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TEXAS MEDICAL CENTER NASA/JOHNSON SPACE CENTER

COOPERATIVE AGREEMENT PROGRAM NCC 9-36, ROUND 1

COVER SHEET FOR FINAL REPORT

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The Use of the Discrete Wavelet Transform to Perform High Level Data Compression for Applications in Telemedicine.

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FINAL PROGRESS REPORT
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Executive Summary

Work during this period concentrated on collecting previous results and documenting by drafting a technical manuscript in the format for submission to the journal *Radiology*. As of this report, the Abstract, Introduction, Materials and Methods, and Reference sections are complete. Two synopses were prepared for Dr. Mastromarino detailing the impact of this NASA/TMC grant. A meeting was held with Jeff Gavornik to discuss the progress of the work so that a seamless handover can be effected. A list of questions were developed concerning tiling that hadn't yet been addressed. The list of remaining questions follows.

Remaining Questions

1. What is the effect of asymmetry (non-square mosaics) on compression?
2. What is the effect of relative position within the mosaic on compression?
3. Were the effects observed for the reference slice representative of all other slices in the mosaic?
4. Will tiling improve the maximum compression ratio for MR images?
5. Does the new Silicon Graphics compressor software behave the same as the RICCOH compressor used in this work?
6. Will other clinical CT studies behave similarly to the CT Chest exam?
7. How will the tiled compressed images appear when properly windowed and leveled and printed on a laser printer?
8. In cases where there are not enough slices to form a rectangular mosaic, what filler slices should be used?
9. Why does the RICCOH compressor allow decomposition to higher levels than should be appropriate for the kernal size?
10. Is it possible to develop a Fourier filter or unsharp mask technique to boost high frequency features that are lost in the wavelet compression encoding?

D Schomer, M.D.

Donald F. Schomer, M.D.
Principal Investigator

Impact of NASA/TMC Grants Received (NCC 9-36)

I am the Principle Investigator on the NASA/TMC grant entitled "The Use of the Discrete Wavelet Transform to Perform High Level Data Compression for Applications in Telemedicine" in the amount of $70,000. The overall objective of our work is to develop methods to reduce bandwidth for transmission and storage requirements for archive of digital medical images. This grant augmented a number of our research activities that were already underway. Below is a summary of the positive impact of the award.

MDACC Infrastructure Development. The grant enabled us to purchase a Sun Sparc Server 3000 computer that expedites computationally intensive tasks of compressing and decompressing, performing image metrics, and storing large medical images. The grant activity contributed to development of software to expedite the acquisition, processing, and output of large digital images in the quantities required for observer performance studies.

Support of Technology Transfer. The grant supported demonstration of discrete wavelet compression technology for telemammography at the 1996 annual meeting of the Radiological Society of North America, the largest medical meeting in the world. The grant supported presentation of two technical papers at the Society of Computer Applications in Radiology 1996 Annual Meeting in Denver. An abstract was submitted and accepted for the RSNA 1997 Annual Meeting. Two additional technical manuscripts have recently been submitted for publication, one of which will be published in RadioGraphics in early 1998..

Technical Accomplishments. The Houston Advanced Research Center (HARC) compression algorithm is implemented in software on MDACC computers. The algorithm has been applied to clinical images from multiple modalities, including Magnetic Resonance Imaging, Computed Tomography, Ultrasound, Nuclear Medicine, and Computed Radiography. Software has been developed that performs a set of objective measurements of image quality to determine image fidelity upon compression and decompression. We are hopeful that our technical findings will influence the Digital Image Communications (DICOM) standard for compression, specifically, accommodation of use of a cubic-spline discrete wavelet transform, compression of normalized CR data instead of edge-enhanced data, and compression of a mosaic of CT slices within a study rather than individual slices.

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