Medical Xpress

Video game processors help lower CT scan radiation

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A new approach to processing X-ray data could lower by a factor of ten or more the amount of radiation patients receive during cone beam CT scans, report researchers from the University of California, San Diego.

Cone beam CT plays an essential role in image-guided radiation therapy (IGRT), a state-of-the-art cancer treatment. IGRT uses repeated scans during a course of radiation therapy to precisely target tumors and minimize radiation damage in surrounding tissue. Though IGRT has improved outcomes, the large cumulative radiation dose from the repeated scans has raised concerns among physicians and patients.

Reducing the total number of X-ray projections and the mAs level per projection (by tuning down the X-ray generator pulse rate, pulse duration and/or current) during a CT scan can help minimize patient's exposure to radiation, but the change results in noisy, mathematically incomplete data that takes hours to process using the current iterative reconstruction approaches. Because CBCT is mainly used for treatment setup while patients are in the treatment position, fast reconstruction is a requirement, explains lead author Xun Jia, a UCSD postdoctoral fellow.

Based on recent advances in the field of compressed sensing, Jia and his colleagues developed an innovative CT reconstruction algorithm for graphic processing unit (GPU) platforms. The GPU processes data in parallel --- increasing computational efficiency and making it possible to reconstruct a cone beam CT scan in about two minutes. (Modern GPU cards were originally designed to power 3D computer graphics, especially for video games.)

With only 20 to 40 total number of X-ray projections and 0.1 mAs per projection, the team achieved images clear enough for image-guided radiation therapy. The reconstruction time ranged from 77 to 130 seconds on an NVIDIA Tesla C1060 GPU card, depending on the number of projections --- an estimated 100 times faster than similar iterative reconstruction approaches, says Jia.

Compared to the currently widely used scanning protocol of about 360 projections with 0.4 mAs per projection, Jia says the new processing method resulted in 36 to 72 times less radiation exposure for patients.

"With our technique, we can reconstruct cone beam CT images with only a few projections -- 40 in most cases -- and lower mAs levels," he says. "This considerably lowered the radiation dose."

The reconstruction algorithm is part of the UCSD group's effort to develop a series of GPU-based low dose technologies for CT scans.

"In my mind, the most interesting and compelling possibilities of this technique are beyond cancer radiotherapy," says Steve Jiang, senior author of the study and a UCSD associate professor of radiation oncology.

"CT dose has become a major concern of medical community. For each year's use of today's scanning technology, the resulting cancers could cause about 14,500 deaths.

"Our work, when extended from cancer radiotherapy to general diagnostic imaging, may provide a unique solution to solve this problem by reducing the CT dose per scan by a factor of 10 or more," says Jiang.

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