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3D LANCZOS INTERPOLATION FOR MEDICAL VOLUMES

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Summary: Medical imaging techniques have been widely used in the diagnosis and treatment of many diseases, such as magnetic resonance imaging, computed tomography, mammography, ultrasonography, and photon emission tomography. Their main purpose is to enable the visualization of internal anatomic structures, such as organs and tissues, for clinical procedures. Resampling is required for certain medical tasks, for instance, registration and reconstruction, which occur when images or volumes are scaled, translated or rotated. The result of the resampling depends on the interpolation filter. In this paper, we develop and analyze a novel three-dimensional Lanczos resampling method in the context of medical imaging.

Lanczos resampling is a 1-D interpolation method based on the Lanczos kernel, which is dynamic and must be calculated for each value to be interpolated. Lanczos resampling is a separable filter, which means that it is possible to first apply it in the horizontal direction, then in the vertical direction and, finally, in the depth direction to be used in the 3D interpolation. Since the kernel may have negative values, the range of values of the output image may be wider than the input image. Therefore, the output image must be rescaled after the interpolation process in order to obtain the same value interval as the input values.

In our experiments, we observed that a=2 (the filter size) can generate images with ringing artifacts, which did not occurred with a=3 or a=4. Several data sets are used to demonstrate the effectiveness of the proposed approach. Results are compared with nearest neighbor, trilinear and tricubic interpolation methods.