University of Moratuwa

PC – BASED IMAGE RECONSTRUCTION FOR MR IMAGING

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The work presented in this dissertation has not been submitted for the fulfilment of any other degree.

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Abstract

Reconstruction is the abstract *rebuilding* of something that has been torn apart. In the medical imaging context, it is often necessary to acquire data from methods that essentially *tear* data apart in order to be able to view what is inside. Also, a big part of reconstruction is then being able to view, or visualise, all the data once it is been put back together again. In MRI, the imaging device acquires data of a cross-sectional plane of the tissue being studied. The process of reconstruction then involves rebuilding of the cross-sectional view of that plane from the acquired data. Usually, the imaging device acquires data from a number of cross-sectional planes of the tissue being examined. Then, in reconstruction, all these planes are stacked back together to obtain a complete picture of the tissue.

Image reconstruction in MRI is usually performed by dedicated hardware. A typical system usually consists of multi-processors, application specific integrated circuits (ASIC) and uses parallel processing techniques. These systems are capable of high-speed image reconstruction, both 2D and 3D, high resolution image display and manipulation. Obviously, these systems are fairly expensive.

In this project a general purpose PC operating on Microsoft® Windows® 98 operating system was used to reconstruct a 2D image of a slice through the human head, using head scan data available from a MRI scanner. The FID signals from the scanner were available as projection data, which have been collected by suitably rotating the magnetic gradients. The filtered back-projection algorithm with nearest neighbour interpolation scheme was used in the reconstruction program, which was written in Matlab®. The resulting image from this system is acceptable. With the ever-increasing processor power of PC's and cost of PC's coming down, PC-based image reconstruction would find its way in a cost effective MRI system.

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List of Abbreviations Used

A/D	Analog to Digital
ASIC	Application Specific Integrated Circuit
CT	Computerised Tomography
DFT	Discrete Fourier Transform
EPI	Echo Planar Imaging
FFT	Fast Fourier Transform
FID	Free Induction Decay
FT	Fourier Transform
GB	Giga Bytes
GUI	Graphical User Interface
IFFT	Inverse Fast Fourier Transform
KB	Kilo Bytes
MB	Mega Bytes
MMX®	Multi Media Extension
MR	Magnetic Resonance
MRI	Magnetic Resonance Imaging
NMR	Nuclear Magnetic Resonance
NMRI	Nuclear Magnetic Resonance Imaging
PC	Personal Computer
RF	Radio Frequency
SIMD	Single Instruction Multiple Data
SNR	Signal to Noise Ratio
ZP	Zero Pad

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