

Progressive Transmission of 3D MR Images: Data- and Transform-Space Strategies

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ABSTRACT

The paper addresses progressive transmission of magnetic resonance images across a network. For an interactive capability, the percentage of the data set transmitted *vis-à-vis* quality of the evolving rendering is fundamental, and three progressive schemes with different characteristics are presented. (a) A basic parallel-slice decomposition is accompanied by the optimal Individually Best Remaining Region (IBRR) ordering algorithm provided. (b) A non-planar decomposition algorithm with IBRR gives a second direct way. (c) A transform space approach which uses element magnitude ordering followed by inverse transformation supplies a third method for 3D progressive imaging. Results are illustrated and discussed with a 50x256x256 MR head section: (b) is more accurate than (a) for overall rendering if 8, 12, 16 or 20 percent of the data are transmitted, while (c) is effective for showing internal detail (MS lesions) earlier in its sequence – in fact when only 1% of the data is transmitted and used.

1. INTRODUCTION

In the evolving fields of medical imaging, problems of manipulating, processing or analyzing large data sets grow in complexity. Routinely now, CT scans can

generate 50 Mbytes of data, for one patient in one examination, representing a single 3D digital description of a part of his or her body. With emerging 3D ultrasound and dynamic MRI technologies, data sets of 500 Mbytes or more can be created, and accompanying problems of storage, querying, compression or transmission grow in complexity as well as size. For large amounts of 3D data, their network transmission is approached in different ways [1,2,4,5]. One class of techniques, and this is the scenario for the development below, hinges on progressive network transmission of constituent subsets of the object, for subsequent evolving renderings. During progressive viewing at the recipient node, (i) if the evolving renderings indicate that the object seems to be desirable, then only the remainder of the data need be transmitted, (ii) if it is not appearing to be required, transmission can be terminated, or (iii) if some sub-feature is emerging as important, the recipient can interrupt the process and initiate transmission of contiguous sub-data instead. Progressive transmission could also be a basic tool in design of a LAN data-capture system that would permit interaction by an observer: "rapid-enough" display of "good-enough" evolving renderings would be a key component in interactive MRI.

Algorithms for progressive transmission of 3D images may be classified into at least two categories: those which are devised using the data set directly, and those which are constructed in some transform space of

Acknowledgements: We are pleased to acknowledge the funding support from the Natural Sciences and Engineering Research Council, the Multiple Sclerosis Society of Canada and the Spanish Ministerio de Ciencia y Tecnología and FEDER grant TIC2002-02249, and the continued support of the Seaman Family Research Centre in Calgary, Canada.

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