3D RECONSTRUCTION OF CT SCANNED IMAGES

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Abstract

3D scanners are growing in their popularity as many new applications and products are becoming a commodity. But, these are providing complexity and cost is also on higher side. So, this project provides the alternative solution for this problem. It starts with brief discussion on the principle of CT. The objective of this project is to develop a system that is able to reconstruct raw data acquired from a CT machine & give user an ability to manipulate the reconstructed image. Here 3D reconstruction will be implemented which uses MATLAB and reconstruction algorithm.

Computed tomography has become major area in biomedical imaging system to reconstruct 3D image. Several, exact CT reconstruction algorithms such as generalized filter back projection and back projection filtration methods and cone beam reconstruction algorithms have been developed to solve the long object problem. In this project, we have collected MRI and CT scan image slices. First, we projected the slices in z and y direction. Then, we combined these slices in order to achieve a 3D image.

Index Terms: Principle of CT scanned images, Projection, wavelet transform

I. INTRODUCTION

Acquisition of the three-dimensional geometry of a shape arises in a wide variety of applications, including biometrics, robot navigation, movie and video game production, industrial design and modeling, to name a few. Three-dimensional displaying of parts of human body obtained by modern diagnostic imaging methods is even more customary. This enables observing the layers of the tissue shown in the images on a pixel by pixel level and in the context of the 3D structure of the human body. The goal of our work was to show the possibility of such reconstruction using a wide range programmed such as MATLAB. In many of these applications, the geometric data is required to be captured in real time at frame rates comparable with normal video capture. Despite the availability of different acquisition methods, a low-cost high-speed real time 3D scanner still remains a non-trivial technological challenge. In particular, one of the main purposes of the 3D scanner presented in this paper is a biometric system based on 3D face recognition.

This application requires a fast, accurate and inexpensive solution. The world of 3D incorporates the third dimension of depth, which can be perceived by the human vision in the form of binocular disparity. Human eyes are located at slightly different positions, and these perceive different views of the real world. The brain is then able to reconstruct the depth information from these different views. A 3D display takes advantage of this phenomenon, creating two slightly different images of every scene and then presenting them to the individual eyes. With an appropriate disparity and calibration of parameters, a correct 3D perception can be realized. Our solution is displayed through an example which does not allow virtual “entering” into the 3D structure, but enables slicing out desired volume to a size of one pixel of the original images. Tomography layers at the appropriate depth will be displayed on both sides of chosen parallel piped. Medical imaging is set of non invasive techniques and processes used to create images of the human body. In case of X-ray CT, image reconstruction is process that used to reconstruct 3D images from amount of X-ray attenuated at a certain point, at a certain angle.

II. WAVELET TRANSFORM

Over the past ten years much has been accomplished in the development of the theory of wavelets, and people are continuing to find new application domains. Theoretical accomplishments include specification of new bases for many different function spaces and characterization of orthogonal wavelets with compact support. Application areas so far discovered include signal processing, especially for non stationary signals, image processing and compression, data compression, and quantum mechanics. However, at the present time most of the literature remains highly mathematical and requires a large investment of time to develop an understanding of wavelets and their potential uses. The purpose of this paper is to provide an overview of wavelet theory by developing, from an intuitive standpoint, the idea of the wavelet transform. Since a complete study of wavelets would encompass both a lengthy mathematical development and consideration of many application domains, we adopt a particular viewpoint that lends itself readily to signal processing applications. Our discussion starts with a comparison of the wavelet and Fourier transforms of an impulse function. This motivates a discussion of the multi resolution decomposition of a function with finite energy. We then give the definition of a wavelet and the wavelet transform. Following is a comparison of the similarities and differences between the wavelet and Fourier transforms. We conclude with some examples of wavelet transforms of "popular" signals. Other introductions to wavelets and their applications may be found in. The short-time Fourier transform is frequently utilized for non stationary signal analysis. Although a powerful tool, it has some limitations in analyzing time-localized events. The wavelet transform has similarities with the short-time Fourier transform, but it also possesses a time-localization property that generally renders it superior for analyzing non stationary phenomena.

III. RECONSTRUCTION ALGORITHM

A. Load the CT scanned RGB images.

Using this step we had converted RGB images to an indexed images using minimum variance quantization and dithering. For this we have used map instruction which contains at most n colors. n must less than or equal to 65536.The values in resultant image are indexed into the color map map and should not be used in mathematical processing, such as filtering operation.
If we specify n, rgb2ind uses minimum variance quantization. This method involves cutting the RGB color cube into smaller boxes of different sizes, depending on how the colors are distributed in the image. rgb 2ind uses color map mapping, which involves finding the color in map that based match the colors in the RGB image.

B. Display some slices along the Z, Y-orientation of the original brain data.

For plotting 3D volume in MATLAB data set should include X, Y, Z coordinates and intensity values. Here we have use pink instruction for coloring and shading. ‘int2str(N)’ converts an integer to a string with integer format. The input N can be a single integer or a vector or matrix of integers. Non integer inputs are rounded before conversion. cat instruction concatenates arrays along specified dimension. By using cat we have arranged nine images in 3x3 array. ‘perm’ instruction returns matrix containing all permutation of elements of define value in reverse lexicographic order. Our goal is to plot 3D grid with corresponding intensity value per coordinate and apply shading between these points.

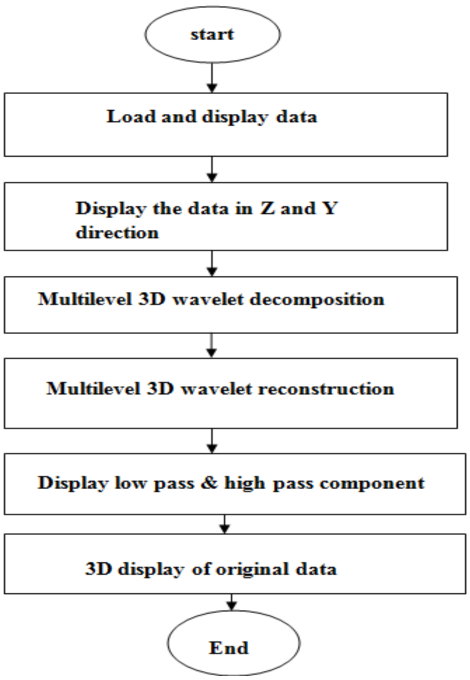
C. COMPUTE THE WAVELET DECOMPOSITION OF THE 3D DATA AT LEVEL 3.

Here we have done wavelet decomposition of the 3-D array X at level N, using the particular wavelet filters we specify. For this we have used wavedec3 instruction. In wavelet decomposition only the low pass output is sub divided further into low pass and high passes part. Wavelet packet decomposition divides both low pass and high pass outputs at each resolution level.

D. 3D Display of Original Data and Approximation at Level 2.

The size of the 3D original array X is (128 x 128 x 27) = 442368. We can use a 3D display to show it. The 3D array of the coefficients of approximation at level 2, whose size is (22 x 22 x 9) = 4356, is less than 1% the size of the original data. With these coefficients, we can reconstruct A2, the approximation at level 2, which is a kind of compression of the original 3D array. A2 can also be shown using a 3D display.

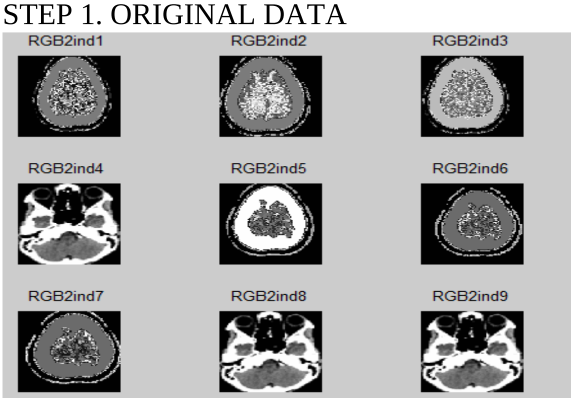
IV FLOWCHART



ENTIRE ALGORITHEM OF SYSTEM

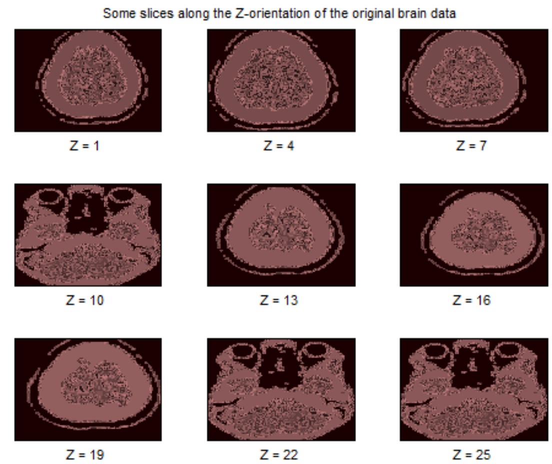
V RESULTS

STEP 1. ORIGINAL DATA

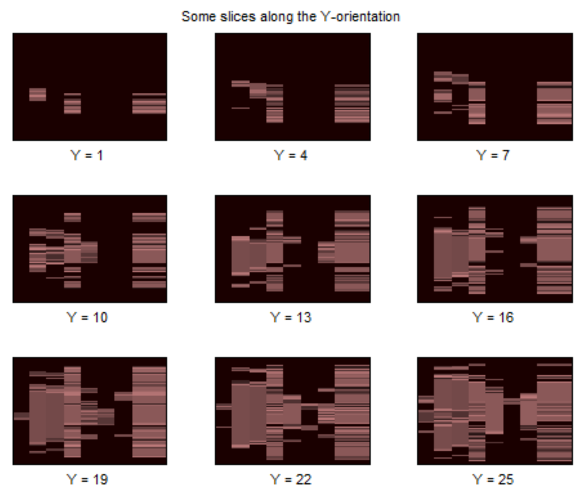


INDEXED IMAGES

STEP 2. PROJECTION ALONG Z AND Y DIRECTION

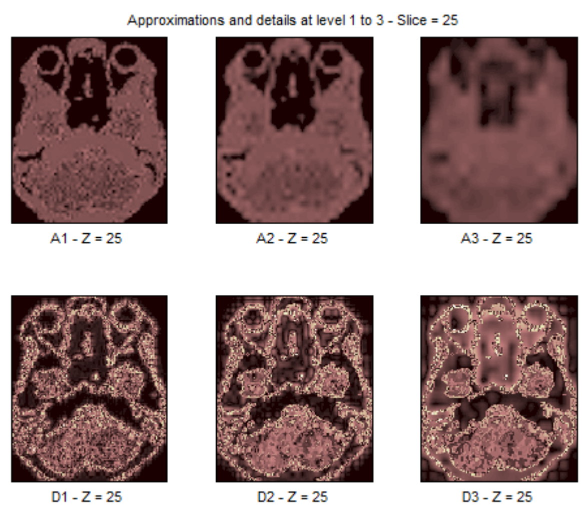


SLICES ALONG Z DIRECTION



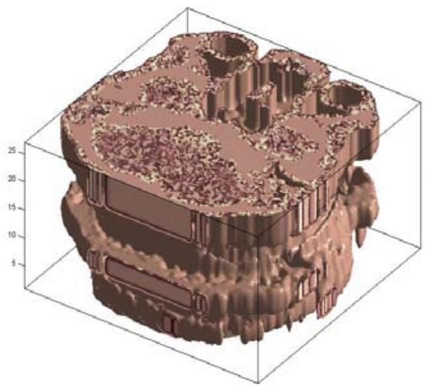
SLICES ALONG Y DIRECTION

STEP 3. APPROXIMATION AND DETAILS



APPROXIMATION AND DETAILS AT Z=25

STEP 4. RECONSTRUCTED HEAD



3D RECONSTRUCTION

VI CONCLUSION

Method of 3D reconstruction is presented. This demo shows how to analyze 3D data using the three-dimensional wavelet analysis tool, and how to display low-pass and high-pass components along a given slice. A key feature of this analysis is to track the optimal, or at least a good, wavelet-based sparsity of the image which is the lowest percentage of transform coefficients sufficient for diagnostic-quality reconstruction.

We conclude that higher-dimensional wavelet transform in 3 & 4 dimensions is feasible and computationally not too expensive. By exploitation of data coherent in higher dimensions, it allows much higher data compression rates than a comparable 2D approach while retaining image quality.

REFERANCES

[1] Nino-Murcia M, Jeffrey RB, Jr, Beaulieu CF, Rubin GD. Multi detector CT of the pancreas and bile duct system. Thibault JB, Bouman CA, Reconstruction for Computed Tomography.

[2] Dogan, S., 2003. 3D Reconstruction and evaluation of tissues by using CT, MR slices and digital images.

[3] Pretorius ES Spiral CT and three dimensional CT of musculoskeletal pathology.

[4] Cody, Mac A. "The Fast Wavelet Transform," Dr. Dobb's Journal, April 1992. This paper provides a quick overview of wavelets and the fast wavelet transform. It also contains and discusses some C code that implements a wavelet transform.

[5] Wavelets: Time-Frequency Methods and Phase Space. Proceedings of the International Conference, Marseille, France, December 14-18, 1987. Combes, J. M., et al. eds. Springer-Verlag. This book presents some of the earlier papers in the development of wavelets. The papers are organized into the five categories: Part I*:* Introduction to Wavelet Transforms Part II*:* Some Topics in Signal Analysis Part III*:* Wavelets and Signal Processing Part IV*:* Mathematics and Mathematical Physics Part V*:* Implementations