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A Novel Ultra Low Cost CT Image Quality Measurement Device

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Background

Assessing CT image quality is becoming of increasing concern in the domain of quantitative imaging. Current calibration devices tend to be time-consuming to use and often require special expertise for analysis. We have developed a novel approach for measuring image quality on CT scanners that is automated and inexpensive.

Method

Three new rolls of 3M 3/4x1000 Inch Scotch Magic tape(\$1.50 each) were placed radially out from iso-center and CT scanned using standard head, body,and low dose lung protocols on a GE VCT and a Siemens Somatom Definition AS scanner. A Gammex 464 ACR CT Accreditation phantom was also scanned on the same scanners with identical protocols. GE and Siemens scans were reconstructed with 0.625, 1.25,and 2.5mm and 0.6, 1.0,and 2.0mm slice thickness and spacing, respectively. A total of 36 3D CT scans(36=2 objects x 2 scanners x 3 protocols x 3 thicknesses) were used for this study.

Automated analysis was performed using Radia Diagnostic Software(Radiological Image Technology, Inc.) for the Gammex scans and Accumetra software for the tape scans. Both software tools produced measurements for CT linearity(air and acrylic HU), in-plane resolution, slice thickness,and image noise. Mean, standard deviation,and difference in measurements was used to evaluate performance.

Result

	Gammex	Tape	(Tape-Gammex)
	Mean, SD	Mean, SD	Mean, SD
Air (HU)	-988, 10.4	-995, 4.6	-6.97, 6.38
Acrylic (HU)	130, 2.0	121, 12.3	-8.90, 12.75
In-plane Resolution (LP/cm)	6.32, 0.31	6.09, 0.67	-0.23, 0.91
Slice Thickness (mm)	1.88, 1.13	1.42, 0.57	-0.46, 0.63
Image Noise (HU SD)	13.39, 9.93	7.05, 2.65	-6.35, 8.47

Given that mean tape measurements differed from Gammex phantom measurements by <10 for HU density, <0.25 for LP/cm of in-plane resolution, <0.5 for mm of slice thickness, and <10 for HU SD of image noise, scotch tape has the potential to be used as a fast, accurate, and inexpensive tool for assessing CT scanner and protocol image quality.

Conclusion

A new automated and inexpensive method for CT scan image quality assessment that relies on advanced image processing techniques provides results comparable to standard calibration methods

thus allowing CT scan calibration to be performed rapidly and inexpensively allowing for more comprehensive integration of quality standards into daily practice.

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