as MRI and CT, are fused together of the same organ, a more complete picture of that organ may be obtained for diagnostic purposes.

Keywords: DWT, Bi-cubic Interpolation, PCA Fusion Techniques

Introduction-T The wavelet transform is a two-dimensional method for characterizing an image's structure; it offers multiresolution, sparse resolution, and other benefits. The magnitude it conveys is also very resistant to transformations. Bi-cubic interpolation is a mathematical technique for fusing pictures that builds on cubic interpolation. The coefficients of a discrete wavelet transform are used to represent a signal in the time frequency domain. Two scale signal decomposition is used to guarantee that high and low frequency disturbances are removed. Wavelet analysis

The final product is a pair of decomposed signals at two distinct resolutions. Where f is the sample frequency of the time domain signal, the frequency ranges for the first and second scaled signals are (f/2-f/4) and (f/4-f/8) correspondingly.

i-cubic Interpolation- In mathematics, bicubic interpolation is an extension of cubic interpolation for interpolating data points on a two dimensional regular grid. The interpolated surface is s moother than corresponding surfaces obtained by bilinear interpolation or nearest-neighbor interpolation.Bicubic interpolation can be accomplished using either Lagrange nterpolation for interpolating data points on a twopolynomials, cubic splines,or cubic
mensional regular grid. The interpolated surface is smoother than corresponding surfaces obtained bybilinear interpolation or nearest-neighbor interpolation. Bicubic interpolation can be accomplished using Lagrange polynomials, cubic splines, or cubic convolution algorithm. In image processing, bi-cubic interpolation is often chosen over bilinear interpolation or nearest neighbor in image resampling, when speed is not an issue. PCA isa mathematical tool which transforms a number of correlated variables into a number of uncorrelatedvariables. In this project PCA fusion technique isused to fused the two or more images.

Discrete Wavelet Transform-

Principle Component Analysis (PCA) Fusion-

It is a mathematical tool from applied linear algebra
.It is a simple non-parametric method of extracting relevant information from confusing data sets. PCA is a useful statistical technique that has found application in fields such as face recognition and image compression, and is a common technique for finding patterns in data of high dimension. The

origins of PCA lie in multivariate data analysis, it has a wide range of other applications PCA has been called, 'one of the most important results from applied linear algebra and perhaps its most common use is as the first step in trying to analyses large data sets. In general terms, PCA uses a vector space transform to reduce the dimensionality of large data sets. Using mathematical projection, the original data set, which may have involved many variables, can often be interpreted in just a few variables (the principal components).

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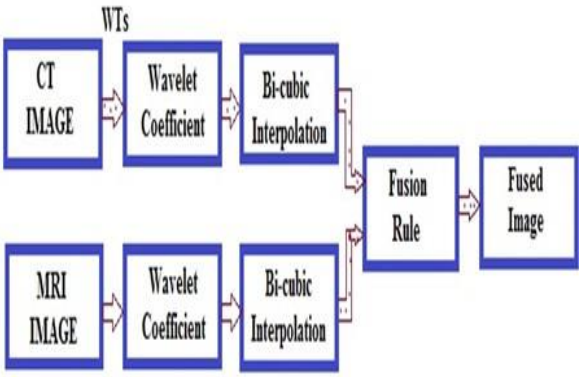


formulation of PCA- Let us consider X be a d- dimensional random vector and assume it to have zero empirical mean. The orthonormal projection matrix V would be such that Y=VTX with thefollowing constraints. The covariance of Y, i.e., cov(Y) is a diagonal and inverse of V is equivalent toits transpose (V-1=VT). Using Matrix Algebra,**Fig: 1 image fusion process**

Proposed Methodology- In the proposed method noise is removed from medical images using combination of wavelet transform and bicubic interpolation. First the medical images are taken asthe input and wavelet transform and bicubic interpolation technique are applied to the input image. And then the output of this transform is applied as a input to the PCA fusion technique. Andwe get the output enhanced image and more informative images as compare to the input images

$$\text{cov}(Y) = E\{YY^T\}$$
$$\text{cov}(Y) = E\{(XV^T)(V^TX)^T\}$$
$$\text{cov}(Y) = E\{(XV^T)(VX^T)\}$$
$$\text{cov}(Y) = V^T\text{conv}(X)V$$

Multiplying both sides of equation (4) by V, we get,

$$\text{Vocv}(Y) = VV_T\,\text{conv}(X)V = \text{conv}(X)V$$

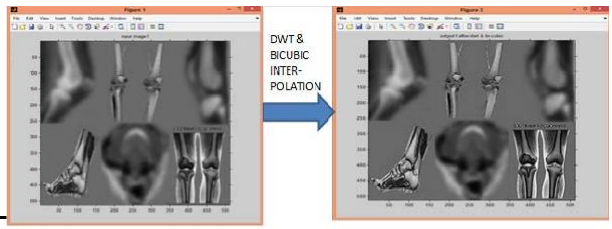
Substituting equation (4) into the equation (5) gives,

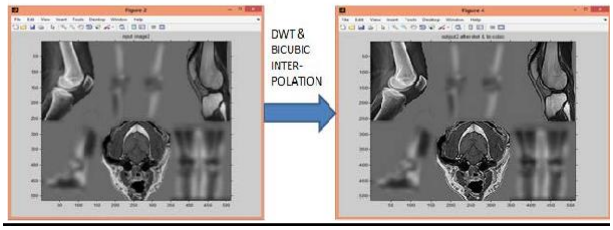
$$[\lambda_1 V_1, \lambda_2 V_2 \ldots\ldots, \lambda_d V_d]$$
$$= [\text{conv}(X)V_1, \text{Cov}(X)V_2, \text{cov}(X)V_d]$$

This could be rewritten asb

$$\lambda_i\, Vi = \text{cov}(X)\, Vi$$

Where, i =1, 2, ... , d and Vi is an eigenvector of cov(X).





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Results-

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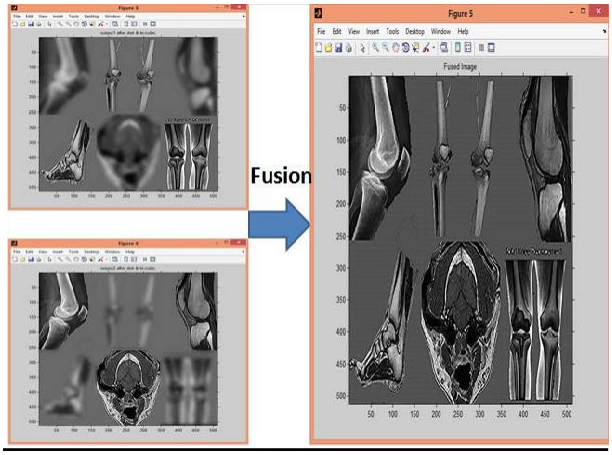

Conclusion- In this case, the wavelet transform is utilized since it is more effective at suppressing background noise and highlighting foreground details. To improve resolution, the bicubic interpolation method is applied. The photos are combined using principal component analysis.

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