

Design and Implementation of Image fusion using PCA algorithm using Xilinx System Generator

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Abstract: Image fusion is a data fusion technology which keeps images as main research contents. Magnetic Resonance Imaging (MRI) and Computer Tomography (CT) scan images are used to identify the tissues in various organs of the human body. In brain medical imaging, the brain structural information without functional data will be given by MRI scan. But, CT scan image includes the functional data with brain activity. To improve the low dose CT scan, Principal Component Analysis (PCA) algorithm is used in this paper which is implemented on FPGA. The Maximum Selection Rule (MSR) is used to select the high frequency component from the image.

Keywords: Application specified integrated chips, Field programmable gate array, Principle component analysis, Maximum selection rule

I. INTRODUCTION

The term fusion means in general an approach to extraction of information acquired in several domains. The goal of image fusion (IF) is to integrate complementary multi sensor, multi temporal and/or multi view information into one new image containing information.

Image fusion is the process of combining relevant information from two or more images into a single image. Image fusion techniques are widely used in various applications such as remote sensing, medical imaging, military and astronomy. Image fusion is a process of combining two or more images to enhance the information content.

II. LITERATURE SURVEY

S.K. Hussain, C.L. Reddy, and V.A. Kumar, "Implementation of Medical Image Fusion Using DWT Process on FPGA," Image fusion is a data fusion technology which keeps images as main research contents. It refers to the techniques that integrate multi-images of the same scene from multiple image sensor data or integrate multi images of the same scene at different times from one image sensor.

H.B. Kekre, T. Sarode, and R. Dhannawat, "Implementation and comparison of different transform techniques using kekre's wavelet transform for image fusion," Image fusion combines several images of same object or scene so that the final output image contains more information.

Pavithra, and Dr S. Bhargavi, "Fusion of two images based on wavelet transform," In this paper we have presented a method for fusing two dimensional multi-resolution 2-D images using wavelet transform under the combine gradient and smoothness criterion.

III. PRINCIPAL COMPONENT ANALYSIS

Principal Component Analysis is a quantitatively rigorous method for achieving simplification. Often, its operation can be thought of as revealing the internal structure of the data in a way which best explains the variance in the data. The method generates a new set of variables called Principal Components (PC). Each principal component is a linear combination of the original variables and all the PCs are orthogonal to each other, and as a whole form an orthogonal basis for the space of the data; thereby removing redundant information.

The multidimensional space is mapped into a space of fewer dimensions by transforming the original space using a linear transformation via a principal component analysis.

IV. THE STEPS INVOLVED IN THE PCA TRANSFORM ARE

Calculate the covariance matrix or the correlation matrix of the data sets to be transformed. The covariance matrix is used in the case of the unstandardized PCA, while the standardized PCA uses the correlation matrix.

Calculate the Eigen values and the Calculate eigenvectors from the correlation / covariance matrix.

Principal Components of the given data set are the eigenvectors of the covariance matrix of the input.

V. XILINX SYSTEM GENERATOR:

The name MATLAB stands for Matrix Laboratory. MATLAB was written originally to provide easy access to matrix software developed by the LINPACK (linear system package) and EISPACK (Eigen system package) projects. MATLAB is a high-performance language for technical

computing. It integrates computation, visualization, and a programming environment. Furthermore, MATLAB is a modern programming language environment: it has sophisticated data structures, contains built-in editing and debugging tools, and supports object-oriented programming. These factors make MATLAB an excellent tool for teaching and research.

MATLAB has many advantages compared to conventional computer languages (e.g., C, FORTRAN) for solving technical problems. . MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. The software package has been commercially available since 1984 and is now considered as a standard tool at most universities and industries worldwide.

VI. IMAGEPROCESSING TECHNIQUES USING XILINX SYSTEM GENERATOR

All Xilinx blocks should be placed between Gateway in and Gateway out blocks. Between those two blocks any method can be designed. All Xilinx blocks work on fixed point, but the real world signal (image, voice signal, etc.) are floating point, so that the gateway in and gateway out blocks used to convert the real world signal into the desired form. These two blocks act as translators

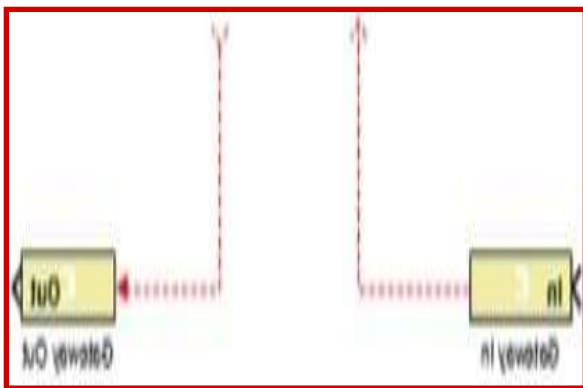


Figure1. Implementation of image fusion using Xilinx System Generator

The image fusion based on PCA using Xilinx system generator is shown in fig

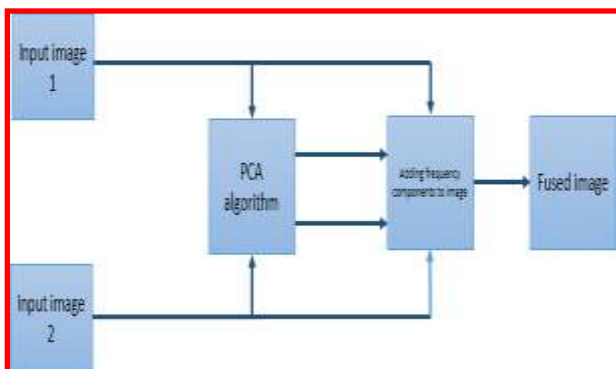


Figure2. Implementation of image fusion using Xilinx System Generator

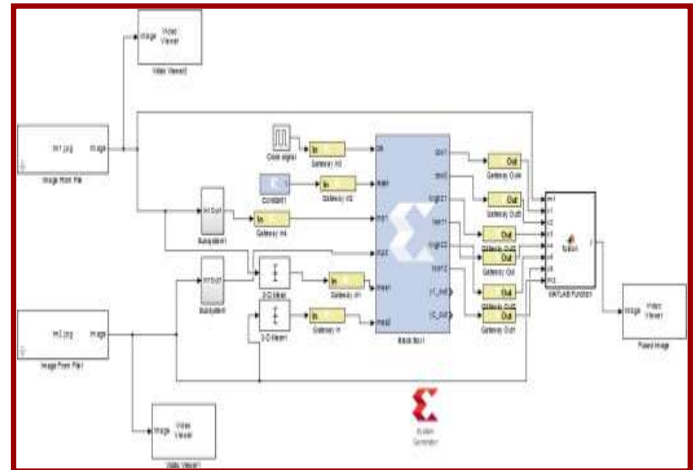


Figure 3. Implementation of image fusion using PCA in Xilinx system generator

VII. RESULTS AND SIMULATION

In this section, the experimental results and discussion of this methodology is detailed effectively in terms of performance parameters. There are a number of applications where the fusion of digital images is quite useful.

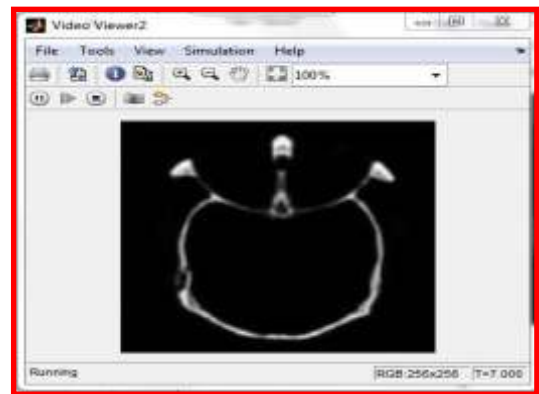


Figure 4. Input image 1

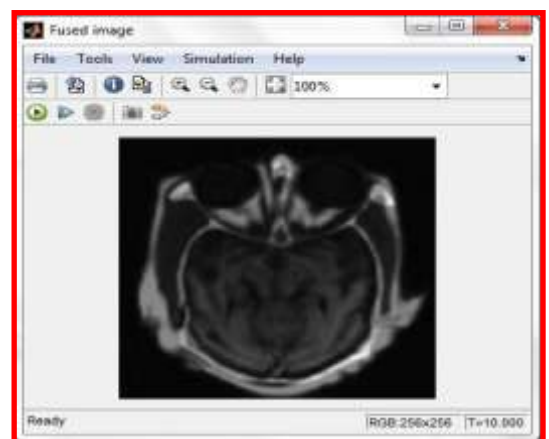


Figure 5. Input image 2

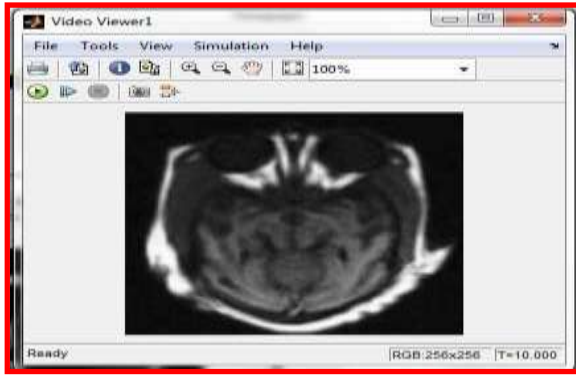


Figure 6. Output image

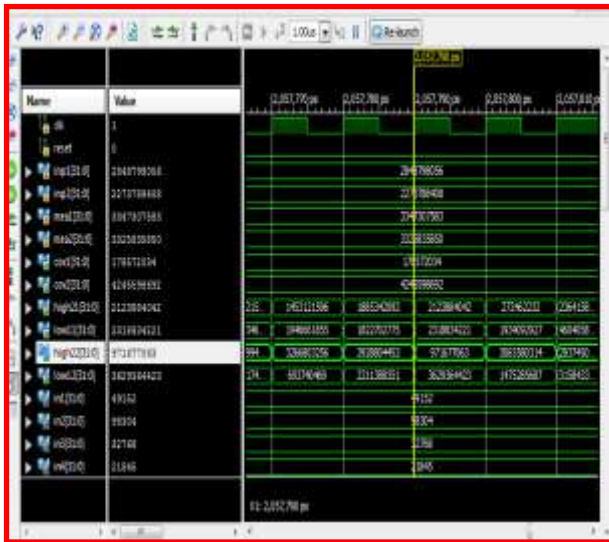


Figure 7. Simulation output of PCA

S. No.	Parameters	Values
1	Area (LUT Count)	10581
2	Bandwidth	27.949
3	power	0.913

TABLE 1. TABLE RESULTS FOR PCA ALGORITHM

VIII. FUTURE SCOPE

Principal component analysis is used for dimensionally reduction and analysis of the data. **In future, we develop a general method for stock price prediction using time varying co variance.**

IX. APPLICATIONS

1. Facial Recognition
2. Image Compression

X. CONCLUSION

The proposed architecture has been designed effectively in order to reduce the hardware utilization. In this work, PCA-IF architecture has been designed to perform the image fusion. In this work, medical images like MRI and CT have been used in the fusion process to obtain more information. The hybrid VLSI architecture provided better fused image compared to previous works. The proposed PCA algorithm was implemented using Xilinx ISE 14.7.

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